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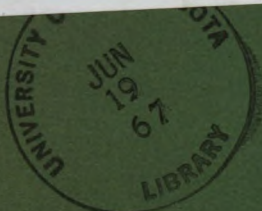
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NA PROJECT



HEARINGS
BEFORE THE
SUBCOMMITTEE ON
WATER AND POWER RESOURCES
OF THE
COMMITTEE ON
INTERIOR AND INSULAR AFFAIRS
UNITED STATES SENATE
NINETIETH CONGRESS
FIRST SESSION
ON
S. 1004, S. 1013, S. 861, S. 1242, and S. 1409
BILLS TO AUTHORIZE THE CONSTRUCTION, OPERATION,
AND MAINTENANCE OF THE CENTRAL ARIZONA PROJECT
(ARIZONA-NEW MEXICO); AND COLORADO RIVER PROJ-
ECT, AND FOR OTHER PURPOSES

MAY 2-5, 1967



CENTRAL ARIZONA PROJECT

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CONTENTS

S. 1004.....	Page 2
S. 1013.....	7
Executive communication.....	11
Departmental reports:	
Department of the Interior.....	44
Bureau of the Budget.....	46
S. 861.....	46
S. 1242.....	59
S. 1409.....	71

STATEMENTS

Allott, Hon. Gordon, a U.S. Senator from the State of Colorado.....	97
Bennett, Hon. Wallace F., a U.S. Senator from the State of Utah.....	109
Bible, Hon. Alan, a U.S. Senator from the State of Nevada.....	97
Bishop, Floyd A., State engineer, accompanied by John Bereman, inter- state streams engineer for the State of Wyoming; Thomas Cahill, Assistant Attorney General; and C. J. Kuiper, assistant commissioner, Upper Colorado River Commission.....	405
Brandborg, Stewart M., executive director, the Wilderness Society, Washington, D.C.....	700
Brower, David R., executive director, Sierra Club, San Francisco, Calif; accompanied by Jeffrey Ingram, Southwest representative, Sierra Club, Albuquerque, N. Mex.....	443
Budd, Joe L., assistant commissioner, Upper Colorado River Commission.....	302
Case, Hon. Clifford P., a U.S. Senator from the State of New Jersey.....	526
Chafin, Carl, chairman, Grand Canyon Subcommittee, Sierra Club, Tucson, Ariz.....	626
Cole, Dallas E., chief engineer, Colorado River Board of California.....	300
Davis, Floyd G., mayor, Farmington, N. Mex.....	396
Davis, John D., member, State Water Resources Board of Oregon; ap- pearing on behalf of Hon. Tom McCall, Governor of the State of Oregon.....	658
Delaney, Frank, former commissioner of the Upper Colorado River Commission for the State of Colorado, accompanied by William B. Jackson, president of the district.....	581
Dominick, Hon. Peter H., a U.S. Senator from the State of Colorado.....	114
Dunn, William G., civil engineer, Water Resources Developments.....	718
Ely, Northcutt, Special Assistant Attorney General, and Special Counsel to the Colorado River Board of California.....	258
Evans, Hon. Daniel J., Governor, State of Washington; presented by Paul Hamilton, field secretary, Columbia Basin Commission of the State of Washington.....	630
Ewing, Dean, Save the Grand Canyon Committee, Albuquerque, N. Mex.....	461
Fannin, Hon. Paul J., a U.S. Senator from the State of Arizona.....	107
Supplemental statement.....	84
Franks, Alvin Ellis, president, Hooker Dam Association.....	398
Gianelli, William R., director, Department of Water Resources, State of California, and Northcutt Ely special counsel, Colorado River Board of California, and special assistant attorney general, State of California; accompanied by Dallas E. Cole, chief engineer, Colorado River Board of California; Burton J. Gindler, deputy attorney general, and W. Don Maughan principal, hydraulic engineer, Department of Water Re- sources, State of California.....	253
Goss, Floyd L., chief electrical engineer and assistant manager, Los Angeles Department of Water and Power; accompanied by William A. Myers, chairman, Water and Power Commission, City of Los Angeles; Los Angeles, Calif.; Myron B. Holburt, principal hydraulic engineer, Colorado River Board, State of California; and Peter G. Lowery, senior electrical engineer, Los Angeles Department of Water and Power.....	324

	Page
Hayden, Hon. Carl, a U.S. Senator from the State of Arizona.....	84
Memorandum for Senator Kuchel.....	286
Supplemental statement.....	84
Idaho Water Resources Board.....	706
Jackson, Hon. Henry M., a U.S. Senator from the State of Washington...	93
Jackson, William B., director, West Divide Water Conservancy District, State of Colorado.....	586
Jett, Stephen C., Ph. D., assistant professor, University of California, Davis.....	707
Johnson, Hon. Ed. C., former U.S. Senator and former Governor, State of Colorado, Colorado commissioner, Upper Colorado River Com- mission.....	566
Kimball, Thomas L., executive director, National Wildlife Federation, Washington, D.C.....	624
Kroeger, Jack, board member and president of the San Juan Basin Associa- tion of Soil Conservation Districts; accompanied by Robert Taylor, board member; District Judge William Eakes; Fred Kroeger, member of the Colorado Water Conservation Board; and Frank S. Maynes, counsel for the district.....	579
Kuchel, Hon. Thomas H., a U.S. Senator from the State of California...	93
Laxalt, Hon. Paul, Governor, State of Nevada.....	529
Lewis, Robert K., president, the Tri-County Water Conservancy District, State of Colorado; accompanied by Robert Field, manager, Tri-County Conservancy District; and Jack Hughes general counsel.....	588
Love, Hon. John A., Governor, State of Colorado.....	531
Magnuson, Hon. Warren G., a U.S. Senator from the State of Washington...	112
Martin, Dr. Paul S., associate professor, of geochronology, University of Arizona, and Chairman, Grand Canyon Study Committee, Arizona Academy of Sciences.....	616
Montoya, F. F., Chairman, La Plata Conservancy district, La Plata, N. Mex.; accompanied by Price W. Nelson.....	402
Montoya, Hon. Joseph M., a U.S. Senator from the State of New Mexico...	359
Moss, Hon. Frank E., a U.S. Senator from the State of Utah.....	104
Moss, Laurence I., nuclear engineer.....	632
Comments: Bureau of Reclamation.....	656
Parker, Rupert, Chairman, Hualapai Tribe; accompanied by Royal D. Marks, general counsel for Hualapai Tribe, Phoenix, Ariz.; and Arthur Lazarus, Jr., Strasser, Spiegelberg, Fried, Frank & Kampelman, Wash- ington, D.C.....	237
Rampton, Hon. Calvin L., Governor, State of Utah; presented by Jay R. Bingham, executive director, Utah Water and Power Board, Salt Lake City, Utah.....	312
Rauschenbush, Stephen, consulting economist to the National Parks Association, Washington, D.C.....	666
Rawson, Robert D., M.D., Arizonans for Water Without Waste, Tucson, Ariz.....	682
Reed, Tillmon, vice president, San Miguel Water Conservancy District, and president of the San Miguel Basin Soil Conservation District, accompanied by D. Lew Williams, member of the board of the district, and board member of Southwestern Colorado Water Conservation Board.....	600
Reynolds, S. E., secretary of the New Mexico Interstate Stream Com- mission; accompanied by I. J. Coury, chairman; Hilton A. Dickson, Jr., member; and Claud S. Mann, legal adviser, New Mexico Interstate Stream Commission.....	374
Rummonds, Raymond R., chairman, Colorado River Board of California...	301
Scott, Boyd F., president, Farmington, N. Mex., Chamber of Commerce...	404
Shannon, R. S., Jr., president, Denver Board of Water Commissioners, State of Colorado.....	609
Shubert, Dr. Moras L., president-elect, Colorado-Wyoming Academy of Science.....	728
Southern Arizona branch, Arizona section, American Society of Civil Engineers.....	748
Smith, Dr. Spencer M., Jr., secretary, Citizens Committee on Natural Resources.....	243
Smith, Philip P., secretary-engineer, Colorado River Water Conservation District.....	610

CONTENTS

iv

Soucie, Gary A., assistant to the executive director, Sierra Club, New York City.....	Page 622
Starks, Charles H., president, Central Colorado Water Conservancy District, accompanied by Mills E. Bunger, consulting engineer, and David J. Miller, attorney, of Colorado.....	604
Udall, Hon. Stewart L., Secretary of the Interior, accompanied by Kenneth Holum, Assistant Secretary for Water and Power Development; Floyd E. Dominy, Commissioner, Bureau of Reclamation; and Edward Weinberg, Deputy Solicitor, Department of the Interior.....	136
Vinger, W. T. (Jack), president, Dolores Water Conservancy District, State of Colorado, accompanied by Ivan Patterson, secretary, Dolores Water Conservancy District.....	592
Weiner, Mrs. Ruth, representing the Colorado Open Space Coordinating Council, Inc., the Colorado Mountain Club, and other affiliated organizations of the Open Space Coordinating Council, Inc.....	360
Williams, D. Lew, rancher, Norwood, Colorado.....	603
Williams, Hon. Jack, Governor, State of Arizona.....	107

COMMUNICATIONS

Abel, Karl F., president, Arizona Association of Soil and Water Conservation Districts, Tolleson, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	757
Allen, James A., West Covina, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 4, 1967.....	739
Anderson, William T., chairman, Luna County Board of Commissioners, Deming, N. Mex.: Letter to Alvin Franks, Silver City, N. Mex., dated April 25, 1967.....	732
Andrews, William S., chairman, Board of Supervisors, Maricopa County, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	752
Andriano, Donald, secretary, Colorado River Wildlife Council: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 20, 1967.....	716
Barron, John E., president, Grant County Association of Independent Insurance Agents, Silver City, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 19, 1967.....	736
Bean, G. Clarke, president, Arizona Bankers Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 28, 1967.....	754
Block, Mrs. Mary, West Covina, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 4, 1967.....	717
Bodkin, Bruce, president, Kirtland Lions Club: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 2, 1967.....	404
Bostick, Neil, secretary, Stanford Conservation Group, Stanford, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 9, 1967.....	717
Boyd, James M., chairman, Arizona Forest Industries Committee, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 28, 1967.....	750
Bronn, Carl H., National Reclamation Association: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 2, 1967.....	709
Cade, John T., commander, Post 3347, VFW, Bayard, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 22, 1967.....	731
Carlin, Alan: Letter to Hon. Henry M. Jackson, chairman, Committee on Interior and Insular Affairs.....	463
Carlos, Filmore, president, Inter Tribal Council of Arizona: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 1, 1967.....	715
Codd, George G., president, Arizona Building Contractors, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967.....	753
Davis, Bill, executive secretary, Arizona Cattle Growers Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 25, 1967.....	758

DeBolske, John J., executive secretary, the League of Arizona Cities and Towns, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, Phoenix, Ariz., dated April 25, 1967.....	Page 749
Dossey, H. C., executive vice president, Arizona Retailers Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	752
Dow, Allison C., president, Arizona Society of Professional Engineers: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	751
Dunlap, Jim, president, Lower Valley Water Users Cooperation: Letter to chairman, Water and Power Resources Subcommittee, dated May 2, 1967.....	405
Durham, G. Homer, president, Arizona State University, Tempe, Ariz.: Letter to Hon. Carl Hayden and Hon. Paul J. Fannin, U.S. Senators from the State of Arizona, dated April 27, 1967.....	749
Ehrman, Mr. and Mrs. Carl W., Minneapolis, Minn.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 3, 1967.....	739
Eloesser, Miss Nina H., San Francisco, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 10, 1967.....	746
Florian, Kenneth, president, Arizona section, ASCE, Tucson, Ariz.: Letter to Hon. Carl Hayden and Hon. Paul Fannin, U.S. Senators from the State of Arizona, dated April 30, 1967.....	762
Foster, Fred W., House of Representatives, State of New Mexico, Santa Fe, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 25, 1967.....	730
Gayman, Evelyn, conservation chairman, Desomount Club, Los Angeles, Calif.: Letter to the Water and Power Resources Subcommittee, dated May 2, 1967.....	715
Goslin, Ival V., executive director, Upper Colorado River Commission: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated February 25, 1967.....	705
Graves, Mrs. James F., Princeton, N.J.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated April 6, 1967.....	739
Gray, Walter S., president, Arizona Association of Manufacturers, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	752
Harvill, Richard A., the University of Arizona, Tucson, Ariz., letters to: Hon. Carl Hayden and Hon. Paul Fannin, U.S. Senators from the State of Arizona, dated April 27, 1967.....	748
Mr. Evo DeConcini, Arizona Interstate Streams Commission, dated March 28, 1967.....	755
Haycock, Joseph B., Silver City, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 22, 1967.....	734
Hollis, Mrs. Wm. W., corresponding secretary, Crestview Garden Club, Durango, Colo.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 9, 1967.....	746
Jenkins, Leland M., Scottsdale, Ariz.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated April 27, 1967.....	741
Kreiger, James H., chairman, Southern California Water Conference, Los Angeles, Calif.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 3, 1967.....	709
Lacy, Wade, executive secretary, Arizona Cattle Feeders' Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	759
Landry, Robert B., State of Arizona Development Board, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967.....	756
Lazarus, Arthur, Jr.: Letter to Hon. Ed Reinecke, a Representative in Congress from the State of California.....	241
Lee, Arlo B., president, Arizona Supervisors & Clerks Association, St. Johns, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967.....	751

CONTENTS

VII

Leyendecker, Claude E., president, Deming Rotary Club, Deming, N. Mex.: Letter to Alvin Franks, Silver City, N. Mex., dated April 28, 1967-----	Page 731
McCabe, Thomas W., Republican county chairman, Silver City, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 30, 1967-----	736
McGinn, John R., city manager, city of Aztec: Letter to Interior and Insular Affairs Committee, dated May 2, 1967-----	404
McSweeney, E. S., executive vice president, Arizona Cotton Growers Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 25, 1967-----	756
Martin, Robert C., House of Representatives, State of New Mexico, Red-rock, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 24, 1967-----	729
Morrison, Donald R., Altus, Okla.: Letter to the Senate Interior and Insular Affairs Committee, dated May 13, 1967-----	737
Nakai, Raymond, Navajo Tribal Council: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 3, 1967-----	710
O'Mara, Roger, city manager, Tucson, Ariz.: Letter to Lewis E. Haas, Central Arizona Project Association, dated, April 27, 1967-----	757
Orloski, Raymond F., and Gloria, Venice, Calif.: Letter to the Senate Interior and Insular Affairs Committee, dated May 6, 1967-----	737
Osborn, Sidney P., Governor of Arizona: Letters to Gov. Earl Warren of California, dated March 12, 1947, and May 23, 1947-----	290
Patrick, Jim, Valley National Bank, Phoenix, Ariz.: Letter to Hon. Carl Hayden and Hon. Paul J. Fannin, U.S. Senators from the State of Arizona, dated April 27, 1967-----	753
Peplow, Edward H., Jr., executive secretary, Arizona Mining Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967-----	756
Phillips, Howard, president, Lordsburg-Hidalgo County Chamber of Commerce: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 20, 1967-----	735
Pilgrim, R. E., executive secretary, Arizona Farm Bureau Federation: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, Phoenix, Ariz., dated May 14, 1967-----	749
Pine, Bertha R., president, Arizona chapter, Public Relations Society of America, Phoenix, Ariz.: Letter to Lewis E. Haas, Central Arizona Project Association-----	757
Price, Dix W., Arizona Education Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967-----	753
Rankin, Noel, president, Grant County Farm & Livestock, New Mexico: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 22, 1967-----	734
Reynolds, S. E., State engineer, State of New Mexico: Letter to Mr. Harold T. Johnson, chairman, House Subcommittee on Irrigation and Reclamation-----	196
Rodack, Juel, chairman, Arizonans for Water Without Waste: Letter to Hon. Clinton P. Anderson, chairman, Subcommittee on Water and Power Resources-----	688
Rogers, Charles W., president, Bayard Chamber of Commerce, Bayard, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 2, 1967-----	731
Rosenberg, Allen L., president, Pioneer Bank of Arizona, Phoenix, Ariz.: Letter to Hon. Carl Hayden and Hon. Paul Fannin, U.S. Senators from the State of Arizona-----	758
Ross, James W., president, Arizona Broadcasters Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967-----	755
Rozema, Don, executive director, Arizona Aggregate Association, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967-----	755
Sale, J. A., president, Downtown Merchants Association of Phoenix: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967-----	754

Seifer, E. R., president, Arizona Hotel & Motel Association, Inc., Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 26, 1967-----	Page 754
Shaw, Mrs. A. W., and family, Oceanside, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 7, 1967-----	740
Shores, Carl, president, board of directors, Deming-Luna County Chamber of Commerce, New Mexico: Letter to Hon. Thomas G. Morris, a Representative in Congress from the State of New Mexico-----	733
Spaw, Mrs. Scott, president, Arizona Conservation Council, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 28, 1967-----	750
Suggs, Ellis, president, Home Builders Association of Central Arizona, Phoenix, Ariz.: Letter to Mr. H. S. Raymond, president, Central Arizona Project Association, dated April 27, 1967-----	754
Swanson, John R., Berkeley, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 3, 1967-----	738
Taylor, Lyle A., West Covina, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 6, 1967-----	740
Taylor, Mrs. Ruth M., West Covina, Calif.: Letter to Hon. Henry M. Jackson, chairman, Interior and Insular Affairs Committee, dated May 6, 1967-----	740
Trapp, Harold F., mayor, town of Hurley, N. Mex.: Letter to the Dam-sitters, Silver City, N. Mex., dated April 24, 1967-----	731
Udall, Hon. Stewart L., Secretary of the Interior: Letters to Hon. Wayne Aspinall, chairman, House Committee on Interior and Insular Affairs dated-----	
May 17, 1965-----	155
April 29, 1967-----	176
Vencill, Lewis C., Grant County Bank, Silver City office, New Mexico: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated May 1, 1967-----	736
Veseley, Edith H., senator, Grant County, New Mexico State Senate, Santa Fe, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 24, 1967-----	730
Walkey, Thomas E., Grant County Development Committee, Silver City, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 27, 1967-----	736
Warren, Earl, Governor of California: Letters to Gov. Sidney R. Osborn of Arizona and Gov. Vail N. Pittman of Nevada, dated-----	
March 3, 1947-----	289
May 16, 1947-----	292
Werner, Don G.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 21, 1967-----	735
Wirth, Conrad L., chairman of the board, the National Conference on State Parks, Washington, D.C.-----	747
Word, William G., Jr., Silver City, N. Mex.: Letter to Hon. Clinton P. Anderson, chairman, Water and Power Resources Subcommittee, dated April 20, 1967-----	734
Wymer, Chad A., executive vice president, chamber of commerce: Letter to Hon. Joseph M. Montoya, a U.S. Senator from the State of New Mexico-----	735

TABLES AND CHARTS

Apportioned revenues, utilization of-----	426
Bureau of Reclamation reservoir operation and water supply studies-----	29, 282
California, Arizona, and Nevada shortages-----	546
Central Arizona project, economic and financial analysis-----	145
Central Arizona project with Federal prepayment power arrangements, summary report-----	20
Colorado River Basin, summary of depletions 1913-58-----	208
Colorado River at Lee Ferry, virgin flow 1896-1965 (chart)-----	318
Colorado River use by Arizona past 3 years-----	222
Compact apportionments, upper basin States-----	320
Farmington, Aztec, and Kirkland districts, New Mexico, water needs-----	398
Grand Canyon dams, benefits and costs of-----	496



CONTENTS

ix

	Page
Hooker high and low dams, basic data.....	370
Hualapai and Marble Canyon projects, capital cost of.....	495
Hualapai Dam, comparison of power prepurchase plans.....	119
Hualapai Dam and Reservoir, summary of construction costs.....	177
Irrigation assistance from ad valorem tax.....	40
Irrigation assistance from M. & I. revenues.....	36
Lower Basin, analysis of depletions in.....	203
Lower Colorado River Basin, acreages irrigated in.....	204
Lower Colorado River Basin project repayment analysis.....	515
Marble Canyon powerplant, estimated value of power output.....	474
Marble project, summary of calculated values.....	475
Marble project costs at 1966 prices.....	473
Nuclear alternatives, benefit-cost ratios (chart).....	466
Nuclear growth projections.....	472
Nuclear plants, capital cost of plants ordered.....	472
Nuclear powerplants, average annual costs.....	493
Nuclear power, trend in estimated costs of.....	471
Upper Basin depletions (three charts).....	550
Upper Basin States depletions (chart).....	319
Upper Basin storage capacity and depletions.....	543
Upper Colorado River Basin depletions.....	425

ADDITIONAL INFORMATION

Analysis of the five bills prepared by Paul L. Billhymer.....	121
Analysis prepared by committee staff.....	135
Arizona's brief in answer to the brief of California on the protection of existing uses in California and granting of a 4.4 priority.....	88
"Bridge and Marble Canyon Dams," from the National Parks magazine.....	672
Brief on the protection of existing projects against the proposed central Arizona project.....	293
Cargo, David F., Governor, New Mexico; press release dated April 17, 1967.....	461
Central Arizona project with Federal prepayment power arrangements, summary report.....	20
Excerpt from H.R. 4671, 89th Congress.....	228
"Good News on the Grand Canyon," from the National Parks magazine, March 1967.....	678
"Gravity Flow Tunnel Is Favored," from Scottsdale Daily Progress, dated April 15, 1967.....	742
Map—California developments on the Colorado River.....	299
Map—Central Arizona project.....	44
"More Than One Way To Skin That Cat—Engineer Says CAP Thinking Is Frozen in 1947 Mold," from Arizona Republic, January 22, 1967.....	744
"Need for Cost Examination in Tunnel Project Cautioned," from Arizona Republic, March 20, 1967.....	743
Resolutions:	
Arizona Academy.....	620
Arizona Cattle Feeders' Association.....	759
Arizona Game Protective Association.....	760
Board of County Commissioners, Grant County, N. Mex.....	733
Board of Supervisors of Pima County, Ariz.....	761
Board of Water Commissioners, city of Long Beach, Calif.....	738
City Council of the City of Phoenix.....	761
City of Tucson.....	761
Colorado River Board of California.....	94
Colorado River Wildlife Council.....	716
Dearborn, Marguerite, and others.....	737
Havasupai Tribe of the Havasupai Reservation.....	239
Hualapai Tribe of the Hualapai Reservation.....	240
National Conference on State Parks.....	747
National Reclamation Association.....	710
National Wildlife Federation.....	449
Navajo Tribal Council.....	711
Northern Arizona University.....	760
Phoenix Chamber of Commerce.....	760

Resolutions—Continued	Page
Town Council of Hurley, N. Mex.....	732
Town of Silver City, N. Mex.....	733
Tucson Chamber of Commerce.....	762
Upper Colorado River Commission.....	705
Upper Snake River Water Users Protective Union.....	728
"Rethink the CAP," from Scottsdale Daily Progress, March 29, 1967.....	741
"River Basin Leader Vows To Keep Water," from the Salem (Oreg.) Statesman, March 8, 1967.....	233
"Suggestions Offered for Economizing Water," from Arizona Republic, April 25, 1967.....	741
Tipton, R. J., Tipton & Kalmbach, Inc., report: Upper Colorado River Commission.....	535
"Underground CAP Route Proposed," from Scottsdale Progress, February 15, 1967.....	743



CENTRAL ARIZONA PROJECT

TUESDAY, MAY 2, 1967

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER RESOURCES
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 1202, New Senate Office Building, Senator Clinton P. Anderson, presiding.

Present: Senators Anderson, Jackson, Hayden, Bible, Church, Moss, Kuchel, Allott, Jordan of Idaho, Fannin, Hansen, and Hatfield.

Also present: The Honorable Morris K. Udall, U.S. Representative from the Second Congressional District of the State of Arizona.

Staff members present: Jerry T. Verkler, staff director; Stewart French, chief counsel; William Van Ness, special counsel; Roy Whitacre and Mike Griswold, professional staff members; E. Lewis Reid, minority counsel; and Darryl Hart, assistant minority counsel.

Senator ANDERSON. The purpose of the hearing before the Water and Power Resources Subcommittee this morning is to take testimony on the five bills having to do with the construction of the central Arizona project and other issues related to the water resources of the Colorado River Basin.

The bills are: (1) S. 1004 by Senator Hayden; (2) S. 1013 by Senator Jackson at the request of the administration; (3) S. 861 by Senator Kuchel; (4) S. 1242 with an amendment sponsored by Senators Allott and Dominick; and (5) S. 1409 by Senator Moss.

As the dean of the Senate is only too painfully aware, this proposal has had a long and frustrating history before this committee and the Congress. The Bureau of Reclamation's original planning report was completed in December 1947, and was published as House Document 136, 81st Congress, first session.

Hearings on bills to authorize the project were conducted in both the Senate and House in 1949. The central Arizona project was passed by the Senate in 1950 and again in 1951. Action was indefinitely postponed by the House Interior and Insular Affairs Committee in 1951 pending an adjudication of the waters of the Lower Colorado River Basin.

Following the Supreme Court decision in the case of *Arizona v. California*, Senators Hayden and Goldwater introduced a central Arizona project bill on June 4, 1963. This subcommittee held 4 days of hearings on this matter in 1963, and there were many more days of consideration in 1964. On August 6, 1964, our colleague, Senator Hayden, once more reported a bill to the floor of the Senate but again final action was not taken.

All of the measures before us today would authorize the Hooker Dam and Reservoir on the Gila River in New Mexico as a unit of the central Arizona project. The witnesses from New Mexico will testify on the details of this project, but I do want to state for the record at the outset that the chairman of the subcommittee cannot overemphasize his support for this proposal. It is located in an area of my State which needs the full and wise development of its water resources in order to trigger the maximum use of our mineral and other natural resources in this part of New Mexico.

The Hooker Dam project will insure a firm water supply for this part of my arid State. Outdoor recreation, fish and wildlife enhancement, and flood control will be some of the benefits to the area as well as the use of this badly needed water for municipal, industrial, and agricultural purposes.

It is my sincere hope that 1967 will see the successful culmination of our years of consideration, and the central Arizona project will be authorized at last.

Before calling on Senator Hayden, who has waited longer than anyone else for approval of this project, and without objection, a copy of each of the bills, as well as the available executive reports of the departments will be made a part of the record at this point.

(The five bills referred to follow:)

[S. 1004, 90th Cong., first sess.]

A BILL To authorize the construction, operation, and maintenance of the central Arizona project, Arizona-New Mexico, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. That this Act may be cited as the "Central Arizona Project Act."

Sec. 2. (a) For the purposes of furnishing irrigation water and municipal water supplies to the water deficient areas of Arizona and western New Mexico through direct diversion or exchange of water, generation of electric power and energy, control of floods, conservation and development of fish and wildlife resources, enhancement of recreation opportunities, and for other purposes, the Secretary of the Interior (hereinafter referred to as the "Secretary") shall construct, operate, and maintain the central Arizona project, consisting of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system shall have a capacity of not less than three thousand cubic feet per second; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59); (4) Hooker Dam and Reservoir which shall be constructed to an initial capacity of ninety-eight thousand acre-feet and in such a manner as to permit subsequent enlargement of the structure (to give effect to the provisions of subsection (i) of this section; (5) Charleston Dam and Reservoir; (6) Tucson aqueduct and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, hydroelectric powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) (1) The Secretary may enter into an agreement with non-Federal interests proposing to construct a thermal generating powerplant whereby the United States shall acquire the right to such portion of the capacity of such plant, including delivery of power and energy over appurtenant transmission facilities to mutually agreed upon delivery points, as he determines is required in connection with the central Arizona project. Power and energy acquired thereunder may be



disposed of intermittently by the Secretary when not required in connection with the central Arizona project. The agreement shall provide, among other things, that—

(i) The United States shall pay not more than that portion of the total construction cost, exclusive of interest during construction, of the powerplant, and of any switchyards and transmission facilities serving the United States, as is represented by the ratios of the respective capacities to be provided for the United States therein to the total capacities of such facilities. The Secretary shall make the Federal portion of such costs available to the non-Federal interests during the construction period, including the period of preparation of designs and specifications, in such installments as will facilitate a timely construction schedule;

(ii) Annual operation and maintenance costs, including provision for depreciation (except as to depreciation on the pro rata share of construction cost borne by the United States in accordance with the foregoing subdivision (i)) shall be prorated between the United States and the non-Federal interests on the basis of the ratios determined in accordance with the foregoing subdivision (i);

(iii) The United States shall be given appropriate credit for any interests in Federal lands administered by the Department of the Interior that are made available for the powerplant and appurtenances.

(c) Unless and until otherwise provided by Congress, water from the central Arizona project shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered wildlife management areas.

(d) (1) Irrigation and municipal and industrial water supply under the central Arizona project within the State of Arizona may, in the event the Secretary determines that is necessary to effect repayment, be pursuant to master contracts with organizations which have power to levy assessments against all taxable real property within their boundaries. The terms and conditions of contracts or other arrangements whereby each such organization makes water from the central Arizona project available to users within its boundaries shall be subject to the Secretary's approval and the United States shall, if the Secretary determines such action is desirable to facilitate carrying out the provisions of this Act, have the right to require that it be a party to such contracts or that contracts subsidiary to the master contracts be entered into between the United States and any user. The provisions of this subparagraph (1) shall not apply to the supplying of water to an Indian tribe for use within the boundaries of an Indian reservation.

(2) Any obligation assumed pursuant to section 9(d) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(d)) with respect to any project contract unit or irrigation block shall be repaid over a basic period of not more than fifty years; any water service provided pursuant to section 9(e) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(e)) may be on the basis of delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes.

(3) Contracts relating to municipal and industrial water supply under the central Arizona project may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(c)); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

(e) Each contract under which water is provided under the central Arizona project shall require that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment

ment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the central Arizona project for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent, and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the central Arizona project or (ii) waters stored or developed by any Federal reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the central Arizona project or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this subsection, the agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent, and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the central Arizona project, if not needed for use or reuse in such Federal reclamation project.

(f) The Secretary may require in any contract under which water is provided from the central Arizona project that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in the case of users in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsection (i) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(g) In times of shortage or reduction of main stream Colorado River water for the central Arizona project, as determined by the Secretary, users which have yielded water from other sources in exchange for main stream water supplied by that project shall have a first priority to receive main stream water, as against other users supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(h) In the operation of the central Arizona project, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until and shall continue only so long as delivery of Colorado River water to downstream Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved. All additional consumptive uses provided for in this subsection shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

SEC. 3. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the central Arizona project works authorized pursuant to this Act shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 4. The Secretary shall determine the repayment capability of Indian lands within, under, or served by the central Arizona project. Construction costs al-



located to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

SEC. 5. The interest rate applicable to those portions of the reimbursable costs of the central Arizona project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such project, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

SEC. 6. The Secretary may undertake programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary.

SEC. 7. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2 (d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1967, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from net revenues derived from the sale of electric energy generated at Hoover Dam.

SEC. 8. Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin compact (63 Stat. 31), the water treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774) or the Colorado River Storage Project Act (70 Stat. 105).

SEC. 9. The Secretary is directed to—

(a) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River compact;

(b) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River compact.

SEC. 10. (a) The Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act and the Boulder Canyon Project Act, consistent with the provisions of those statutes, the Boulder Canyon Project Adjustment Act, the Colorado River compact, the Upper Colorado River compact and the Mexican Water Treaty. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River compact, if any such deficiency exists and is chargeable to the States of the upper division.

(2) Releases to comply with article III (d) of the Colorado River compact.

(3) Storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and probabilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III (e) of the Colorado River compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the Governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such State representatives as each Governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 11. (a) Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with, or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 12. Except as otherwise provided in this Act, in constructing, operating, and maintaining the central Arizona project, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902: 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

SEC. 13. (a) All terms used in this Act which are defined in the Colorado River compact shall have the meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree of the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming.

SEC. 14. There is hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purposes of this Act.



[S. 1013, 90th Cong., first sess.]

A BILL To authorize the construction, operation, and maintenance of the central Arizona project, Arizona-New Mexico, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. That this Act may be cited as the "Central Arizona Project Act."

SEC. 2. (a) For the purposes of furnishing irrigation water and municipal water supplies to the water deficient areas of Arizona and western New Mexico through direct diversion or exchange of water, generation of electric power and energy, control of floods, conservation and development of fish and wildlife resources, enhancement of recreation opportunities, and for other purposes, the Secretary of the Interior (hereinafter referred to as the "Secretary") shall construct, operate, and maintain the central Arizona project, consisting of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system shall have a capacity of two thousand five hundred cubic feet per second; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59); (4) Hooker Dam and Reservoir; (5) Charleston Dam and Reservoir; (6) Tucson aqueduct and pumping plants; (7) Salt-Gila aqueduct (8) canals, regulating facilities, hydroelectric powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) The Secretary may enter into an agreement with non-Federal interests proposing to construct a thermal generating powerplant whereby the United States shall acquire the right to such portion of the capacity of such plant, including delivery of power and energy over appurtenant transmission facilities to mutually agreed upon delivery points, as he determines is required in connection with the central Arizona project. Power and energy acquired thereunder may be disposed of intermittently by the Secretary when not required in connection with the central Arizona project. The agreement shall provide, among other things, that—

(1) The United States shall pay not more than that portion of the total construction cost, exclusive of interest during construction, of the powerplant, and of any switchyards and transmission facilities serving the United States, as is represented by the ratios of the respective capacities to be provided for the United States therein to the total capacities of such facilities. The Secretary shall make the Federal portion of such costs available to the non-Federal interests during the construction period, including the period of preparation of designs and specifications, in such installments as will facilitate a timely construction schedule;

(2) Annual operation and maintenance costs, including provision for depreciation (except as to depreciation on the pro rata share of construction cost borne by the United States in accordance with the foregoing subdivision (1)) shall be apportioned between the United States and the non-Federal interests on an equitable basis taking into account the ratios determined in accordance with the foregoing subdivision (1);

(3) Costs to be borne by the United States under subdivisions (1) and (2) shall not include (a) interest and interest during construction, (b) financing charges, (c) taxes (except for social security and other payroll taxes) including but not limited to real or personal property taxes, gross or net income taxes, and sales, use, and transaction privilege taxes, (d) franchise fees, and (e) such other costs as shall be specified in the agreement;

(4) The United States shall be given appropriate credit for any interest in Federal lands administered by the Department of the Interior that are made available for the powerplant and appurtenances.

(c) Unless and until otherwise provided by Congress, water from the central Arizona project shall not be made available directly or indirectly for the ir-

rigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and with the approval of the Secretary, State-administered wildlife management areas.

(d) (1) Irrigation and municipal and industrial water supply under the central Arizona project within the State of Arizona may, in the event the Secretary determines that it is necessary to effect repayment, be pursuant to master contracts with organizations which have power to levy assessments against all taxable real property within their boundaries. The terms and conditions of contracts or other arrangements whereby each said organization makes water from the central Arizona project available to users within its boundaries shall be subject to the Secretary's approval and the United States shall, if the Secretary determines such action is desirable to facilitate carrying out the provisions of this Act, have the right to require that it be a party to such contracts or that contracts subsidiary to the master contracts be entered into between the United States and any user. The provisions of this subparagraph (1) shall not apply to the supplying of water to an Indian tribe for use within the boundaries of an Indian reservation.

(2) Any obligation assumed pursuant to section 9(d) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(d)) with respect to any project contract unit or irrigation block shall be repaid over a basic period of not more than fifty years; any water service provided pursuant to section 9(e) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(e)) may be on the basis of delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes. Notwithstanding any other provisions of law no contract relating to an irrigation water supply under the central Arizona project from the main stream of the Colorado River shall commit the United States to deliver such supply for a basic period of more than fifty years for each project contract unit or irrigation block, nor shall such a contract carry renewal or conversion rights or entitle the contractor to water beyond expiration of the delivery periods specified therein. In negotiating new contracts for delivery of such main stream water, the Secretary shall consult with representatives of the State of Arizona and the Secretary shall take into consideration the overall water supply and needs of the central Arizona project.

(3) Contracts relating to municipal and industrial water supply under the central Arizona project may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(c)): may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

(e) Each contract under which water is provided under the central Arizona project shall require that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the central Arizona project for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal, and industrial waste water, return flow, seepage, sewage, effluent, and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the central Arizona project or (ii) waters stored or developed by any Fed-



eral reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the central Arizona project or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this subsection, the agricultural, municipal, and industrial waste water, return flow, seepage, sewage effluent, and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the central Arizona project, if not needed for use or reuse in such Federal reclamation project.

(f) The Secretary may require in any contract under which water is provided from the central Arizona project that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in the case of users in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions in subsection (h) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(g) In times of shortage or reduction of main stream Colorado River water for the central Arizona project, as determined by the Secretary, users which have yielded water from other sources in exchange for main stream water supplied by that project shall have a first priority to receive main stream water, as against other users supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(h) In the operation of the central Arizona project, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over an above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until and shall continue only so long as delivery of Colorado River water to downstream Gila River uses in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved. All additional consumptive uses provided for in this subsection shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

SEC. 3. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the central Arizona project works authorized pursuant to this Act shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 4. The Secretary shall determine the repayment capability of Indian lands within, under, or served by the central Arizona project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

SEC. 5 The interest rate applicable to those portions of the reimbursable costs of the central Arizona project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such project, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

SEC. 6. The Secretary may undertake programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery in the Yuma area. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary. No ground water recovery program hereby authorized shall be undertaken until the Secretary of State has reported to the President on consultation which he may have had with the Government of Mexico pursuant to the Water Treaty of 1944 (Treaty Series 994) and the President has approved a definite plan report thereon.

SEC. 7. Part I of the Federal Power Act (16 U.S.C. 791a-823) shall not be applicable to the reach of the Colorado River between Lake Mead and Glen Canyon Dam until and unless otherwise provided by Congress.

SEC. 8. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1987, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from net revenues derived from the sale of electric energy generated at Hoover Dam.

SEC. 9. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River compact (45 Stat. 1057), the Upper Colorado River Basin compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774) or the Colorado River Storage Project Act (70 Stat. 105).

(b) The Secretary is directed to—

(1) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River compact;

(2) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River compact.

SEC. 10. (a) The Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act and the Boulder Canyon Project Act, consistent with the provisions of those statutes, the Boulder Canyon Project Adjustment Act, the Colorado River compact, the Upper Colorado River compact and the Mexican water treaty. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River compact, if any such deficiency exists and is chargeable to the States of the upper division.

(2) Releases to comply with article III(d) of the Colorado River compact.

(3) Storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and proba-

bilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III(e) of the Colorado River compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the Governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such State representatives as each Governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 11. (a) ~~Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River compact shall not be reduced or prejudiced by any use of such water in the lower basin.~~

(b) Nothing in this Act shall be construed so as to impair, conflict with, or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 12. Except as otherwise provided in this Act, in constructing, operating, and maintaining the central Arizona project, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

SEC. 13. (a) All terms used in this Act which are defined in the Colorado River compact shall have the meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree of the Supreme Court of the United States in Arizona against California and others (376 U.S. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., February 15, 1967.

HON. HUBERT H. HUMPHREY,
President of the Senate,
Washington, D.C.

DEAR MR. PRESIDENT: Enclosed is a draft of a proposed bill to authorize the construction, operation and maintenance of the Central Arizona project, Arizona-New Mexico, and for other purposes.

We recommend that this bill be referred to the appropriate Committee for consideration, and we recommend its enactment.

The draft bill would give effect to certain of the Administration's recommendations for a lower Colorado River development program.

Specifically, the draft bill would :

1. Authorize the Central Arizona project (including Hooker Dam in New Mexico) with provision for assistance in meeting repayment requirements in Arizona through (a) a \$10 per acre-foot average canal-side irrigation rate, (b) a \$50 per acre-foot municipal and industrial water rate, (c) a small addition to the municipal and industrial water rate, or an ad valorem tax, or a combination of the two;

2. Make provision for low-cost pumping power for the Central Arizona project through prepayment for the requisite capacity and associated transmission facilities in a large, efficient thermal plant to be constructed in the southwest area by a combination of public and private utilities associated with Western Energy Supply and Transmission Associates (WEST) ;

3. Encompass programs for water salvage and recovery of ground water along and adjacent to the main stream of the lower Colorado River ;

4. Remove the Hualapai (Bridge Canyon) and Marble Canyon sites from the operation of Part I of the Federal Power Act.

In addition the Administration makes the following recommendations :

- a. Expansion of the Grand Canyon National Park to include the Marble Canyon site and the elimination of the latter development from the program ;

- b. Deferral of action on the Hualapai (Bridge Canyon) project at this time, reserving the question of disposition of the Hualapai site for future consideration by the Congress ;

- c. Establishment of the National Water Commission to re-examine the nation's critical water supply problems, including the Colorado River Basin, as heretofore recommended by the Administration.

The Administration is committed to the authorization of the Central Arizona project. If the State of Arizona is to put to use its entitlement of Colorado River water as adjudicated by the Supreme Court in *Arizona v. California, et al.*, 373 U.S. 546 (1963), this project must be built. The Central Arizona project should be undertaken now in order to slow the pace at which ground water resources in the Central Arizona area are being exhausted.

Similarly, we are in agreement that studies of the long-range water supply problems of the Colorado River Basin should now be initiated in order that proposed solutions may be evolved and considered in a timely fashion.

The foregoing program will, we believe, provide the authorization necessary to meet the most immediate water development needs in the lower Colorado River Basin area. At the same time, the studies of the National Water Commission will provide a background of information and advice against which long-range solutions to the region's water supply problems can be effectively evolved.

The segments of the lower Colorado River that would be inundated by the Hualapai and Marble Canyon developments possess major scenic and wilderness values. Whether the benefits to be derived from construction of these projects are of sufficient importance to outweigh the retention of these areas in their present state has been one of the most vexing issues that has emerged in connection with consideration of Colorado River resource problems. After further consideration of all aspects of the matter, we have concluded that the highest and best use of the Marble Canyon site is to retain it in its natural state as an addition to the existing Grand Canyon National Park. Studies regarding the boundaries of the proposed addition to the park will be completed shortly and, as soon as possible, we shall transmit for the Congress's consideration a draft of a bill to carry out this recommendation. Pending action on it, we believe that legislation authorizing the Central Arizona project should also remove the Marble Canyon site, along with the Hualapai site hereafter discussed, from the operation of Part I of the Federal Power Act. If the necessary determinations can be completed in time, there would be no objection to including the park extension in the proposed legislation transmitted herewith.

Whether hydroelectric development of the Hualapai site should also be precluded permanently need not be decided at this time. Deferment of this decision need not affect construction of the Central Arizona project since, under our recommendations, the Central Arizona unit will not depend upon a main stream Colorado River hydroelectric power development as a source of pumping power and financial assistance.

We, therefore, reiterate the recommendation made in our report of May 17, 1965, on H.R. 4671 and by the Bureau of the Budget in its report of May 10, 1965,

on S. 75 and S. 1019, that consideration of the Hualapai site be deferred by the Congress pending evaluation of the issue by the National Water Commission.

In order to preserve Congressional freedom of action with respect to Hualapai, Part I of the Federal Power Act should be made inapplicable to it.

We believe that the National Water Commission should be authorized separately as provided by S. 20 which was passed by the Senate on February 6 and is now before the House Committee on Interior and Insular Affairs.

We believe the Commission is the appropriate entity to undertake an evaluation of basic issues relative to Colorado River water supply problems. The Commission would be directed by section 3(a) of the Senate-passed bill to:

(1) review present and anticipated national water resource problems, making such projections of water requirements as may be necessary and identifying alternative ways of meeting these requirements—giving consideration, among other things, to conservation and more efficient use of existing supplies, increased usability by reduction of pollution, innovations to encourage the highest economic use of water, interbasin transfers, and technological advances including, but not limited to desalting, weather modification and waste water purification and reuse; (2) consider economic and social consequences of water resource development, including, for example, the impact of water resource development on regional economic growth, on institutional arrangements, and on esthetic values affecting the quality of life of the American people; and (3) advise on such specific water resource matters as may be referred to it by the President and the Water Resources Council.

Advice and guidance on these matters, all relevant to the Colorado Basin's water problems, by a disinterested and objective Commission composed of outstanding citizens should provide background of great assistance in the formulation of specific proposals. The Commission can be expected to give prompt consideration to the problems of the Colorado River Basin. As President Johnson said in his message to the Congress on "Protecting our Natural Heritage" of January 30, 1967, in renewing his recommendation for the establishment of the Commission, "We must thoroughly explore every means for assuring an adequate supply of pure water to arid areas like the Southwest."

Under the previously proposed plan for the Central Arizona project, which envisioned provision of pumping power and financial assistance from main stream hydroelectric power developments, all reimbursable costs would have been returned through financial assistance from power sales and average rates of \$10 and \$50 per acre-foot for irrigation and municipal and industrial water, respectively. This \$50 M&I rate included a component for irrigation assistance. Federal financing of a portion of a nonfederally owned thermal plant through prepayment for project power requirements would provide low-cost pumping power and would eliminate the necessity for financial assistance from main stream Colorado River hydroelectric projects.

Using the previously proposed average water rates, our studies estimate that under such a situation, the project cost would be repaid either by increasing the M&I rate to \$56.00 per acre-foot or by assessing the project service area in Arizona with an annual ad valorem tax levy which would come to 0.6 mills per dollar of assessed valuation if Pinal, Maricopa, and Pima Counties are included. The economic benefits of the project should manifest themselves in an increase in the area's wealth which, in turn, would be reflected in a growth of the tax base. All things considered, the increase in taxes would seem to be relatively modest.

Obviously, various combinations of the two alternatives of the municipal and industrial water charge and the ad valorem levy are possible. Decisions on the actual mix should be taken only in closest consultation with the State and local people concerned. The legislation we are suggesting will provide the requisite flexibility. The average \$10 per acre-foot canal-side irrigation water rate, which results in an average rate of \$16 per acre-foot at the farmer's headgate, however, is not capable of substantial adjustment. It represents the average repayment ability of the water users, given other necessary costs, reasonable profit allowances and maintenance of the type of agriculture consistent with the objectives of the Federal reclamation program. Among the factors which restrict an upward thrust of the average irrigation water rate for the Central Arizona project are the restraints proposed upon the expansion of irrigation and the lack of an as-

surance of a continuing water supply. Consequently, we contemplate retention of the \$10 rate, on the basis of current price levels.

This plan adheres to all present reclamation repayment policies. There are precedents for the use of a small M&I surcharge or ad valorem tax for irrigation repayment assistance. The Central Valley Project in California is an example of the former. The Colorado River Storage Project and the Fryingspan-Arkansas Project, both upper Colorado River Basin projects, are among the latter, as is the Garrison Diversion Project in North Dakota.

While the prepaid purchase of pumping power from a non-Federal steam-electric plant would be a departure in reclamation history, the provision of pumping power for project use is, itself, customary. There are indications that Bureau of Reclamation cooperation in a non-Federal steamplant would be acceptable to the public and private generating utilities in the WEST organization.

Sections 1-7 of the enclosed draft of bill (Attachment A) would give effect to the foregoing recommendations.

Colorado River legislation considered in the 89th Congress would have granted California a priority for the consumptive use of 4,400,000 acre-feet of water as against diversions for the Central Arizona project in any year in which there is less than 7,500,000 acre-feet of main stream Colorado River water available for consumptive use in the three lower basin States of Arizona, California, and Nevada. In such event, diversions for the Central Arizona project would also be curtailed in favor of existing users in Arizona and Nevada. This priority would persist until works are in operation capable of augmenting the flow of the main stream of the Colorado River below Lee Ferry by not less than 2,500,000 acre-feet annually. This interstate priority was arrived at by agreement of the States involved. Earlier, the Senate Interior and Insular Affairs Committee, in favorably reporting S. 1658 in the 88th Congress, provided a similar California priority as against the Central Arizona project, but terminating in 25 years.

We believe the questions of whether there should be a statutory priority and of its terms are primarily for resolution by the States involved and the Congress. If agreement can be reached upon an interstate priority, the Administration would offer no objection. The Bureau of Reclamation water supply studies, financial analysis and feasibility determination for the Central Arizona project have been made in the light of a priority of 4,400,000 acre-feet per annum for California uses and for existing rights and uses in Nevada and Arizona.

Payout assistance from a lower Colorado River Basin fund would not be necessary under our proposal. However, if the Congress deems it appropriate to establish such a fund at this time to provide financial assistance for other future water developments for the lower basin, we perceive no objection thereto. Presumably, such a fund would include post-amortization revenues from the existing Hoover and Parker-Davis projects, the Central Arizona project, and such other Federal dams as may be subsequently constructed in the lower basin. The most recent step by the Congress in this direction was the establishment of a Columbia Basin account by section 2 of P.L. 89-448 of June 14, 1966. In the event the Congress concludes that a lower Colorado River Basin development fund should be established at this time, we also transmit such a provision (Attachment B) for consideration.

The following table compares the construction cost of the lower Colorado program we recommend be authorized with the cost of the construction authorizations contained in Title III of S. 861, now before the Committee on Interior and Insular Affairs of the Senate, and of H.R. 3300, pending before the House Committee:

	Adminis- tration recommen- dation	Title III, S. 861 and H.R. 3300
Hualapai (including Coconino silt retention dam).....		\$529,000,000
Paria silt retention dam.....		11,000,000
Central Arizona project.....	\$580,000,000	580,000,000
Thermal prepay.....	92,000,000	
Water salvage.....	42,000,000	42,000,000
Fish and wildlife.....	5,000,000	5,000,000
Total.....	719,900,000	1,167,000,000

S. 861 would also authorize five participating projects under the Colorado River Storage Project Act, Animas-La Plata, Colorado-New Mexico and Dolores, Dallas Creek, West Divide and San Miguel in Colorado. Similar authorizations are contained in H.R. 3300.

In transmitting the planning reports on these projects to the Congress, the Animas-La Plata and Dolores projects were recommended for immediate authorization. Deferral, pending the establishment and completion of review by the National Water Commission of related water problems, was proposed for the others. This proposed legislation would seem to be the appropriate vehicle to authorize the Animas-La Plata and Dolores projects. This could be accomplished by inclusion therein of a provision along the lines of Section 501 of S. 861. In that event subsections (a) and (c) would be modified to omit the Dallas Creek, West Divide and San Miguel projects. We would also propose to eliminate what is now subsection (d) of Section 501 of S. 861 for the reasons stated last year in Commissioner Dominy's testimony before the House Committee on Interior and Insular Affairs on H.R. 4671. (See pp. 1343-1344, Serial 89-17 Part II, Hearings before House Committee on Interior and Insular Affairs on "Lower Colorado River Basin Project.") We would offer no objection to the inclusion of provisions like Sections 501(b) and (e) of S. 861. Nor would there be objection to applying the "Class 1 equivalency" concept to acreage limitations for the Animas-La Plata, Dolores and Seedskadee projects (Sec. 501(c), S. 861), in view of the high altitude and relatively short growing seasons of the areas involved.

In addition to the foregoing authorization of participating projects under the Colorado River Storage Project Act, S. 861 includes a number of provisions affecting upper and lower Colorado River Basin relationships. These provisions have largely been arrived at in the course of interbasin discussions and Congressional consideration of earlier Colorado River bills. There is no objection to inclusion of the substance of these provisions in this legislation and the attached draft bill so provides, commencing with Section 8.

The Bureau of the Budget advises that the enactment of the legislation to authorize the Central Arizona project as herein proposed is in accord with the program of the President.

Sincerely yours,

STEWART UDALL,
Secretary of the Interior.

A BILL To authorize the construction, operation, and maintenance of the Central Arizona project, Arizona-New Mexico, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled.

SEC. 1. That this Act may be cited as the "Central Arizona Project Act."

SEC. 2(a). For the purposes of furnishing irrigation water and municipal water supplies to the water deficient areas of Arizona and western New Mexico through direct diversion or exchange of water, generation of electric power and energy, control of floods, conservation and development of fish and wildlife resources, enhancement of recreation opportunities, and for other purposes, the Secretary of the Interior (hereinafter referred to as the "Secretary") shall construct, operate, and maintain the Central Arizona project, consisting of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plans (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system shall have a capacity of two thousand five hundred cubic feet per second; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59); (4) Hooker Dam and Reservoir; (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, hydroelectric powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) The Secretary may enter into an agreement with non-Federal interests proposing to construct a thermal generating powerplant whereby the United States shall acquire the right to such portion of the capacity of such plant, including

delivery of power and energy over appurtenant transmission facilities to mutually agreed upon delivery points, as he determines is required in connection with the Central Arizona project. Power and energy acquired thereunder may be disposed of intermittently by the Secretary when not required in connection with the Central Arizona project. The agreement shall provide, among other things, that—

(1) The United States shall pay not more than that portion of the total construction cost, exclusive of interest during construction, of the powerplant, and of any switchyards and transmission facilities serving the United States, as is represented by the ratios of the respective capacities to be provided for the United States therein to the total capacities of such facilities. The Secretary shall make the Federal portion of such costs available to the non-Federal interests during the construction period, including the period of preparation of designs and specifications, in such installments as will facilitate a timely construction schedule;

(2) Annual operation and maintenance costs, including provision for depreciation (except as to depreciation on the pro-rata share of construction cost borne by the United States in accordance with the foregoing subdivision (1)) shall be apportioned between the United States and the non-Federal interests on an equitable basis taking into account the ratios determined in accordance with the foregoing subdivision (1);

(3) Costs to be borne by the United States under subdivisions (1) and (2) shall not include (a) interest and interest during construction, (b) financing charges, (c) taxes (except for Social Security and other payroll taxes) including but not limited to real or personal property taxes, gross or net income taxes, and sales, use, and transaction privilege taxes, (d) franchise fees, and (e) such other costs as shall be specified in the agreement;

(4) The United States shall be given appropriate credit for any interests in Federal lands administered by the Department of the Interior that are made available for the powerplant and appurtenances.

(c) Unless and until otherwise provided by Congress, water from the Central Arizona project shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered wildlife management areas.

(d) (1) Irrigation and municipal and industrial water supply under the Central Arizona project within the State of Arizona may, in the event the Secretary determines that it is necessary to effect repayment, be pursuant to master contracts with organizations which have power to levy assessments against all taxable real property within their boundaries. The terms and conditions of contracts or other arrangements whereby each said organization makes water from the Central Arizona project available to users within its boundaries shall be subject to the Secretary's approval and the United States shall, if the Secretary determines such action is desirable to facilitate carrying out the provisions of this Act, have the right to require that it be a party to such contracts or that contracts subsidiary to the master contracts be entered into between the United States and any user. The provisions of this subparagraph (1) shall not apply to the supplying of water to an Indian tribe for use within the boundaries of an Indian reservation.

(2) Any obligation assumed pursuant to section 9(d) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(d)) with respect to any project contract unit or irrigation block shall be repaid over a basic period of not more than fifty years; any water service provided pursuant to section 9(e) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(e)) may be on the basis of delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes. Notwithstanding any other provisions of law no contract relating to an irrigation water supply under the Central Arizona project from the main stream of the Colorado River shall commit the United States to deliver such supply for a basic period of more than fifty years for each project contract unit or irrigation block, nor shall such

a contract carry renewal or conversion rights or entitle the contractor to water beyond expiration of the delivery periods specified therein. In negotiating new contracts for delivery of such main stream water, the Secretary shall consult with representatives of the State of Arizona and the Secretary shall take into consideration the overall water supply and needs of the Central Arizona project.

(3) Contracts relating to municipal and industrial water supply under the Central Arizona project may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(c)); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

(e) Each contract under which water is provided under the Central Arizona project shall require that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the Central Arizona project for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the Central Arizona project or (ii) waters stored or developed by any Federal reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the Central Arizona project or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this subsection, the agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the Central Arizona project, if not needed for use or reuse in such Federal reclamation project.

(f) The Secretary may require in any contract under which water is provided from the Central Arizona project that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in the case of users in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsection (h) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(g) In times of shortage or reduction of main stream Colorado River water for the Central Arizona project, as determined by the Secretary, users which have yielded water from other sources in exchange for main stream water supplied by that project shall have a first priority to receive main stream water, as against other users supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(h) In the operation of the Central Arizona project, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive year of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until and shall continue only so long as delivery of Colorado River water to downstream

Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved. All additional consumptive uses provided for in this subsection shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

SEC. 3. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the Central Arizona project works authorized pursuant to this Act shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 4. The Secretary shall determine the repayment capability of Indian lands within, under, or served by the Central Arizona project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

SEC. 5. The interest rate applicable to those portions of the reimbursable costs of the Central Arizona project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such project, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

SEC. 6. The Secretary may undertake programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery in the Yuma area. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary. No ground water recovery program hereby authorized shall be undertaken until the Secretary of State has reported to the President on consultation which he may have had with the Government of Mexico pursuant to the Water Treaty of 1944 (Treaty Series 994) and the President has approved a definite plan report thereon.

SEC. 7. Part I of the Federal Power Act (16 U.S.C. 791a-823) shall not be applicable to the reach of the Colorado River between Lake Mead and Glen Canyon Dam until and unless otherwise provided by Congress.

SEC. 8. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1967, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from net revenues derived from the sale of electric energy generated at Hoover Dam.

SEC. 9(a). Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder

Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774) or the Colorado River Storage Project Act (70 Stat. 105).

(b) The Secretary is directed to—

(1) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River Compact.

(2) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River Compact.

SEC. 10(a). The Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act and the Boulder Canyon Act, consistent with the provisions of those statutes, the Boulder Canyon Project Adjustment Act, the Colorado River Compact, the Upper Colorado River Compact and the Mexican Water Treaty. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River Storage Project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River Compact, if any such deficiency exists and is chargeable to the States of the upper division.

(2) Releases to comply with article III(d) of the Colorado River Compact.

(3) Storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and probabilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River Compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III(e) of the Colorado River Compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the governors of the seven Colorado River Basin States and appropriate consultation with such state representatives as each governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 11(a). Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River Compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 12. Except as otherwise provided in this Act, in constructing, operating and maintaining the Central Arizona project, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

SEC. 13 (a). All terms used in this Act which are defined in the Colorado River Compact shall have the meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree of the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming.

DRAFT PROVISION FOR "LOWER COLORADO RIVER BASIN DEVELOPMENT FUND"

SEC. —. All Federal revenues from the Boulder Canyon, Parker-Davis, Central Arizona and any other Federal reclamation projects hereafter constructed in the Lower Colorado River Basin, which, after completion of the respective repayment requirements thereof, are surplus, as determined by the Secretary, to their respective operation, maintenance, and replacement requirements shall be kept in a separate fund in the Treasury of the United States, to be known as the Lower Colorado River Basin development fund, to be expended or applied in connection with water conservation and development for the Lower Colorado River Basin as may hereafter be prescribed by the Congress.

SUMMARY REPORT—CENTRAL ARIZONA PROJECT WITH FEDERAL PREPAYMENT POWER ARRANGEMENTS

Costs

Project costs:

Granite Reef aqueduct.....	\$336,430,000
Salt-Gila aqueduct.....	38,400,000
Tucson aqueduct.....	42,030,000
Orme Dam and Reservoir.....	38,418,000
Buttes Dam and Reservoir.....	31,974,000
Charleston Dam and Reservoir.....	33,048,000
Hooker Dam and Reservoir.....	28,797,000
Drainage system.....	10,500,000
Power generation and transmission arrangements.....	¹ 91,950,000
Subtotal.....	651,547,000
Indian distribution system.....	19,970,000
Water salvage and recovery.....	42,450,000
Fish hatcheries and wildlife refuge.....	5,250,000
Total project costs.....	719,217,000

Annual operation, maintenance, and replacement costs:

Aqueduct system.....	² 3,203,000
Power generation and transmission arrangements.....	³ 6,566,000
Subtotal.....	9,769,000
Water salvage projects.....	1,000,000
Fish hatcheries and wildlife refuge.....	490,000
Total.....	11,259,000

¹ Includes \$27,650,000 for federally constructed transmission system to project pumps.

² Pumping power costs are associated with powerplant and transmission system rather than aqueduct system.

Benefit-cost analysis

Benefits	Direct	Indirect	Total
Function:			
Irrigation.....	31,558,000	33,926,000	65,484,000
M. & I.....	16,853,000		16,853,000
Commercial power.....	3,725,000		3,725,000
Fish and wildlife.....	1,635,000		1,635,000
Recreation.....	583,000		583,000
Flood control.....	780,000		780,000
Area redevelopment.....	267,000		267,000
Total.....	55,401,000	33,926,000	89,327,000

Costs:

Total project costs.....	\$719,217,000
Interest during construction.....	46,993,000
Subtotal	766,210,000

Less:

Investigation costs.....	5,794,000
Indian distribution system.....	19,970,000
Total	25,764,000
Net Federal investment.....	740,446,000

Annual equivalent of investment costs (100 years, 3½ percent interest)	24,257,000
Average annual O.M. & R.....	11,259,000

Total annual costs.....	35,516,000
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Benefit-cost ratios:

Total benefits, 100 years.....	2.5 to 1
Direct benefits only, 100 years.....	1.5 to 1
Total benefits, 50 years.....	¹ 2.5 to 1
Direct benefits only, 50 years.....	¹ 1.5 to 1

¹ Because of declining water supplies, annual irrigation benefits are less in later years. Therefore, the average annual benefits are greater over the 1st 50 years than over 100 years. This effect offsets the higher annual costs over 50 years.

Cost allocation (100-year period—3½ percent interest)

Purpose	Project cost	Interest during construction	Total Federal investment	Average annual OM&R
Irrigation.....	\$322,301,000	\$23,957,000	\$346,258,000	¹ \$2,378,000
Municipal and industrial.....	194,029,000	12,924,000	206,953,000	¹ 445,000
Power.....	91,950,000	5,087,000	97,037,000	¹ 6,566,000
Irrigation.....	(48,366,000)	(2,676,000)	(51,042,000)	(3,454,000)
M. & I.....	(16,459,000)	(910,000)	(17,369,000)	(1,175,000)
Commercial.....	(27,125,000)	(1,501,000)	(28,626,000)	(1,937,000)
Recreation.....	6,343,000	926,000	7,269,000	278,000
Flood control.....	11,164,000	812,000	11,976,000	34,000
Fish and wildlife.....	24,129,000	1,843,000	25,972,000	68,000
Prepaid investigation.....	² 1,631,000		² 1,631,000	
Subtotal.....	651,547,000	45,549,000	697,096,000	9,769,000
Indian distribution system.....	³ 19,970,000			
Water salvage and recovery.....	42,450,000	1,444,000	43,894,000	1,000,000
Fish hatcheries and wildlife refuge.....	5,250,000		5,250,000	490,000
Total.....	719,217,000	46,993,000	746,240,000	11,259,000

¹ Pumping power costs shown under power allocation.

² Prepaid from Colorado River development fund. Remainder of investigation costs are allocated among project purposes.

³ Included for authorization purposes but not considered in economic and financial analyses. Repayment would be deferred under the provisions of the Leavitt Act.

Repayment analysis—Summary of reimbursable and nonreimbursable costs

	Project cost	Interest during construction at 3.225 percent	Total for repayment
Reimbursable:			
Irrigation.....	\$322,301,000		\$322,301,000
Municipal and industrial.....	194,029,000	\$14,784,000	208,813,000
Power.....	91,950,000	2,489,000	94,439,000
Irrigation.....	(48,366,000)		(48,366,000)
M. & I.....	(16,459,000)	(940,000)	(17,399,000)
Commercial.....	(27,125,000)	(1,549,000)	(28,674,000)
Recreation.....	1,525,000	217,000	1,742,000
Fish and wildlife.....	294,000	40,000	344,000
Total.....	610,099,000	17,630,000	627,629,000
Nonreimbursable:			
Flood control.....	11,164,000		11,164,000
Recreation.....	4,818,000		4,818,000
Fish and wildlife.....	23,835,000		23,835,000
Indian distribution system ¹	19,970,000		19,970,000
Water salvage and recovery.....	42,450,000		42,450,000
Fish hatcheries and wildlife refuge.....	5,250,000		5,250,000
Total.....	107,487,000		107,487,000
Prepaid investigation costs ²	1,631,000		
Total project cost.....	719,217,000		

¹ Repayment deferred under Leavitt Act provisions.² Prepaid from Colorado River development fund.*Repayment of reimbursable costs*

	Reimbursable costs	Net revenues available for repayment	Surplus or deficit
Repayment with ad valorem tax:			
Irrigation.....	\$322,301,000	\$95,846,000	—\$226,455,000
Municipal and industrial.....	208,813,000	217,095,000	8,282,000
Power, total.....	94,439,000	166,776,000	72,337,000
Fish and wildlife.....	334,000	334,000	
Recreation.....	1,742,000	1,742,000	
Subtotal.....	627,629,000	481,793,000	—145,836,000
Ad valorem tax.....		145,836,000	145,836,000
Total.....	627,629,000	627,629,000	
Repayment without ad valorem tax:			
Irrigation.....	322,301,000	95,846,000	—226,455,000
Municipal and industrial.....	208,813,000	363,906,000	155,093,000
Power, total.....	94,439,000	166,776,000	72,337,000
Fish and wildlife.....	334,000	334,000	
Recreation.....	1,742,000	1,742,000	
Total.....	627,629,000	628,804,000	975,000

INTRODUCTION

The Central Arizona Project initially was recommended to the Congress for construction by the Secretary of the Interior in 1948. The conceptual framework and principal objectives of the project have remained substantially unchanged since that time; however, details of the project plan, repayment, and specific features have been changed to reflect the negotiations, legal decisions, and additional studies which subsequently have taken place.

The Pacific Southwest Water Plan, which was approved by the Secretary of the Interior in January of 1964, incorporated the Central Arizona Project, as a unit, into a plan for regional water resource development designed to meet the immediate and long-range water needs of the Pacific Southwest. The Hualapai (Bridge Canyon) Dam, which had previously been a feature of the Central

Arizona Project, was included in the Pacific Southwest Water Plan, but as a separate unit. The report on the Pacific Southwest Water Plan was reviewed by the States of the Colorado River Basin and the interested Federal agencies, and aspects of the plan became the basis for proposed legislation to authorize construction of the Colorado River Basin Project which was considered in the 89th Congress.

The action of the House of Representatives Committee on Interior and Insular Affairs, which, in turn, reflects a great deal of interstate negotiation and compromise, introduced further changes in the legislative proposals culminating in a bill to authorize the Colorado River Basin Project (H.R. 4671 of the 89th Congress) which was favorably reported by the Committee on August 11, 1966. The bill was not acted upon further by the Congress.

After the adjournment of the 89th Congress, the Bureau of Reclamation undertook a series of analyses of a wide variety of alternative plans which would accomplish in varying degree the objectives of the previous proposals for the Lower Colorado River Basin portion of the Colorado River Basin Project. The results of these studies were utilized by the Secretary of the Interior and the Administration in formulating a revised development program for the Lower Colorado River and the Central Arizona Project. The revised program was announced by the Secretary of the Interior on February 1, 1967, and was transmitted to the Congress with a recommended draft of a bill on February 15, 1967.

Current proposal

This summary report describes the portion of the Administration's currently proposed development program pertaining to the Central Arizona Project. It represents a modification of that portion of the Pacific Southwest Water Plan which was described in detail in the Supplemental Information Report on Central Arizona Project and includes the previously proposed Water Salvage Program and fish hatcheries and wildlife refuge included in the Pacific Southwest Water Plan.

The Central Arizona Project has been revised in two major aspects:

(1) The Central Arizona Project, including the Water Salvage Program and other fish and wildlife measures, is proposed as an independent development without financial assistance from the Lower Colorado Basin Development Fund which was included in the Pacific Southwest Water Plan and the legislation reported on in the 89th Congress. This revised proposal provides that the Federal Government prepay a portion of the capital costs of a large, thermal powerplant and of a related transmission system which would be constructed by non-Federal interests. The prepayment would be a project cost and would be repaid as such under Reclamation law and policy. Federal participation in the construction costs would enable the project to obtain low-cost pumping power from the thermal powerplant. In years when water supplies are low, a portion of the power associated with the capacity of the prepaid portion of the plant would be excess to pumping needs. The revenues from sales of this power would be used in part to amortize the prepayment investment and in part to assist in the repayment of project costs allocated to irrigation.

The remaining irrigation repayment assistance required by the project would be obtained by increasing the municipal and industrial water rate over that contemplated in earlier proposals, or by levying an ad valorem tax on the project area, or by a combination of the two.

(2) The capacity of the main aqueduct has been increased from 1,800 to 2,500 c.f.s. This change is consistent with the action of the House Committee on Interior and Insular Affairs on H.R. 4671. On the basis of hydrologic predictions and without augmentation of the flows of the Colorado River, the 2,500 c.f.s. aqueduct will be necessary for Arizona to divert an average of almost 1.2 million acre-feet annually over the repayment period of the project. The 1,800-c.f.s. aqueduct contemplated in the Pacific Southwest Water Plan would have accomplished this objective only in conjunction with the augmentation of Colorado River flows. Adoption of the 4.4 million acre-foot priority for California would reduce the total water supply available for diversion by the Central Arizona Project in years of low flow. The 2,500-c.f.s. canal would be of greater importance under such conditions as it would permit larger diversions in years of high flow and help to maintain overall diversions which would approach full use of Arizona's entitlement to Colorado River water within the State.

Other aspects of the revised Lower Colorado River plan

This summary report includes only that portion of the revised development program for the Lower Colorado River which pertains to the authorization of the Central Arizona Project. The plan must be considered, however, in view of the associated recommendations which are included in the proposal. The points, other than the immediate authorization of the development described herein, are as follows:

(1) Place Marble Canyon in an enlarged Grand Canyon National Park; reserve final decision on the Hualapai Dam for future congressional action.

(2) Leave the issue of a 4.4 million acre-foot annual priority of Colorado River water for California to the States involved and to the Congress.

(3) Authorize a National Water Commission as in the Bill S. 20 passed by the Senate on February 6, 1967. The Commission would be expected to give early attention to the Colorado River Basin and study all problems of water supply, shortages, and potential solutions.

(4) Leave for determination by the Congress the establishment of a development fund which would receive revenues, after completion of existing repayment schedules, from the federally constructed Hoover, Parker, and Davis Dams on the Lower Colorado. Revenues from the Central Arizona Project after pay-out also could be covered into the development fund as could post-amortization revenues from other Federal dams hereafter constructed in the Lower Colorado River Basin.

PLAN OF DEVELOPMENT

Purposes

As originally set forth in the 1947 report, the Central Arizona Project plan of development would make Colorado River water available to the project area through a pumping and aqueduct system which would raise and convey the water from Lake Havasu, on the Colorado River, into the Central Service Zone which is essentially comprised of the Phoenix-Tucson area. Through exchange, water could be made available in the areas of Arizona and New Mexico outside of the Central Service Zone.

The present plan of development remains the same in all major aspects with the exception of the source of pumping energy required for project pumping needs. Project facilities would coordinate the use of imported Colorado River water and the local water resources of the Gila River Basin. The project is designed to provide water for irrigation and municipal and industrial purposes. Additional purposes include flood control, recreation, fish and wildlife conservation, sediment retention, salinity control, power generation, and area redevelopment.

Project facilities

The backbone facilities of the Central Arizona Project would be the Granite Reef, Salt-Gila, and Tucson Aqueducts, which would convey pumped Colorado River water to the Central Service Zone. Minor changes in the 1947 aqueduct location have been made due to urbanization. This is particularly true on the north side of the Phoenix metropolitan area.

Major project features include:

Granite Reef Aqueduct and Pumping Plants.

Salt-Gila Aqueduct and Pumping Plant.

Orme Dam and Reservoir (designated as McDowell Dam and Reservoir in the 1947 report) or suitable alternative.

Tucson Aqueduct and Pumping Plants (Colorado River source).

Buttes Dam and Reservoir.

Hooker Dam and Reservoir (New Mexico).

Charlston Dam and Reservoir.

Tucson Aqueduct (San Pedro River source).

Aqueduct system

Granite Reef Aqueduct.—The Granite Reef Aqueduct would transport water diverted from Lake Havasu by the Havasu Pumping Plant about 200 miles to Orme Dam located a few miles northeast of Phoenix. The designed capacity of the concrete-line aqueduct is 2,500 c.f.s. The Granite Reef Aqueduct, in addition

to the initial pumping plant at Lake Havasu, would require a series of lower lift pumping plants, short tunnels, and siphon crossings at major drainages.

Orme Dam and Reservoir.—Located on the Salt River just downstream from its junction with the Verde River, the Orme Dam would be integrated with the present Salt River Project storage system as well as import water supply from the Colorado River. Sediment-laden stormflows, originating on tributaries below Bartlett and Stewart Mountain Dams, would be regulated and controlled. Coordinated with operation of the Granite Reef Aqueduct, it would provide regulatory storage as needed for both Salt-Verde flows and Granite Reef Aqueduct deliveries. In its multiple-purpose role it would serve as an afterbay, reregulate releases from upstream reservoirs, improve the Salt River Project operating conditions by removing sediment, create a recreational area with fish and wildlife conservation uses, and in combination and coordination with the upstream reservoirs and downstream channelization, provide storage to meet the flood control requirements of the Salt River through the Phoenix area.

Salt-Gila Aqueduct and Pumping Plant.—The 1,400-c.f.s.-capacity Salt-Gila Aqueduct would receive water either directly from the Granite Reef Aqueduct or by releases from Orme Reservoir. A relatively low-head pumping plant is required to lift the water into the aqueduct from either source.

Buttes Dam and Reservoir.—Although investigated and reported previously as a separate facility, Buttes Dam and Reservoir was included as an integral part of the Central Arizona Project in the 1947 report and in the 1964 supplemental report. An earthfill structure, the Buttes Dam would form a reservoir of 366,000-acre-foot capacity. Conservation storage capacity would be 100,000 acre-feet, and 266,000 acre-feet of capacity would be used for sediment and flood control purposes.

Tucson Aqueduct (Colorado source).—An aqueduct to deliver 100,000 feet annually to the Tucson metropolitan area would originate at the terminus of the Salt-Gila Aqueduct. This municipal and industrial water supply would be conveyed through a 150-c.f.s.-capacity pipeline and would be lifted 920 feet by a series of pumping plants.

Charleston Dam and Reservoir.—On the San Pedro River between Tombstone and Fort Huachuca, a concrete gravity structure rising 158 feet above streambed, with earthen wing dams, would create a 238,000-acre-foot-capacity reservoir. Water conservation would be provided through exchanges. Recreation, fish and wildlife uses, sediment detention, and flood control benefits would also accrue.

Tucson Aqueduct (San Pedro source).—This conduit would convey about 12,000 acre-feet annually from the Charleston Reservoir to Tucson and vicinity.

Hooker Dam and Reservoir.—Hooker Dam on the Upper Gila River in New Mexico would create a reservoir having an initial capacity of 98,000 acre-feet. The dam would be a concrete gravity structure rising 222 feet above streambed and would be so designed as to permit subsequent enlargement. The reservoir would provide water conservation, fish and wildlife uses, recreation, sediment detention, and flood control.

Distribution systems.—In all areas an improvement in conveyance and distribution system efficiencies is essential to obtain optimum water development and use. Widely varying capabilities and conditions exist among the various organized districts and unorganized areas. Lining of presently unlined and future conveyance and distribution systems would be provided by, and would be the responsibility of, existing or to-be-formed districts.

The existing facilities of the Salt River and San Carlos Projects, the Maricopa County Municipal Water Conservation District, and several other districts are based on integrated surface and ground-water supplies. Rehabilitation and lining of conveyance and distribution works in progress by these districts to improve their system efficiencies would be completed under project conditions.

Construction of new irrigation systems and rehabilitation and lining of existing systems are included for the seven Indian reservations within the project area.

Additional works.—Growing and potential water needs of the area require facilities in addition to those included in the project works. Existing facilities of other agencies which could be integrated operationally into the Central Arizona Project include dams, reservoirs, and irrigation works serving proposed contracting agencies in the project area.

The proposed channel improvements of the middle Gila River and the construction of Camelsback Reservoir by the Corps of Engineers and the continuing soil and moisture conservation programs of the Bureau of Land Management and Soil Conservation Service would be integrated or coordinated with the project. Natural channels used for water transport are basically canals and, when used as part of a system, their efficiency should be commensurate with their use. The lining of presently unlined conveyance and distribution systems is also essential for maximum utilization of the water supplies of the area.

Drainage and reuse facilities.—The control, use, and disposal of the return and effluent flows to be made available in the project area will require additional study to properly evaluate the benefits accruing from reuse and the attendant costs of physical facilities. The cost of such facilities would not affect economic and financial aspects of the project as presented in this report because these units would have to be justified by benefits over and above those considered herein.

Drainage facilities contemplated as part of the project works are open drains and drainage wells upstream from Gillespie Dam. Costs of these facilities are included in the project cost.

Power generation and transmission arrangements

No thermal electric power generating facilities will be constructed as project features. This plan proposes a cooperative approach with the utility industry somewhat comparable to the currently being employed by private and public utility companies.

The Secretary of the Interior would be authorized to make arrangements with non-Federal interests to acquire the right to a portion of the capacity and associated energy from the output of a large thermal generating powerplant as necessary to serve project purposes. The right would also include delivery of the power on jointly shared transmission facilities. Current studies indicate that 400,000 kilowatts of capacity would be required in connection with the Central Arizona Project as proposed with the Granite Reef Aqueduct sized at 2,500 c.f.s. In this way, the project would obtain power for pumping at a low cost reflecting the economy of large thermal electric powerplants; shared economical, high-capacity, extra-high-voltage transmission facilities; and the benefits of Federal financing.

Payment for the capacity entitlement would be made to the plant owners from time to time during the construction period by advancing a portion of construction costs in a ratio not to exceed the ratio of the capacity entitlement acquired to the total plant capacity. Transmission of power and energy to points of project use would be provided both by Federal construction of transmission lines and by acquiring capacity in lines jointly used by plant owners and the Government through the Government advancing a portion of the construction costs of such dual-use lines in a ratio not to exceed the ratio of the capacity requirement of the Government to the total of capacity of such facilities.

In addition to the payments associated with construction, the Government would also pay to the owners of plant and transmission lines a commensurate portion of the annual operation and maintenance cost and of the replacement costs as they occur.

The United States would not participate in any of the owners' costs associated with interest, financing charges, taxes (except payroll taxes), or other similar items. The Federal financing costs would become project costs, and as such would be subject to repayment by the project beneficiaries under applicable provisions of Reclamation law and policy.

In the analyses for this report, it was assumed that a power banking arrangement with utilities in the area would be established. Surplus power and energy when available would be put into the bank to be withdrawn later to accommodate fluctuating project pumping requirements. The ratio between amounts of deposit and withdrawal would be adjusted for losses between the banking utilities' systems and the Central Arizona Project pumping plants as well as providing a small incentive to the utilities.

The power and energy available for commercial sale each year was assumed to be the Government's entitlement to total generation less the Central Arizona Project pumping requirement, transmission losses, and reserve for the capacity

sold commercially, and it was adjusted for the power banking service described above. Based on water supply projections, practically the entire Federal share of the thermal plant output will be required for project pumping purposes through the year 1990. A small increment of commercial power sales would be anticipated during this period because of the smaller amount of reserve capacity that would be maintained in the early years. Following 1990, it is expected that commercial power sales would increase gradually as project water supply and associated project pumping power requirements decrease. By the year 2030 it is estimated that commercial sales would average 179,000 kilowatts.

For purposes of deriving power prepayment cost estimates, it was assumed that a large, coal-fired powerplant would be located near Page, Arizona, adjacent to Lake Powell. Such a plant would burn coal obtained from the Black Mesa fields in northeastern Arizona. Sufficient transmission costs were included in the estimates to provide for proper connection of the plant to the integrated system.

Even though the central Arizona area would be the large commercial load area closest to the powerplant, the commercial power production of the plant would not necessarily serve this area alone. The power output of the thermal plant could be integrated with the power production of Reclamation's interconnected hydro-electric power system which extends generally throughout the West. Such coordination could enhance and broaden the usability of the power produced by both the thermal plant and the hydroplants. The coordinated output of these plants could be available to serve loads from Reclamation's interconnected transmission system.

Water salvage measures

Included in this plan are water salvage measures consisting of ground-water recovery in the Yuma area and phreatophyte clearing along the lower Colorado River. These undertakings would yield 320,000 acre-feet of water annually for use in the Lower Colorado River Basin which, particularly in years of low water supply, would be necessary to realize the projected diversion of water to the Central Arizona Project.

Fish hatcheries and wildlife refuge

Fish and wildlife measures not reflected in the costs of multipurpose project structures include national fish hatcheries for both warm water fish and trout, the Cibola National Wildlife Refuge, the New Mexico State Fish Hatchery, and a rough fish eradication program.

PROJECT OPERATION

Water rights

The water legally available for diversion from the Colorado River by the Central Arizona Project is defined by a succession of legal determinations. The Colorado River Compact was signed in 1922; consented to by the Congress in the Boulder Canyon Project Act, without Arizona's ratification, in 1928; and was ultimately ratified by Arizona in 1944. The Compact divides the Colorado River Basin into the Upper and Lower Divisions with the division point being at Lee Ferry, and enjoins the States of the Upper Division not to cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of 10 consecutive years.

The Boulder Canyon Project Act required that California limit its consumptive use of Colorado River water to 4.4 million acre-feet annually of the waters apportioned to the Lower Basin States by Article III(a) of the Colorado River Compact plus not more than one-half of any surplus waters apportioned by the Compact.

The Compact recognized the possibility of a treaty with Mexico whereby the latter might share in Colorado River water. A treaty was consummated in 1944 which guarantees Mexico 1.5 million acre-feet of water annually with provisions for increase when surpluses are available and reductions in times of extreme drought.

In 1952 Arizona brought suit in the Supreme Court against California to establish the States' respective entitlements of water from the Colorado River. The Supreme Court Decree of March 9, 1964, among other items, provides that

the first 7.5 million acre-feet of mainstream water below Lee Ferry available for release for consumptive use in the United States shall be apportioned 2.8 million to Arizona, 4.4 million to California, and 0.3 million to Nevada.

The Supreme Court Decree provides that if less than 7.5 million acre-feet are available for release to the Lower Basin for consumptive use, the first call on such water shall be for satisfaction of present perfected rights and any remainder shall be apportioned "in such manner as is consistent with the Boulder Canyon Project Act."

A number of the recent proposals for the Colorado River basin legislation have included a provision for what is termed herein the 4.4 priority. This provision, if enacted, would require that in years when there is insufficient mainstream water for release to satisfy annual consumptive use of 7.5 million acre-feet from the Colorado River below Lee Ferry, the available water would be apportioned according to the following priorities:

(1) Present perfected rights.

(2) Other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of main-stream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada would not be required to bear shortages in any proportion greater than would have been imposed in the absence of the 4.4 priority.

In other words, California would have a priority over the Central Arizona Project, up to 4.4 million acre-feet annually, in the event shortages must be apportioned.

The 4.4 priority has been assumed to be in effect in the hydrologic studies associated with the plan presented herein.

As a planning assumption, the priority is conservative in that of the various probable methods of apportioning shortages it reflects the economic and financial conditions most adverse to the Central Arizona Project. If the priority were omitted from the assumptions, the benefit-cost analysis and repayment of the project would be improved.

Water supply

Within the framework of the legal limitations described above, the Central Arizona Project water supply will be determined by the physical availability of water. Two general factors apply in the consideration of water availability. The first is the wide fluctuation in the natural flow of the Colorado River. Computed annual virgin flows at Lee Ferry since 1896 vary from about 5.6 to 24.0 million acre-feet. Superimposed upon this natural variation is an increasing depletion due to increasing consumptive uses in the Upper Basin as that basin develops uses for its remaining share of Colorado River water as determined by the Colorado River Compact.

The assumption of average available flows upon which the Colorado River Compact was predicated has not been borne out in recent decades of record. Primarily because of this, the Central Arizona Project has had to be planned to accommodate a fluctuating and decreasing diversion over time.

The studies underlying the analyses in this report are based upon a method of operation of the existing storage reservoirs on the Colorado River designed to maximize the average annual yield over the entire study period. To account for the probable fluctuation of natural flows of the river, the actual recorded flows for the period 1906 through 1965 are used. These flows are corrected for existing and projected consumptive uses and modified for reservoir operation to provide a basis for project water supply studies. The studies also assumed that the 4.4 priority for California would be in effect.

In addition to the water supplies provided from the Colorado River, the Central Arizona Project would develop additional water by regulation of Gila River System flows. Operation of the Buttes Reservoir would contribute 38,000 acre-feet and Charleston Reservoir would contribute 12,000 acre-feet annually.



Additional water would be made available for use in the area by reuse of percolation, waste, and effluent flows originating from project supplies. This secondary utilization of project water, however, is not provided for in the physical plan or considered in the economic or financial analyses.

The tabulation which follows presents a summary of the project water supply studies for the representative years of 1975, 1990, 2000, and 2030. Year 1975 is assumed to be the initial year of full project operation, while year 2030 is the point at which the water supply available to the Lower Basin would become stabilized under the assumptions and projections adopted relative to Upper Basin depletions.

Summary of Bureau of Reclamation reservoir operation and water supply studies

[Averages for 60-year period 1906-65, inclusive, in thousands of acre-feet]

Item	Year 1975	Year 1990	Year 2000	Year 2030
Virgin flow—Lee Ferry.....	15,063	15,063	15,063	15,063
Upper basin depletion.....	4,220	5,100	5,430	5,800
Upper basin end-of-year storage:				
Maximum.....	36,125	34,476	33,329	30,386
Minimum.....	15,769	14,280	9,186	6,888
Net storage change.....	0	0	0	0
Lee Ferry regulated delivery.....	9,570	8,770	8,600	8,250
Upper basin spills.....	1,273	1,193	1,033	1,013
Net gain, Lee Ferry to Hoover.....	772	753	732	704
Lake Mead:				
Inflow.....	11,615	10,716	10,365	9,967
Evaporation.....	898	872	835	853
Spills.....	653	269	148	158
Regulated release.....	10,064	9,575	9,382	8,956
Maximum end-of-year storage.....	25,900	25,900	25,900	24,900
Minimum end-of-year storage.....	13,370	13,000	11,800	11,090
Net storage change.....	0	0	0	0
Bill Williams River.....	50	50	50	50
Net losses, Hoover to Mexico (after salvage).....	590	590	590	590
Delivery to Mexico.....	1,500	1,500	1,500	1,500
Available for use in United States.....	8,024	7,535	7,342	6,916
California ¹	4,762	4,687	4,654	4,564
Nevada.....	100	150	200	—300
Arizona ¹	3,162	2,698	2,488	2,052
Other than central Arizona project.....	1,020	1,160	1,230	1,230
Central Arizona project:				
Available.....	2,142	1,538	1,258	822
Limited by 2,500-cubic-feet-per-second aqueduct.....	1,650	1,255	1,026	676
System losses ²	165	126	103	68
Supplied from Colorado River.....	1,485	1,129	923	608
Supplied from Gila River.....	50	50	50	50
Project deliveries.....	1,535	1,179	973	³ 658
Municipal and industrial.....	82	232	312	312
Irrigation.....	1,453	947	661	346

¹ Figures represent California and Arizona entitlements under the decree in *Arizona v. California* (including surplus in excess of 7.5 million when available) and 4.4 priority for California. California could use more, however, due to Arizona's inability, through physical limitations, to use its full share.

² System losses assumed to be 10 percent throughout. Refinement of this estimate, particularly in years of less than full capacity aqueduct operation, will be considered in more detailed studies.

³ Although the average yield under year 2030 condition would be 658,000 acre-feet, the assured yield would be about one-half of this figure and would be devoted to municipal and industrial use.

The coordination of conservation and control facilities involving surface-water supplies would be essential to realization of the optimum benefits from the introduction of an import supply from the Colorado River. The construction of the Orme, Buttes, Charleston, and Hooker Reservoirs would provide operational and regulatory control of surface water to make exchanges possible. The additional regulation obtained would make possible higher utilization efficiencies in the conveyance and distribution systems. Control of stormflows and improvement of irrigation practices could provide an additional usable water supply.

Through this hydrologic coordination, comprehensive water conservation would be achieved by a combination of water salvage, river channel improvement, river regulation, and watershed soil and moisture programs. For maximum project benefit, direct use of the imported Colorado River water as a base supply would be necessary, requiring seasonal variation in ground-water pumping and storage reservoir draft.

Proposed legislation introduced in the 89th and 90th Congresses has included provisions for exchanges between New Mexico users on the upper Gila River System and users in Arizona who can be physically supplied with Colorado River water from the Central Arizona Project aqueduct system. These provisions would have the effect of transferring to New Mexico a portion of Arizona's entitlement of Colorado River water based upon agreement between the States. The exchange would be accommodated by operation of Hooker Reservoir.

The Secretary could require users of Central Arizona Project water in Arizona to agree to additional exchanges to provide water supplies to other areas in the State of Arizona. These possibilities are under study. Their accomplishment would require authorization of additional facilities.

ECONOMIC AND FINANCIAL ANALYSIS

The project is economically justified. The benefit-cost ratio is 2.5 to 1.0. The comparison of benefits and costs was made on the basis of average annual equivalent values at 3½ percent interest over a 100-year period of analysis. Financial feasibility is established in the repayment analysis which shows that all reimbursable costs can be returned within 50 years after completion of facilities.

Project benefits

Total benefits for the multiple-purpose project are estimated to be \$89,327,000 annually.

Irrigation.—Total irrigation benefits are estimated to be \$65,484,000 annually, of which \$31,558,000 are direct benefits representing increased net farm income based on farm budget analyses, and \$33,926,000 are indirect effects reflecting the movement of farm products through the channels of trade and industry. These benefits are associated with water delivered at canalside.

Municipal and Industrial.—Benefits for canalside delivery of M&I water to the metropolitan water users of Central Arizona are estimated to be \$16,853,000 annually. These benefits are based on the estimated cost of obtaining a comparable supply of water from the most likely single-purpose alternative.

Commercial Power.—The generation of power is primarily for the purpose of providing energy for project pumping. The value of power used for pumping is reflected in the benefits for irrigation and M&I water supply. Due to the variability of river flows and the projected reduction in future supplies, some power is available for commercial sales on an increasing basis as average pumping requirements decline. The evaluation of benefits from commercial power sales of \$3,725,000 annually is based upon Federal Power Commission procedures representing average costs of large efficient coal-fired thermal plants in the Southwest, associated transmission to load centers, and a weighting of both private and public financing.

Flood Control.—While the overall picture in the Gila River Basin is one of water shortage, periodical and destructive floods occur in the area. Annual flood control benefits which will accrue to the project have been estimated by the Corps of Engineers to be \$780,000.

Recreation.—The Central Arizona Project and its reservoirs will create considerable recreation potential. The Fort McDowell and Salt River Indian Reservations should gain significant economic stimulation from the recreational aspects of Orme Dam and Reservoir. The estimated annual benefits were evaluated by the Bureau of Outdoor Recreation at \$583,000.

Area Redevelopment.—Central Arizona Project facilities will provide employment opportunities during construction and operation of the project to areas which have been designated as redevelopment areas. Employment benefits in these areas are estimated to be equivalent to an annual average of \$267,000.

<i>Summary of project benefits</i>	
<i>Function</i>	<i>Annual benefit</i>
Irrigation	\$65,484,000
Municipal and industrial	16,853,000
Power	3,725,000
Fish and wildlife	1,635,000
Flood control	780,000
Recreation	583,000
Area redevelopment	267,000
Total	89,327,000

Project costs

The total estimated project cost of this plan for the Central Arizona Project is \$719,217,000. Cost estimates are based upon October 1963 price levels with the exception of power generation and transmission arrangements which are based upon October 1966 price levels.

Interest during construction amounts to \$46,993,000 calculated at 3½ percent, making the total Federal investment \$766,210,000.

Annual operation, maintenance, and replacement costs are estimated at \$11,259,000.

<i>Summary of costs</i>	
Project costs:	
Granite Reef aqueduct	\$336,430,000
Salt-Gila aqueduct	38,400,000
Tucson aqueduct	42,030,000
Orme Dam and Reservoir	38,418,000
Buttes Dam and Reservoir	31,974,000
Charleston Dam and Reservoir	33,048,000
Hooker Dam and Reservoir	28,797,000
Drainage system	10,500,000
Power generation and transmission arrangements	91,950,000
Subtotal	651,547,000
Indian distribution system	19,970,000
Water salvage and recovery	42,450,000
Fish hatcheries and wildlife refuge	5,250,000
Total project costs	719,217,000
Annual equivalent cost (100 years, 3½-percent interest)	122,718,000
Interest during construction (3½ percent):	
Aqueduct system	40,462,000
Power generation and transmission arrangements	5,087,000
Water salvage and recovery	1,444,000
Total	46,993,000
Annual equivalent cost (100 years, 3½-percent interest)	1,539,000
Annual operation, maintenance, and replacement:	
Aqueduct system	¹ 3,203,000
Power generation and transmission arrangements	² 6,566,000
Water salvage and recovery	1,000,000
Fish hatcheries and wildlife refuge	490,000
Total	11,259,000

¹ Excludes \$5,794,000 investigation costs and \$19,970,000 Indian distribution system costs. Benefits for distribution works excluded from project benefits which reflect values at canal side.

² Pumping power costs are associated with powerplant and transmission system rather than aqueduct system.

Benefit-cost ratio

The benefit-cost ratio, based upon total benefits over a 100-year period of analysis, is 2.5 to 1.0.

Benefit-cost ratios

100 years—total benefits-----	2.5 to 1.0.
100 years—direct benefits only-----	1.5 to 1.0.
50 years—total benefits-----	¹ 2.5 to 1.0.
50 years—direct benefits only-----	¹ 1.5 to 1.0.

¹ Because of declining water supplies, annual irrigation benefits are less in later years. Therefore, the average annual benefits are greater over the 1st 50 years than over 100 years. This effect offsets the higher annual costs over 50 years.

Cost allocation

Costs of the water salvage and recovery program, Indian distribution systems, and fish hatcheries and wildlife refuge were directly assigned to these purposes. The remaining project costs were allocated among the various purposes using the separable costs-remaining benefits method and using a 100-year period of analysis and an interest rate of 3½ percent. A suballocation of the costs allocated to power was made among irrigation pumping, M&I pumping and commercial power sales based on relative uses of power.

Summary of cost allocation

Purpose	Project cost	Interest during construction	Total Federal investment	Annual O.M. & R.
Irrigation-----	\$322,301,000	\$23,957,000	\$346,258,000	¹ \$2,378,000
Municipal and industrial-----	194,029,000	12,924,000	206,953,000	¹ 445,000
Power-----	91,950,000	5,087,000	97,037,000	¹ 6,566,000
Irrigation-----	(48,366,000)	(2,676,000)	(51,042,000)	(3,454,000)
M. & I.-----	(16,474,000)	(910,000)	(17,384,000)	(1,175,000)
Commercial-----	(27,110,000)	(1,501,000)	(28,611,000)	(1,937,000)
Recreation-----	6,343,000	926,000	7,269,000	278,000
Flood control-----	11,164,000	812,000	11,976,000	34,000
Fish and wildlife-----	24,129,000	1,843,000	25,972,000	68,000
Prepaid investigation ² -----	1,631,000	-----	1,631,000	-----
Subtotal-----	651,547,000	45,549,000	697,096,000	9,769,000
Indian distribution system-----	³ 19,970,000	-----	-----	-----
Water salvage and recovery-----	42,450,000	1,444,000	43,894,000	1,000,000
Fish hatcheries and wildlife refuge-----	5,250,000	-----	5,250,000	490,000
Total-----	719,217,000	46,993,000	746,240,000	11,259,000

¹ Pumping power costs shown under power allocation.

² Prepaid from Colorado River development fund. Remainder of investigation costs are allocated among project purposes.

³ Included for authorization purposes but not considered in economic and financial analyses. Repayment would be deferred under the provisions of the Leavitt Act.

Repayment analysis

Two repayment analyses were made of approaches to accomplish payout of reimbursable costs within 50 years after completion of facilities. Irrigation assistance requirement in the first analysis is met by combination of surplus power revenues, surplus M&I revenues, and ad valorem taxes. In the second analysis, irrigation assistance is provided only from surplus power revenues and surplus M&I revenues from an increase in M&I water charges.



Allocations to commercial power and M&I are returned within 50 years at the current interest rate of 3.225. Irrigation costs are repaid within 50 years without interest. Fish and wildlife and recreation costs are repaid in conformance with the provisions of the Federal Water Project Recreation Act of 1965 (P.L. 89-72). Flood control and costs of the water salvage program are considered nonreimbursable. Repayment of costs for the Indian distribution system is deferred under Leavitt Act provisions. A summary of reimbursable and nonreimbursable costs is presented in the next table.

	Project cost	Interest during construction at 3.225 percent	Total for repayment
Reimbursable:			
Irrigation	\$322,301,000		\$322,301,000
Municipal and industrial	194,029,000	\$14,784,000	208,813,000
Power	91,950,000	2,459,000	94,439,000
Irrigation	(48,366,000)		(48,366,000)
M. & I.	(16,459,000)	(940,000)	(17,399,000)
Commercial	(27,125,000)	(1,549,000)	(28,674,000)
Recreation	1,525,000	217,000	1,742,000
Fish and wildlife	294,000	40,000	334,000
Total	610,099,000	17,530,000	627,629,000
Nonreimbursable:			
Flood control	11,164,000		11,164,000
Recreation	4,818,000		4,818,000
Fish and wildlife	23,835,000		23,835,000
Indian distribution system ¹	19,970,000		19,970,000
Water salvage and recovery	42,450,000		42,450,000
Fish hatcheries and wildlife refuge	5,250,000		5,250,000
Total	107,487,000		107,487,000
Prepaid investigation costs ²	1,631,000		
Total project cost	719,217,000		

¹ Repayment deferred under Leavitt Act provisions.

² Prepaid from Colorado River development fund.

Operation, maintenance, replacement (OM&R) costs

Annual operation, maintenance, and replacement (OM&R) costs for flood control, water salvage and recovery, fish hatcheries (with the exception of the New Mexico Hatchery which will be operated by non-Federal interests), and wildlife refuge are nonreimbursable. Fish and wildlife and recreation costs of joint facilities are also nonreimbursable under the provisions of P.L. 89-72 as are separable OM&R costs of facilities administered by Federal agencies. Other separable OM&R costs of recreation and fish and wildlife will be assumed by appropriate local entities.

OM&R costs assignable to irrigation include a charge of 3 mills per kilowatt-hour for pumping power; M&I includes a pumping power charge of 5 mills. All OM&R costs assigned to the irrigation and M&I purposes are recovered from water users.

The OM&R costs of the powerplant and transmission facilities will be repaid from charges to irrigation and M&I pumping and from commercial power sales.

Estimated annual operating costs for irrigation, M&I, and commercial power vary in accordance with available water supplies.

Summary of annual operating expenses for repayment¹

Irrigation (including power at 3 mills)	\$5, 833, 000
Municipal and industrial water (including power at 5 mills)	3, 341, 000
Commercial power	1, 941, 000
Fish and wildlife (fish hatchery, New Mexico)	90, 000
Recreation	134, 000

¹ Average annual costs over the payout period. Total O.M. & R. cost of powerplant and transmission facilities for all power is \$6,579,000.

Repayment with ad valorem tax

This analysis proposes that irrigation water be sold at an average of \$10 per acre-foot at canalside and that municipal and industrial water be sold at an average of \$50 per acre-foot as in previous Central Arizona proposals. Pumping power rates would be 3 mills per kilowatt-hour for irrigation and 5 mills for M&I. Surplus power would be sold commercially at an average return of 5 mills per kilowatt-hour. An ad valorem tax of 0.6 mills per dollar of assessed valuation would be levied against the taxable real properties of Maricopa, Pinal, and Pima Counties, Arizona, and applied to the irrigation obligation. The tax yield is based on a projected increase in the assessed valuation estimated at 3 percent annually. Repayment would be accomplished in 50 years after completion of facilities.

Irrigation.—Of the reimbursable irrigation costs, excluding power facilities, of \$322,301,000, the irrigators would repay \$95,846,000 directly from water revenues. The remaining \$226,455,000 would be repaid by assistance from revenues from M&I water sales (\$8,282,000), power sales (\$72,337,000), and ad valorem tax revenues (\$145,836,000).

Municipal & Industrial Water.—M&I water users return all reimbursable costs with interest within 50 years. In addition, M&I water revenues provide repayment assistance to irrigation.

Power.—All costs of powerplant and transmission facilities are returned from irrigation and M&I pumping charges and revenues from commercial sales with appropriate interest. Surplus power revenues assist in the repayment of irrigation.

Fish and Wildlife and Recreation.—The costs associated with these functions which are reimbursable under the provisions of the Federal Water Project Recreation Act (P.L. 89-72) will be repaid under cost-sharing agreements with local entities.

Summary of repayment analysis with ad valorem tax

Purpose	Reimbursable cost	Net revenues available for repayment	Surplus or deficit
Irrigation	\$322, 301, 000	\$95, 846, 000	—\$226, 455, 000
Municipal and industrial	208, 813, 000	217, 095, 000	8, 282, 000
Power, total	94, 439, 000	166, 776, 000	72, 337, 000
Fish and wildlife	334, 000	334, 000	-----
Recreation	1, 742, 000	1, 742, 000	-----
Subtotal	627, 629, 000	481, 793, 000	—145, 836, 000
Ad valorem tax	-----	145, 836, 000	145, 836, 000
Total	627, 629, 000	627, 629, 000	-----



Repayment without ad valorem tax

This analysis proposes that irrigation water be sold at an average of \$10 per acre-foot at canalside as in previous Central Arizona proposals. Municipal and industrial water would be sold at an average of \$56 per acre-foot, an increase of \$6 over the \$50 rate in previous proposals. The increased revenues accruing from the M&I sales would provide sufficient repayment assistance to achieve total project repayment without an ad valorem tax. Pumping power rates would be 3 mills per kilowatt-hour for irrigation and 5 mills per kilowatt-hour for M&I. Surplus power would be sold commercially to yield an average return of 5 mills per kilowatt-hour. The power rates are the same in both repayment analyses presented herein. Repayment will be accomplished within 50 years after completion of facilities.

Summary of repayment analysis without ad valorem tax

Purpose	Reimbursable costs	Net revenues available for repayment	Surplus or deficit
Irrigation.....	\$322,301,000	\$95,846,000	-\$226,455,000
Municipal and industrial.....	208,813,000	368,906,000	155,093,000
Power, total.....	94,439,000	166,776,000	72,337,000
Fish and wildlife.....	334,000	334,000	-----
Recreation.....	1,742,000	1,742,000	-----
Total.....	627,629,000	628,604,000	975,000

Combination of repayment approaches

Under the basic estimates and assumptions of this report as to costs, interest rates, water supply, power marketing, and other factors, two approaches to the repayment of the project are presented. Insofar as costs to the project beneficiaries are concerned, both assume an average return of \$10 per acre-foot for irrigation water at canalside. The first repayment study includes a \$50-per-acre-foot M&I charge plus the levying of an ad valorem tax while the second study relies entirely on an increase in the M&I rate to \$56 per acre-foot. Combinations of lower ad valorem taxes with lesser increases in the M&I rate could also be used to demonstrate repayment. Any variations in final plans from the basic underlying assumptions would, of course, affect the projected costs to the project beneficiaries. It is not expected, however, that the estimated costs to the beneficiaries would vary significantly.

Consolidated repayment schedules

Individual payout studies for irrigation, M&I, and power were prepared, showing year-by-year financial transactions. These studies are interrelated in that the pumping power charges in the irrigation and M&I schedules are included as revenue inputs in the power payout. Summaries of the significant payout components by purposes are presented in the following consolidated payout schedules for each of the repayment proposals described.

Lower Colorado River Basin plan—Repayment analysis, 2,500 cubic feet per second, central Arizona project, 400-megawatt powerplant portion, coal-fired plant

IRRIGATION ASSISTANCE FROM M. & I. REVENUES¹

[In thousands of dollars]

Year	Power					Municipal and industrial water					
	Interest-bearing investment			Interest-free investment		Assistance to irrigation	Net operating revenue	Interest on unpaid balance at 3.225 percent	Unpaid balance	Plant in service	Assistance to irrigation
	Net revenue	Interest at 3.225 percent	Unpaid balance	Plant in service	Irrigation plant in service end of year						
1973	-5		46,073	46,073	48,366	48,371	35	1,176	36,479	36,479	
1974	-672	1,486	48,231				3,335	4,717	146,250	145,109	
1975	2,008	1,555	47,778				3,843	4,967	154,004	151,481	
1976	2,017	1,541	47,302				3,843	4,967	212,460		
1977	2,291	1,525	46,536				4,062	6,852	215,250		
1978	2,371	1,501	45,666				5,692	6,942	216,530		
1979	2,445	1,473	44,694				6,023	6,983	217,490		
1980	2,522	1,441	43,613				6,354	7,014	218,150		
1981	2,608	1,407	42,412				6,690	7,035	218,495		
1982	2,679	1,368	41,101				7,051	7,046	218,490		
1983	2,763	1,326	39,664				7,396	7,046	218,140		
1984	2,854	1,279	38,089				7,727	7,035	217,448		
1985	2,921	1,228	36,396				8,053	7,013	216,408		
1986	3,005	1,174	34,565				8,399	6,979	214,988		
1987	3,083	1,115	32,587				8,724	6,933	213,197		
1988	3,169	1,051	30,469				9,390	6,876	211,024		
								6,806	208,440		

1986	3,248	983	28,204			9,721	6,722	205,441		
1990	3,331	910	25,783			10,051	6,625	202,015		
1991	3,401	832	23,214			10,427	6,515	198,128		
1992	3,481	749	20,483			10,737	6,390	193,781		
1993	3,566	681	17,877			11,060	6,249	188,961		
1994	3,641	587	14,593			11,403	6,094	183,682		
1995	3,726	488	11,245			11,740	6,023	177,835		
1996	3,814	383	7,704			12,046	6,735	171,625		
1997	3,896	281	4,326			12,385	6,532	164,672		
1998	3,987	184	0			12,728	6,311	157,257		
1999	4,082	11	0			13,028	6,072	149,803		
2000	4,181	0	0			13,346	4,815	140,772		
2001	4,284					13,648	4,540	131,966		
2002	4,394					13,921	4,266	122,901		
2003	4,500					14,163	3,984	113,544		
2004	4,600					14,387	3,692	103,911		
2005	4,700					14,593	3,351	93,987		
2006	4,817					14,780	3,030	83,702		
2007	4,946					14,946	2,699	73,132		
2008	5,075					15,099	2,369	62,322		
2009	5,200					15,244	2,007	50,862		
2010	5,329					15,374	1,670	39,384		
2011	5,461					15,493	1,384	27,409		
2012	5,594					15,600	1,094	15,074		
2013	5,729					15,699	75	2,341		
2014	5,864					15,788	0	0		
2015	5,997					15,868				
2016	6,128					15,939				
2017	6,258					16,000				
2018	6,388					16,053				
2019	6,517					16,100				
2020	6,647					16,143				
2021	6,770					16,181				
2022	6,894					16,219				
2023	7,019					16,256				
2024	7,144					16,292				
2025	7,269					16,329				
Total	193,175	26,399	0	46,073	48,366	570,538	206,680	0	208,813	155,093

See footnote at end of table.

Lower Colorado River Basin plan—Repayment analysis, 2,500 cubic feet per second, central Arizona project, 400-megawatt powerplant portion, coal-fired plant—Continued

[In thousands of dollars]

Year	Net operating revenue	Irrigation		Recapitulation		Cumulative net balance	Allowable
		Unpaid balance	Plant in service	Irrigation assistance required	Allowable unpaid balance	Power	
1973	-1,560	23,151	23,151				
1974	45	271,448	269,888				
1975	4,425	301,997	300,482				
1976	4,313	319,391	322,301				
1977	4,084	315,078					
1978	3,942	310,994					
1979	3,836	307,052					
1980	3,701	303,216					
1981	3,552	299,515					
1982	3,425	295,963					
1983	3,312	292,538					
1984	3,185	289,226					
1985	3,062	286,041					
1986	2,948	282,979					
1987	2,825	280,031					
1988	2,699	277,206					
1989	2,584	274,507					
1990	2,454	271,923					
1991	2,348	269,469					
1992	2,236	267,121					
1993	2,130	264,885					
1994	2,033	262,755					
		260,722					



1995	1,921	238,801																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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Lower Colorado River Basin plan—Repayment analysis, 2,500 cubic feet per second, central Arizona project, 400-megawatt powerplant portion, coal-fired plant—Continued

IRRIGATION ASSISTANCE FROM AD VALOREM TAX *
[In thousands of dollars]

Year	Interest-bearing investment				Power			Interest-free investment				Municipal and industrial water			
	Interest-bearing investment				Power			Interest-free investment				Municipal and industrial water			
	Net revenue	Interest at 3.225 percent	Unpaid balance	Plant in service	Unpaid balance	Plant in service	Interest-free investment	Balance to be repaid	Assistance to irrigation	Net operating revenue	Interest on unpaid balance at 3.225 percent	Unpaid balance	Plant in service	Assistance to irrigation	
1973.	-5		46,073	46,073			48,371			-38	1,176	36,479	36,479		
1974.	-672	1,486	48,231							2,869	4,719	146,323	145,109		
1975.	2,008	1,555	47,778							3,347	4,894	154,545	151,481		
1976.	2,017	1,541	47,302							3,536	6,886	213,514	208,813		
1977.	2,291	1,525	46,536							4,588	6,994	218,864			
1978.	2,371	1,501	45,666							5,200	7,122	218,970			
1979.	2,445	1,473	44,694							5,483	7,220	220,832			
1980.	2,522	1,441	43,613							5,770	7,175	222,471			
1981.	2,608	1,407	42,412							6,083	7,220	223,876			
1982.	2,679	1,368	41,101							6,380	7,257	225,013			
1983.	2,763	1,326	39,664							6,692	7,285	226,890			
1984.	2,854	1,279	38,089							6,940	7,305	228,513			
1985.	2,921	1,228	36,396							7,237	7,317	229,958			
1986.	3,005	1,174	34,565							7,514	7,319	229,763			
1987.	3,093	1,115	32,857							7,791	7,313	229,285			
1988.	3,169	1,051	30,469							8,083	7,298	228,500			
1989.	3,248	983	28,294							8,366	7,272	227,406			
1990.	3,331	910	25,783							8,647	7,237	226,996			
1991.	3,401	832	23,214							8,950	7,192	221,238			
1992.	3,481	749	20,482							9,237	7,135	219,136			
1993.	3,566	661	17,577							9,520	7,067	216,083			

1994	3,641	567	14,503					9,806	6,988	213,965		
1995	3,726	468	11,245					10,064	6,897	210,668		
1996	3,814	363	7,794					10,351	6,794	207,111		
1997	3,886	251	4,159					10,643	6,679	203,147		
1998	3,967	134	328					10,935	6,551	198,763		
1999	4,052	11	0			48,371		11,187	6,410	193,966		
2000	4,152	0				44,656		11,459	6,256	188,763		
2001	4,181					40,504		11,459	6,088	183,412		
2002	4,202					36,323		11,434	5,915	177,893		
2003	4,234					32,121		11,408	5,757	172,196		
2004	4,260					27,887		11,382	5,553	166,841		
2005	4,288					23,627		11,357	5,364	160,297		
2006	4,317					19,339		11,331	5,170	154,059		
2007	4,346					15,022		11,306	4,968	147,645		
2008	4,375					10,676		11,280	4,762	141,025		
2009	4,400					6,301		11,255	4,548	134,216		
2010	4,429					1,901		11,230	4,328	127,187		
2011	4,461					0		11,204	4,102	119,982		
2012	4,482						2,528	11,178	3,888	112,469		
2013	4,514						6,969	11,357	3,627	104,765		
2014	4,540						11,471	11,331	3,379	96,838		
2015	4,567						15,965	11,306	3,123	88,655		
2016	4,597						20,525	11,280	2,859	80,234		
2017	4,626						25,092	11,255	2,588	71,542		
2018	4,658						29,659	11,230	2,307	62,594		
2019	4,679						34,315	11,204	2,019	53,358		
2020	4,711						38,973	11,178	1,721	43,850		
2021	4,740						43,652	11,153	1,414	34,035		
2022	4,765						48,363	11,129	1,098	23,929		
2023	4,794						53,103	11,103	772	13,523		
2024	4,823						57,868	11,078	436	2,781		
2025	4,852						62,662	11,053	90	0		
		0	0	46,073	46,366	0	72,337	489,841	272,746	0	206,813	8,282
Total	183,175	26,399	0	46,073	46,366	0	72,337	489,841	272,746	0	206,813	8,282

See footnote at end of table.

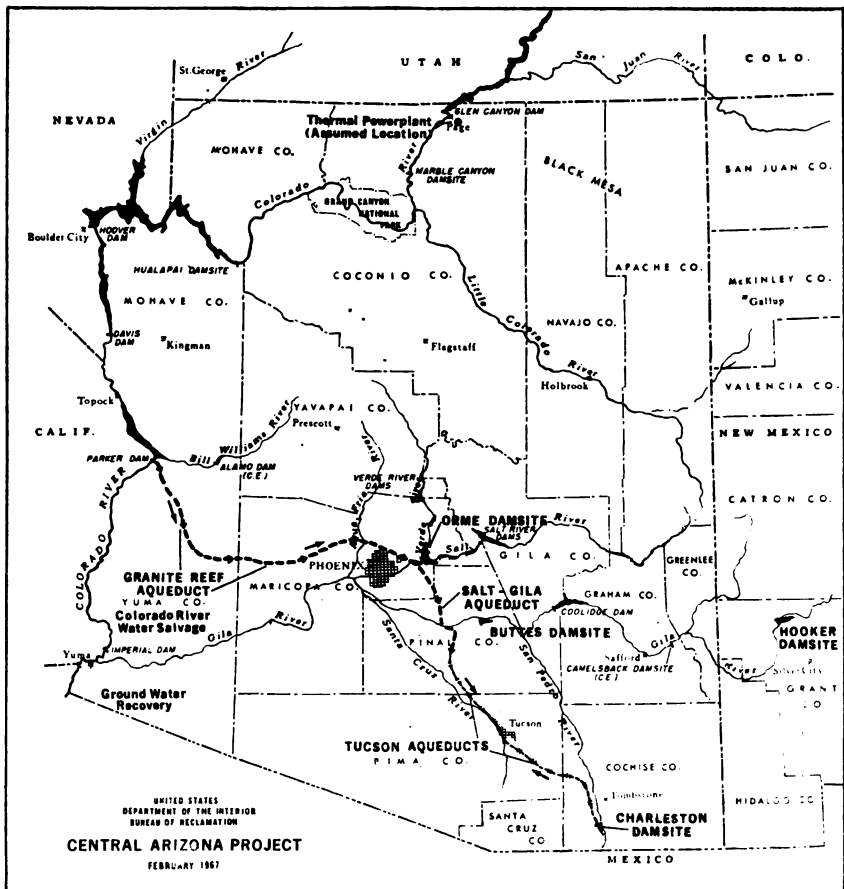
CENTRAL ARIZONA PROJECT

Lower Colorado River Basin plan—Repayment analysis, 2,500 cubic feet per second, central Arizona project, 400-megawatt powerplant portion, coal-fired plan—Continued

[In thousands of dollars]

Year	Net operating revenue			Irrigation			Recapitulation			Cumulative net balance
	Net operating revenue	Unpaid balance	Plant in service	Irrigation assistance required	Allowable unpaid balance	Power	M. & I.	Revenue from 0.6 mill ad valorem tax	Irrigation assistance required	
1973	-1,560	23,151	23,151					5,459		5,459
1974	271,448	271,448	269,888					1,192		6,651
1975	4,425	301,997	300,482					1,227		7,878
1976	4,313	319,391	322,301					1,265		9,143
1977	4,064	316,078						1,303		10,446
1978	3,942	310,994						1,342		11,788
1979	3,836	307,062						1,382		13,170
1980	3,701	303,216						1,424		14,594
1981	3,552	299,515						1,466		16,060
1982	3,425	295,963						1,510		17,570
1983	3,312	289,226						1,556		19,126
1984	3,185	286,041						1,602		20,728
1985	3,062	282,979						1,649		22,377
1986	2,948	280,031						1,700		24,077
1987	2,825	277,206						1,750		25,827
1988	2,699	274,507						1,802		27,629
1989	2,584	271,923						1,857		29,486
1990	2,454	269,469						1,913		31,399
1991	2,348	267,121						1,970		33,369
1992	2,236	264,885						2,029		35,398
1993	2,130	262,755						2,090		37,488
1994	2,033	260,722						2,153		39,641
1995	1,921	258,801						2,218		41,859

CENTRAL ARIZONA PROJECT



U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY.
Washington, D.C., April 28, 1967.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR SENATOR JACKSON: Your letter of April 5 requested a report on S. 861, S. 1004, S. 1242, and S. 1409. These bills, like S. 1013, deal with Colorado River authorizations.

Our letter of February 15 to the President of the Senate submitted the Administration's recommendations on Colorado River legislation. The draft bill transmitted with that letter was introduced by you (S. 1013) at our request on February 17. On the same date, Senator Hayden introduced a similar bill (S. 1004) on his own behalf and on behalf of Senators Fannin and Cannon as well as yourself.

Since the issues involved in Colorado River resource development are dealt with in depth in our letter of February 15, we request that that letter be considered as our basic report on these bills, and that this letter be regarded as in the nature of a supplemental report.

As indicated above, the differences between S. 1013 and S. 1004 are few. Both would (a) authorize the Central Arizona project, (b) provide for water salvage programs and ground-water recovery along the lower Colorado, and (c) cover a number of items of mutual concern to the upper and lower Colorado River basins.

The few differences between the two bills and our comments thereon are as follows:

(1) The Granite Reef aqueduct of the Central Arizona project would have a capacity of 2,500 cubic feet per second under the Administration's recommendation (S. 1013), while the capacity is specified in S. 1004 as not less than 3,000 c.f.s.

Comment. The Central Arizona project originally was formulated on the basis of an 1,800 c.f.s. aqueduct having a diversion capacity of 1.2 million acre-feet per year. With the 4.4 million acre-feet priority to California in effect it would require an aqueduct capacity of 2,500 c.f.s. to divert an average annual quantity of 1.2 million acre-feet over the 50-year payout period. Additionally, a 2,500 c.f.s. aqueduct would have a maximum diversion capacity of 1.6 million acre-feet in any one year which, together with other uses of Colorado River water by Arizona, would permit Arizona to use its full entitlement of 2.8 million acre-feet in those years when 7.5 million acre-feet of Colorado River water are available for consumptive use in the Lower Basin. A 2,500 c.f.s. aqueduct could be serviced by approximately 400 megawatts of thermal power. A 3,000 c.f.s. aqueduct would require an additional 70 megawatts, which would increase the prepaid purchase costs in a non-Federal steamplant.

(2) S. 1004 omits section 2(b)(3) of S. 1013 which provides expressly that costs to be borne by the United States under the Federal prepayment arrangements for thermal power to meet Central Arizona project pumping requirements shall not include interest, financing charges, taxes or other similar items.

Comment. These items could be omitted as a matter of negotiation even though no specific instruction to that effect is included in the legislation. It may be that the specific language we have proposed is unduly restrictive in respect of items such as sales taxes on equipment and supplies if purchased outside the state in which the plant would be constructed.

(3) S. 1004 omits a provisions included in section 2(d)(2) of S. 1013 which provides for a review of other requirements for water in the Central Arizona projects service area before irrigation water supply contracts may be renewed.

Comment. The omitted provision is similar to a provision first included as section 107(e) of the draft bill transmitted with our report of April 9, 1964, to the Senate Committee on Interior and Insular Affairs on S. 1658 in the 88th Congress. Our report of May 18, 1965, to your Committee on S. 75 and S. 1019, 89th Congress, also proposed its inclusion. We reiterate here what was said in that letter:

"Until such time as sufficient water is available to meet all demands, it is important that legislation authorizing new projects using lower basin Colorado River water include the mechanisms whereby the availability of water as between irrigation and municipal and industrial uses can be further considered from time to time. Irrigation water contracts should be of a definite term—long enough to justify investments and development to put the water to use, but nevertheless with a finite time limit—to provide the opportunity for reappraisal of the water situation at the end of the contract period looking to the dedication of water to its highest use at that time. We recognize that this is a departure from the permanent service requirement of the Boulder Canyon Project Act and the provisions of the act of July 2, 1956 (70 Stat. 415) providing for the renewal of irrigation water delivery contracts. It is, however, in our view justified by the conditions now prevailing in the Southwest."

(4) Section 6 of S. 1004 omits the requirement of the identically numbered section in S. 1013 requiring a report by the State Department and Presidential approval of a definite plan report before ground-water recovery programs may be undertaken in the Yuma area.

Comment. The Mexican government has been concerned about possible adverse effects of ground-water recovery in the Yuma area upon the flow of underground water across the international boundary. We do not propose to do more through these ground-water recovery programs than to recover the recharge which occurs from surface irrigation in the Yuma area. Consequently, there will be no reduction in the ground water which would flow into Mexico in this area in the absence of irrigation on the American side of the border. However, in view of the concern of the Mexican government, the Administration believes the provision should be retained.

(5) S. 1004 omits section 7 of S. 1013 which would remove the reach of the Colorado River between Lake Mead and Glen Canyon Dam from the licensing jurisdiction of the Federal Power Commission.

Comment. Our letter of February 15 to the President of the Senate recommends that Marble Canyon dam be eliminated from the Colorado River development program and that consideration of Hualapai (Bridge Canyon) dam be deferred pending study by the National Water Commission. Enlargement of Grand Canyon National Park to include the Marble Canyon site, as we have recommended, would, of course, eliminate the need for this provision so far as concerns that site. However, it would still be necessary to place a moratorium on the Hualapai site to preserve the status quo pending final decision as to its disposition.

S. 861, S. 1242, and S. 1409 are similar in most respects, and have each evolved from H.R. 4671, 89th Congress, as reported out by the House Committee on Interior and Insular Affairs in August of last year. They are also similar in most respects to H.R. 3300 which is now before the House Committee. Our reasons for proposing that the approach of these bills be dropped in favor of that taken by S. 1013 and S. 1004 are fully set out in our letter of February 15.

In summary, we recommend enactment of either S. 1013 or S. 1004, if amended to conform thereto. We recommend also that Grand Canyon National Park be enlarged as proposed in our letter of March 9 to the President of the Senate. As stated in our letter of February 15 to the President of the Senate, these bills would seem to be the appropriate vehicle to authorize the Animas-La Plata and Dolores projects.

The Bureau of the Budget has advised that there is no objection to the presentation of this supplemental report, and that the enactment of legislation to authorize the Central Arizona project as proposed in our letter of February 15 to the President of the Senate and in S. 1013 is in accord with the program of the President.

Sincerely yours,

STEWART L. UDALL,
Secretary of the Interior.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., April 28, 1967.

HON. HENRY M. JACKSON,
*Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D.C.*

DEAR MR. CHAIRMAN: This responds to your letter of April 5, 1967, requesting the views of the Bureau of the Budget on S. 861, S. 1242, and S. 1409, bills "To authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes," and on S. 1004, a bill "To authorize the construction, operation, and maintenance of the central Arizona project, Arizona-New Mexico, and for other purposes."

The purposes of these bills are stated in their titles.

By letter of February 15, 1967, the Secretary of the Interior submitted recommendations to the President of the Senate on Colorado River legislation. The draft bill transmitted with that letter was introduced by you (S. 1013) on February 17, 1967.

S. 1013 reflects the position of the Administration and, accordingly, we recommend that it be enacted in lieu of the bills on which our views were requested.

Sincerely yours,

WILFRED H. ROMMEL,
Assistant Director for Legislative Reference.

[S. 861, 90th Cong., first sess.]

A BILL To authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COLORADO RIVER BASIN PROJECT: OBJECTIVES

SEC. 101. That this Act may be cited as the "Colorado River Basin Project Act".

SEC. 102. The Congress recognizes that the present and growing water shortages in the Colorado River Basin constitute urgent problems of national concern, and

accordingly authorizes and directs the National Water Commission and the Water Resources Council, established by the Water Resources Planning Act (Public Law 89-80), to give highest priority to the preparation of a plan and program for the relief of such shortages, in consultation with the States and Federal entities affected, as provided in this Act. This program is declared to be for the purposes, among others, of regulating the flow of the Colorado River; controlling floods; improving navigation; providing for the storage and delivery of the waters of the Colorado River for reclamation of lands, including supplemental water supplies, for municipal, industrial, and other beneficial purposes; improving water quality; providing for basic public outdoor recreation facilities; improving conditions for fish and wildlife; and the generation and sale of hydroelectric power as an incident of the foregoing purposes.

TITLE II—SOUTHWEST INVESTIGATIONS AND PLANNING

SEC. 201. (a) The Council, in consultation with the Commission, acting in accordance with the procedure prescribed in section 103 of the Water Resources Planning Act, shall within one hundred and twenty days following the effective date of this Act establish principles, standards, and procedures for the program of investigations and submittal of plans and reports authorized by this section and section 203. The Secretary of the Interior hereinafter referred to as the "Secretary"), under the direction of the Commission, in conformity with the principles, standards, and procedures so established, is authorized and directed to—

- (1) prepare estimates of the long-range water supply available for consumptive use in the Colorado River Basin, of current water requirements therein, and of the rate of growth of water requirements therein to at least the year 2030;
 - (2) investigate sources and means of supplying water to meet the current and anticipated water requirements of the Colorado River Basin, including reductions in losses, importations from sources outside the natural drainage basin of the Colorado River system, desalination, weather modification, and other means;
 - (3) investigate projects with the lower basin of the Colorado River, including projects on tributaries of the Colorado River, where undeveloped water supplies are available or can be made available by replacement or exchange;
 - (4) undertake investigations, in cooperation with other concerned agencies, of the feasibility of proposed development plans in maintaining an adequate water quality throughout the Colorado River Basin;
 - (5) investigate means of providing for prudent water conservation practices to permit maximum beneficial utilization of available water supplies in the Colorado River Basin;
 - (6) investigate and prepare estimates of the long-range water supply in States and areas from which water may be imported into the Colorado River system, together with estimates of the probable ultimate requirements for water within those States and areas of origin, for all purposes, including, but not limited to, consumptive use, navigation, river regulation, power, enhancement of fishery resources, pollution control, and disposal of wastes to the ocean, and estimates of the quantities of water, if any, that will be available in excess of such requirements in the States and areas of origin for exportation to the Colorado River system; and
 - (7) investigate current and anticipated water requirements of areas outside the natural drainage areas of the Colorado River system which feasibly can be served from importation facilities en route to the Colorado River system.
- (b) The Secretary is authorized and directed to prepare reconnaissance reports of a staged plan or plans for projects adequate, in its judgment, to meet the requirements reported under subsection (a) of this section, in conformity with section 202.
- (c) The plan for the first stage of works to meet the future requirements of the areas of deficiency and surplus as determined from studies performed pursuant to this section shall include, but not be limited to, import works necessary to provide two million five hundred thousand acre-feet annually for use from the main stream of the Colorado River below Lee Ferry, including satisfaction of the obligations of the Mexican Water Treaty and losses of water associated with

the performance of that treaty. Plans for import works for the first stage may also include facilities to provide water in the following additional quantities:

(1) Up to two million acre-feet annually in the Colorado River for use in the Lower Colorado River Basin;

(2) Up to two million acre-feet annually in the Colorado River system for use in the Upper Colorado River Basin, directly or by exchange;

(3) Such additional quantities, not to exceed two million acre-feet annually, as the Secretary finds may be required and marketable in areas which can be served by said importation facilities en route to the Colorado River system.

(d) The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty constitutes a national obligation. Accordingly, the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) and States of the lower division (Arizona, California, and Nevada) shall be relieved from all obligations which may have been imposed upon them by article III(c) of the Colorado River Compact when the President issues the proclamation specified in section 305(b) of this Act.

(e) The Secretary shall submit annually to the Commission, the President, and the Congress reports covering progress on the investigations and reports authorized by this section.

SEC. 202. (a) In planning works to import water into the Colorado River system from sources outside the natural drainage areas of the system, the Secretary shall make provision for adequate and equitable protection of the interests of the States and areas of origin, including (in the case of works to import water for use in the lower basin of the Colorado River) assistance from the development fund established by title IV of this Act, to the end that water supplies may be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.

(b) All requirements, present or future, for water within any State lying wholly or in part within the drainage area of any river basin and from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of that river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.

SEC. 203. (a) On or before December 31, 1970, the Secretary shall submit a proposed reconnaissance report on the first stage of the staged plan of development to the Commission and affected States and Federal agencies for their comments and recommendations which shall be submitted within six months after receipt of the report.

(b) After receipt of the comments of the Commission, affected States, and Federal agencies on such reconnaissance report, but not later than January 1, 1972, the Secretary shall transmit the report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

(c) The Secretary shall proceed promptly thereafter with preparation of a feasibility report on the first stage of said plan of development if he finds, on the basis of reconnaissance investigations pursuant to section 201, that a water supply surplus to the needs of the area of origin exists, benefits of the proposed first stage exceed costs, and repayment can be made in accordance with titles III and IV of this Act. Such feasibility report shall be submitted to the Commission and to the affected States and Federal agencies not later than January 1, 1973.

(d) After receipt of the comments of the Commission and affected States and Federal agencies on such feasibility report, but not later than June 30, 1973, the Secretary shall transmit his final report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

SEC. 204. There are hereby authorized to be appropriated such sums as are required to carry out the purposes of this title.

TITLE III—AUTHORIZED UNITS: PROTECTION OF EXISTING USES

SEC. 301. The Secretary shall construct, operate, and maintain the lower basin units of the Colorado River Basin project (herein referred to as the "project"), described in sections 302, 303, 304, 305, and 306.

SEC. 302. The main stream reservoir division shall consist of the Hualapai (formerly known as Bridge Canyon) unit, including a dam, reservoir, power-plant, transmission facilities, and appurtenant works, and the Coconino and Paria River silt-detention reservoirs: *Provided*, That (1) Hualapai Dam shall be constructed so as to impound water at a normal surface elevation of one thousand eight hundred and sixty-six feet above mean sea level, (2) fluctuations in the reservoir level shall be restricted, so far as practicable, to a regimen of ten feet, and (3) this Act shall not be construed to authorize any diversion of water from Hualapai Reservoir except for incidental uses in the immediate vicinity. The Congress hereby declares that the construction of the Hualapai Dam herein authorized is consistent with the Act of February 26, 1919 (40 Stat. 1175). No licenses or permits shall be issued hereafter under the Federal Power Act for projects on the Colorado River between Glen Canyon Dam and Lake Mead.

SEC. 303. (a) As fair and reasonable payment for the permanent use by the United States of not more than twenty-five thousand acres of land designated by the Secretary as necessary for the construction, operation, and maintenance of the Hualapai unit, said land being a part of the tract set aside and reserved by the Executive order of January 4, 1883, for the use and occupancy of the Hualapai Tribe of Arizona (1 Kappler, Indian Laws and Treaties, 804), \$16,398,000 shall be transferred in the Treasury, during construction of the unit, to the credit of the Hualapai Tribe from funds appropriated from the general fund of the Treasury to the Department of the Interior, Bureau of Reclamation, for construction of the project and, when so transferred, shall draw interest at the rate of 4 per centum per annum until expended. The funds so transferred may be expended, invested, or reinvested pursuant to plans, programs, and agreements duly adopted or entered into by the Hualapai Tribe, subject to the approval of the Secretary, in accordance with the tribal constitution and charter.

(b) As part of the construction and operation of the Hualapai unit, the Secretary shall (1) construct a paved road, having a minimum width of twenty-eight feet, from Peach Springs, Arizona, through and along Peach Springs Canyon within the Hualapai Indian Reservation, to provide all-weather access to the Hualapai Reservoir; and (2) make available to the Hualapai Tribe up to twenty-five thousand kilowatts and up to one hundred million kilowatt-hours annually of power from the Hualapai unit at the lowest rate established by the Secretary for the sale of firm power from said unit for the use of preferential customers: *Provided*, That the tribe may resell such power only to users within the Hualapai Reservation: *Provided further*, That the Hualapai Tribal Council shall notify the Secretary in writing of the reasonable power requirements of the tribe up to the maximum herein specified, for each three-year period in advance beginning with the date upon which power from the Hualapai unit becomes available for sale. Power not so reserved may be disposed of by the Secretary for the benefit of the development fund.

(c) Except as to such lands which the Secretary determines are required for the Hualapai Dam and Reservoir site and the construction of operating campsite and townsite, all minerals of any kind whatsoever, including oil and gas but excluding sand and gravel and other building and construction materials, within the areas used by the United States pursuant to this section are hereby reserved to the Hualapai Tribe: *Provided*, That no permit, license, lease or other document covering the exploration for or the extraction of such materials shall be granted by the tribe nor shall the tribe conduct such operations for its own account, except under such conditions and with such stipulations as are necessary to protect the interests of the United States in the construction, operation, and maintenance of the Hualapai unit.

(d) The Hualapai Tribe shall have the exclusive right, if requested in writing by the tribe, to develop the recreation potential of, and shall have the exclusive right to control access to, the reservoir shoreline adjacent to the reservation, subject to conditions established by the Secretary for use of the reservoir to protect the operation of the project. Any recreation development established by the tribe shall be consistent with the Secretary's rules and regulations to protect the overall recreation development of the project. The tribe and the members thereof shall have nonexclusive personal rights to hunt and fish on the reservoir without charge, but shall have no right to exclude others from the reservoir except as to those who seek to gain access through the Hualapai Reservation, nor the right to require payments to the tribe except for the use of tribal lands

or facilities: *Provided*, That under no circumstances will the Hualapai Tribe make any charge, or extract any compensation, or in any other manner restrict the access or use of the paved road to be constructed within the Hualapai Indian Reservation pursuant to this Act. The use by the public of the water areas of the project shall be pursuant to such rules and regulations as the Secretary may prescribe.

(e) Except as limited by the foregoing, the Hualapai Tribe shall have the right to use and occupy the area of the Hualapai unit within the Hualapai Reservation for all purposes not inconsistent with the construction, operation, and maintenance of the project and townsite, including, but not limited to, the right to lease such lands for farming, grazing, and business purposes to members or nonmembers of the tribe and the power to dispose of all minerals as provided in paragraph (c) hereof.

(f) Upon a determination by the Secretary that all of any part of the lands utilized by the United States pursuant to paragraph (a) of this section is no longer necessary for purposes of the project, such lands shall be restored to the Hualapai Tribe for its full use and occupancy.

(g) No part of any expenditures made by the United States, and no reservation by or restoration to the Hualapai Tribe of the use of land under any of the provisions of this section shall be charged by the United States as an offset or counterclaim against any claim of the Hualapai Tribe against the United States other than claims arising out of the utilization of lands for the project: *Provided, however*, That the payment of moneys and other benefits as set forth herein shall constitute full, fair, and reasonable payment for the permanent use of the lands by the United States.

(h) All funds authorized by this section to be paid or transferred to the Hualapai Tribe, and any per capita distribution derived therefrom, shall be exempt from all forms of State and Federal income taxes.

(i) No payments shall be made or benefits conferred as set forth in this section until the provisions hereof have been accepted by the Hualapai Tribe through resolution duly adopted by its tribal council. In the event such resolution is not adopted within six months from the effective date of this Act, and litigation thereafter is instituted regarding the use by the United States of lands within the Hualapai Reservation or payment therefor, the amounts of the payments provided herein and the other benefits set out shall not be regarded as evidencing value or as recognizing any right of the tribe to compensation.

Sec. 304. (a) The Central Arizona unit shall consist of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system shall have a capacity of one thousand eight hundred cubic feet per second (A) unless the definite plan report of the Bureau of Reclamation shows that additional capacity (i) will provide an improved benefit-to-cost ratio and (ii) will enhance the ability of the Central Arizona unit to divert water from the main stream to which Arizona is entitled and (B) unless the Secretary finds that the additional cost resulting from such additional capacity can be financed by funds from sources other than the funds credited to the development fund pursuant to section 403 of this Act and without charge, directly or indirectly, to water users or power customers in the States of California and Nevada; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59); (4) Hooker Dam and Reservoir, which shall be constructed to an initial capacity of ninety-eight thousand acre-feet and in such a manner as to permit subsequent enlargement of the structure (to give effect to the provisions of section 304 (c) and (d)); (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) Unless and until otherwise provided by Congress, water from the natural drainage area of the Colorado River system diverted from the main stream below Lee Ferry for the Central Arizona unit shall not be made available directly or



indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered wildlife management areas. It shall be a condition of each contract under which such water is provided under the Central Arizona unit that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the Central Arizona unit for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal, and industrial waste water, return flow, seepage, sewage effluent, and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the Central Arizona unit or (ii) waters stored or developed by any Federal reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the Central Arizona unit or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this sentence, the agricultural, municipal, and industrial waste water, return flow, seepage, sewage effluent, and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the Central Arizona unit, if not needed for use or reuse in such Federal reclamation project.

(c) The Secretary may require as a condition in any contract under which water is provided from the Central Arizona unit that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in contracts with such contractors in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsections (e) and (f) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(d) In times of shortage or reduction of main stream water for the Central Arizona unit (if such shortages or reductions should occur), contractors which have yielded water from other sources in exchange for main stream water supplied by that unit shall have a first priority to receive main stream water, as against other contractors supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(e) In the operation of the Central Arizona unit, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive use shall not begin until and shall continue only so long as delivery of Colorado River water to downstream Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(f) The Secretary shall further offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources in amounts that will permit consumptive uses of water in New Mexico not to exceed an annual average in any period of ten consecutive years of an additional thirty thousand acre-feet, including reservoir evaporation. Such fur-

ther increases in consumptive use shall not begin until and shall continue only so long as works capable of importing water into the Colorado River system have been completed and water sufficiently in excess of two million eight hundred thousand acre-feet per annum is available from the main stream of the Colorado River for consumptive use in Arizona to provide water for the exchanges herein authorized and provided. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

All additional consumptive uses provided for in subsections (e) and (f) of this section shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

Sec. 305. (a) Article II(B)(3) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340) shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream Colorado River water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada, diversions from the main stream for the General Arizona unit shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of main stream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada shall not be required to bear shortages in any proportion greater than would have been imposed in the absence of this section 305(a). This section shall not affect the relative priorities, among themselves, of water users in Arizona, Nevada, and California which are senior to diversions for the Central Arizona unit, or amend any provisions of said decree.

(b) The limitation stated in paragraph (a) shall cease whenever the President shall proclaim that works have been completed and are in operation, capable in his judgment of delivering annually not less than two million five hundred thousand acre-feet of water into the main stream of the Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado River system; and that such sources are adequate, in the President's judgment, to supply such quantities without adverse effect upon the satisfaction of the foreseeable water requirements of any State from which such water is imported into the Colorado River system. Such imported water shall be made available for use in accordance with subsection (c) of this section.

(c) To the extent that the flow of the main stream of the Colorado River is augmented by such importations in order to make sufficient water available for release, as determined by the Secretary pursuant to article II(B)(1) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340), to satisfy annual consumptive use of two million eight hundred thousand acre-feet in Arizona, four million four hundred thousand acre-feet in California, and three hundred thousand acre-feet in Nevada, respectively, the Secretary shall make such additional water available to users of main stream water in those States at the same costs and on the same terms as would be applicable if main stream water were available for release in the quantities required to supply such consumptive use, taking into account, among other things, (1) the nonreimbursable allocation to the replenishment of the deficiencies occasioned by satisfaction of the Mexican Treaty burden provided for in section 401, and (2) such assistance as may be available from the development fund established by title IV of this Act.

(d) Imported water made available for use in the lower basin to supply aggregate annual consumptive uses from the main stream in excess of seven million five hundred thousand acre-feet shall be offered by the Secretary for use in the States of Arizona, California, and Nevada in the proportions provided in article II(b)(2) of said decree. The Secretary shall establish prices therefor which take



into account such assistance as may be available from the development fund established by title IV of this Act in excess of the demands upon that fund occasioned by the requirements stated in subsection (c) of this section. Within each State, opportunity to take such water shall first be offered to persons or entities who are water users as of the effective date of this Act, and in quantities equal to the deficiencies which would result if the total quantity available for consumptive use from the main stream in such State were only the quantity apportioned to that State by article II(B) (1) of said decree.

(e) Imported water made available for use in the upper basin of the Colorado River, directly or by exchange, shall be offered by the Secretary for contract by water users in the States of Colorado, New Mexico, Utah, and Wyoming in the proportions, as among those States, stated in the Upper Colorado River Basin Compact, and at prices which take into account such assistance as may be available from the Upper Colorado River Basin Fund, in excess of the demands upon that fund occasioned by the requirements of the Colorado River Storage Project Act.

(f) Imported water not delivered into the Colorado River system but diverted from the works constructed to import water into that system shall be made available to water users in accordance with the Federal reclamation laws.

SEC. 306. The main stream salvage unit shall include programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary.

SEC. 307. The Secretary shall construct, operate, and maintain such additional works as shall from time to time be authorized by the Congress as units of the project.

SEC. 308. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the project works authorized pursuant to this title shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 309. The Secretary shall integrate the Dixie project and Southern Nevada water supply project heretofore authorized into the project herein authorized as units thereof under repayment arrangements and participation in the development fund established by title IV of this Act consistent with the provisions of this Act.

SEC. 310. There is hereby authorized to be appropriated to carry out the purposes of this title the sum of \$1,167,000,000 based on estimated costs as of October 1963, plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indices applicable to the types of construction involved.

TITLE IV—LOWER COLORADO RIVER BASIN DEVELOPMENT FUND: ALLOCATION AND REPAYMENT OF COSTS: CONTRACTS

SEC. 401. Upon completion of each lower basin unit of the project herein or hereafter authorized, or separate feature thereof, the Secretary shall allocate the total costs of constructing said unit or features to (1) commercial power, (2) irrigation, (3) municipal and industrial water supply, (4) flood control, (5) navigation, (6) water quality control, (7) recreation, (8) fish and wildlife, (9) the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Water Treaty of 1944 with the United Mexican States (treaty series 994), (10) the additional capacity of the system of main conduits and canals of the Central Arizona unit referred to in section 304(a), item (1), in excess of one thousand eight hundred cubic feet per second, and (11) any other purposes authorized under the Federal reclamation laws. Costs of construction, operation, and maintenance allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by compliance with the Mexican Water Treaty (including losses in transit, evaporation from regulatory reservoirs, and regulatory losses at the Mexican boundary, incurred in the transportation, storage, and delivery of water in discharge of the obligations of that treaty) shall be non-reimbursable. All funds paid or transferred to Indian tribes pursuant to this Act, including interest on such funds in the Treasury of the United States, and costs of construction of the paved road, authorized in section 303(b) hereof,

shall be nonreimbursable. The repayment of costs allocated to recreation and fish and wildlife enhancement shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213). Costs allocated to non-reimbursable purposes shall be nonreturnable under the provisions of this Act. Costs allocated to the additional capacity of the system of main conduits and canals of the Central Arizona unit, referred to in section 304(a), item (1), in excess of one thousand eight hundred cubic feet per second shall be recovered as directed in section 304(a).

SEC. 402. The Secretary shall determine the repayment capability of Indian lands within, under, or served by any unit of the project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

SEC. 403. (a) There is hereby established a separate fund in the Treasury of the United States, to be known as the Lower Colorado River Basin development fund (hereinafter called the "development fund"), which shall remain available until expended as hereafter provided for carrying out the provisions of title III.

(b) All appropriations made for the purpose of carrying out the aforesaid provisions of title III of this Act shall be credited to the development fund as advances from the general fund of the Treasury, and shall be available for such purpose.

(c) There shall also be credited to the development fund—

(1) all revenues collected in connection with the operation of facilities herein and hereafter authorized in furtherance of the purposes of this Act (except entrance, admissions, and other recreation fees or charges and proceeds received from recreation concessionaires); and

(2) all Federal revenues from the Boulder Canyon and Parker-Davis projects which, after completion of repayment requirements of the said Boulder Canyon and Parker-Davis projects, are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of those projects: *Provided, however*, That the Secretary is authorize and directed to continue the in-lieu-of-taxes payments to the States of Arizona and Nevada provided for in section 2(c) of the Boulder Canyon Project Adjustment Act so long as revenues accrue from the operation of the Boulder Canyon project.

(d) All revenues collected and credited to the development fund pursuant to this Act shall be available, without further appropriation, for—

(1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the project, within such separate limitations as may be included in annual appropriation Acts;

(2) payments, if any, as required by section 502 of this Act;

(3) payments as required by subsection (f) of this section; and

(4) payments to reimburse water users in the State of Arizona for losses sustained as a result of diminution of the production of hydroelectric power at Coolidge Dam, Arizona, resulting from exchanges of water between users in the States of Arizona and New Mexico as set forth in section 304 of this Act.

(e) Revenues credited to the development fund shall not be available for construction of the works comprised within any unit of the project herein or hereafter authorized except upon appropriation by the Congress.

(f) Revenues in the development fund in excess of the amount necessary to meet the requirements of clauses (1), (2), and (4) of subsection (d) of this section shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit of the project or separable feature thereof, authorized pursuant to title III of this Act which are allocated to irrigation, commercial power, or municipal and industrial water supply, pursuant to this Act, within a period not exceeding fifty years from the date of completion of each such unit or separable feature, exclusive of any development period authorized by law;

(2) the costs which are allocated to recreation or fish and wildlife enhancement in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213); and

(3) interest (including interest during construction) on the unamortized balance of the investment in the commercial power and municipal and in-

dustrial water supply features of the project at a rate determined by the Secretary of the Treasury in accordance with the provisions of subsection (f) of this section, and interest due shall be a first charge.

(g) To the extent that revenues remain in the development fund after making the payments required by subsections (d) and (f) of this section, they shall be available, upon appropriation by the Congress, to repay the costs incurred in connection with units hereafter authorized in providing (i) for the importation of water into the main stream of the Colorado River for use below Lee Ferry as provided in section 201(c) to the extent that such costs are in excess of the costs allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Mexican Water Treaty as provided in Section 401, and (ii) protection of States and areas of origin of such imported water as provided in section 202(a).

(h) The interest rate applicable to those portions of the reimbursable costs of each unit of the project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such unit, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

(i) Business-type budgets shall be submitted to the Congress annually for all operations financed by the development fund.

SEC. 404. (a) Irrigation repayment contracts shall provide for repayment of the obligation assumed under any irrigation repayment contract with respect to any project contract unit or irrigation block over a basic period of not more than fifty years exclusive of any development periods authorized by law; contracts authorized by section 9(e) of the Reclamation Project Act of 1939 (53 Stat. 1196; 43 U.S.C. 485h(e)) may provide for delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes.

(b) Contracts relating to municipal and industrial water supply from the project may be made without regard to the limitations of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (53 Stat. 1194); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

SEC. 405. On January 1 of each year the Secretary shall report to the Congress, beginning with the fiscal year ending June 30, 1968, upon the status of the revenues from and the cost of constructing, operating, and maintaining the project and each unit thereof for the preceding fiscal year. The report of the Secretary shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

TITLE V—UPPER COLORADO RIVER BASIN AUTHORIZATIONS AND REIMBURSEMENTS

SEC. 501. (a) In order to provide for the construction, operation, and maintenance of the Animas-La Plata Federal reclamation project, Colorado-New Mexico; the Dolores, Dallas Creek, West Divide, and San Miguel Federal reclamation projects, Colorado, as participating projects under the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), and to provide for the completion of planning reports on other participating projects, subsection (2) of section 1 of said Act is hereby further amended by deleting the words "Pine River extension", and inserting in lieu thereof the words "Animas-La Plata, Dolores, Dallas Creek, West Divide, San Miguel". Section 2 of said Act is hereby further amended by deleting the words "Parshall, Troublesome, Rabbit Ear,

San Miguel, West Divide, Tomichi Creek, East River, Ohio Creek, Dallas Creek, Dolores, Fruit Growers extension, Animas-La Plata", and inserting after the words "Yellow Jacket" the words "Basalt, Middle Park (including the Troublesome, Rabbit Ear, and Azure units), Upper Gunnison (including the East River, Ohio Creek and Tomichi Creek units), Lower Yampa (including the Juniper and Great Northern units), Upper Yampa (including the Hayden Mesa, Wessels, and Toponas units)", and by inserting after the word "Sublette" the words "(including the Kendall Reservoir on Green River and a diversion of water from the Green River to the North Platte River Basin in Wyoming), Uintah unit and Ute Indian unit of the Central Utah, San Juan County (Utah), Price River, Grand County (Utah), Ute Indian unit extension of the Central Utah, Gray Canyon, and Juniper (Utah)". The amount which section 12 of said Act authorizes to be appropriated is hereby further increased by the sum of \$360,000,000 plus or minus such amounts, if any, as may be required, by reason of changes in construction costs as indicated by engineering cost indexes applicable to the type of construction involved. This additional sum shall be available solely for the construction of the projects herein authorized.

(b) The Animas-La Plata Federal reclamation project shall be constructed and operated in substantial accordance with the engineering plans set out in the report of the Secretary transmitted to the Congress on May 4, 1968, and printed as House Document 436, Eighty-ninth Congress: *Provided*, That the project construction of the Animas-La Plata Federal reclamation project shall not be undertaken until and unless the States of Colorado and New Mexico shall have ratified the following compact to which the consent of Congress is hereby given:

"ANIMAS-LA PLATA PROJECT COMPACT"

"The State of Colorado and the State of New Mexico, in order to implement the operation of the Animas-La Plata Federal Reclamation Project, Colorado-New Mexico, a proposed participating project under the Colorado River Storage Project Act (70 Stat. 105), and being moved by considerations of interstate comity, have resolved to conclude a compact for these purposes and have agreed upon the following articles:

"ARTICLE I

"A. The right to store and divert water in Colorado and New Mexico from the La Plata and Animas River systems, including return flow to the La Plata River from Animas River diversions, for uses in New Mexico under the Animas-La Plata Federal Reclamation Project shall be valid and of equal priority with those rights granted by decree of the Colorado state courts for the uses of water in Colorado for that project, providing such uses in New Mexico are within the allocation of water made to that state by articles III and XIV of the Upper Colorado River Basin Compact (63 Stat. 31).

"B. The restrictions of the last sentence of Section (a) of Article IX of the Upper Colorado River Basin Compact shall not be construed to vitiate paragraph A of this article.

"ARTICLE II

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States."

(c) The Secretary shall, for the Animas-La Plata, Dolores, Dallas Creek, San Miguel, West Divide, and Seedskadee participating projects of the Colorado River storage project, establish the nonexcess irrigable acreage for which any single ownership may receive project water at one hundred and sixty acres of class 1 land or the equivalent thereof as determined by the Secretary, in other land classes.

(d) In the diversion and storage of water for any project or any parts thereof constructed under the authority of this Act or the Colorado River Storage Project Act within and for the benefit of the State of Colorado only, the Secretary is directed to comply with the constitution and statutes of the State of Colorado relating to priority of appropriation; with State and Federal court decrees entered pursuant thereto; and with operating principles, if any, adopted by the Secretary and approved by the State of Colorado.

(e) The words "any western slope appropriations" contained in paragraph (i) of that section of Senate Document Numbered 80, Seventy-fifth Congress, first session, entitled "Manner of Operation of Project Facilities and Auxiliary

Features," shall mean and refer to the appropriation heretofore made for the storage of water in Green Mountain Reservoir, a unit of the Colorado-Big Thompson Federal reclamation project, Colorado; and the Secretary is directed to act in accordance with such meaning and reference. It is the sense of Congress that this directive defines and observes the purpose of said paragraph (i), and does not in any way affect or alter any rights or obligations arising under said Senate Document Numbered 80 or under the laws of the State of Colorado.

SEC. 502. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1987, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from the lower Colorado River Basin development fund, as provided in paragraph (d) of section 403.

TITLE VI—GENERAL PROVISIONS: DEFINITIONS: CONDITIONS

SEC. 601. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder Canyon Project Act. (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774) or the Colorado Storage Project Act (70 Stat. 105).

(b) The Secretary is directed to—

(1) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River Compact.

(2) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River Compact.

(c) All Federal officer and agencies are directed to comply with the applicable provisions of this Act, and of the laws, treaty, compacts, and decree referred to in subsection (a) of this section, in the storage and release of water from all reservoirs and in the operation and maintenance of all facilities in the Colorado River system under the jurisdiction and supervision of the Secretary, and in the operation and maintenance of all works which may be authorized hereafter for construction for the importation of water into the Colorado River system. In the event of failure of any such officer or agency to so comply, any affected State may maintain an action to enforce the provisions of this section in the Supreme Court of the United States and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

(d) Nothing in this Act shall be construed to expand or diminish either Federal or State jurisdiction, responsibility or rights in the field of water resources planning, development, or control; nor to displace, supersede, limit or modify any interstate compact or the jurisdiction or responsibility of any legally established joint or common agency of two or more States, or of two or more States and the Federal Government; nor to limit the authority of Congress to authorize and fund projects.

SEC. 602. (a) In order to fully comply with and carry out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact and the Mexican Water Treaty, the Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated made under the authority of this Act, the Colorado River Storage Project Act, the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River Storage Project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River Compact, if any such deficiency exists and is chargeable to the States of the upper division, but in any event such releases, if any, shall terminate when the President issues the proclamation specified in section 305(b) of this Act.

(2) Releases to comply with article III(d) of the Colorado River Compact, less such quantities of water delivered into the Colorado River below Lee Ferry to the credit of the States of the upper division from sources outside the natural drainage area of the Colorado River system.

(3) Storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and probabilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River Compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III(e) of the Colorado River Compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such state representatives as each governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 603. (a) Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River Compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 604. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the project herein and hereafter authorized, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

SEC. 605. (a) All terms used in this Act which are defined in the Colorado River Compact shall have the meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lees Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree of the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

[S. 1242, 90th Cong., first sess.]

A BILL To authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COLORADO RIVER BASIN PROJECT: OBJECTIVES

SEC. 101. That this Act may be cited as the "Colorado River Basin Project Act".

SEC. 102. The Congress recognizes that the present and growing water shortages in the Colorado River Basin constitute urgent problems of national concern, and accordingly authorizes and directs the National Water Commission and the Water Resources Council, established by the Water Resources Planning Act (Public Law 89-80), to give highest priority to the preparation of a plan and program for the relief of such shortages, in consultation with the States and Federal entities affected, as provided in this Act. This program is declared to be for the purposes, among others, of regulating the flow of the Colorado River; controlling floods; improving navigation; providing for the storage and delivery of the waters of the Colorado River for reclamation of lands, including supplemental water supplies, for municipal, industrial, and other beneficial purposes; improving water quality; providing for basic public outdoor recreation facilities; improving conditions for fish and wildlife; and the generation and sale of hydroelectric power as an incident of the foregoing purposes.

TITLE II—SOUTHWEST INVESTIGATIONS AND PLANNING

SEC. 201. (a) The Council, in consultation with the Commission, acting in accordance with the procedure prescribed in section 103 of the Water Resources Planning Act, shall within one hundred and twenty days following the effective date of this Act establish principles, standards, and procedures for the program of investigations and submittal of plans and reports authorized by this section and section 203. The Secretary of the Interior (hereinafter referred to as the "Secretary"), under the direction of the Commission, in conformity with the principles, standards, and procedures so established, is authorized and directed to—

(1) prepared estimates of the long-range water supply available for consumptive use in the Colorado River Basin, of current water requirements therein, and of the rate of growth of water requirements therein to at least the year 2030;

(2) investigate sources and means of supplying water to meet the current and anticipated water requirements of the Colorado River Basin, including reductions in losses, importations from sources outside the natural drainage basin of the Colorado River system, desalination, weather modification, and other means;

(3) investigate projects with the lower basin of the Colorado River, including projects on tributaries of the Colorado River, where undeveloped water supplies are available or can be made available by replacement or exchange;

(4) undertake investigations, in cooperation with other concerned agencies, of the feasibility of proposed development plans in maintaining an adequate water quality throughout the Colorado River Basin;

(5) investigate means of providing for prudent water conservation practices to permit maximum beneficial utilization of available water supplies in the Colorado River Basin;

(6) investigate and prepare estimates of the long-range water supply in States and areas from which water may be imported into the Colorado River system, together with estimates of the probable ultimate requirements for water within those States and areas of origin, for all purposes, including, but not limited to, consumptive use, navigation, river regulation, power, enhancement of fishery resources, pollution control, and disposal of wastes to the ocean, and estimates of the quantities of water, if any, that will be available in excess of such requirements in the States and areas of origin for exportation to the Colorado River system; and

(7) investigate current and anticipated water requirements of areas outside the natural drainage areas of the Colorado River system which feasibly can be served from importation facilities en route to the Colorado River system.

(b) The Secretary is authorized and directed to prepare reconnaissance reports of a staged plan or plans for projects adequate, in its judgment, to meet the requirements reported under subsection (a) of this section, in conformity with section 202.

(c) The plan for the first stage of works to meet the future requirements of the areas of deficiency and surplus as determined from studies performed pursuant to this section shall include, but not be limited to, import works necessary to provide two million five hundred thousand acre-feet annually for use from the main stream of the Colorado River below Lee Ferry, including satisfaction of the obligations of the Mexican Water Treaty and losses of water associated with the performance of that treaty. Plans for import works for the first stage may also include facilities to provide water in the following additional quantities:

(1) Up to two million acre-feet annually in the Colorado River for use in the Lower Colorado River Basin;

(2) Up to two million acre-feet annually in the Colorado River system for use in the Upper Colorado River Basin, directly or by exchange;

(3) Such additional quantities, not to exceed two million acre-feet annually, as the Secretary finds may be required and marketable in areas which can be served by said importation facilities en route to the Colorado River system.

(d) The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty constitutes a national obligation. Accordingly, the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) and States of the lower division (Arizona, California, and Nevada) shall be relieved from all obligations which may have been imposed upon them by article III(c) of the Colorado River compact when the President issues the proclamation specified in section 305(b) of this Act.

(e) The Secretary shall submit annually to the Commission, the President, and the Congress reports covering progress on the investigations and reports authorized by this section.

SEC. 202. (a) In planning works to import water into the Colorado River system from sources outside the natural drainage areas of the system, the Secretary shall make provision for adequate and equitable protection of the interests of the States and areas of origin, including (in the case of works to import water for use in the lower basin of the Colorado River) assistance from the development fund established by title IV of this Act, to the end that water supplies may be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.

(b) All requirements, present or future, for water within any State lying wholly or in part within the drainage area of any river basin and from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of that river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.

SEC. 203. (a) On or before December 31, 1970, the Secretary shall submit a proposed reconnaissance report on the first stage of the staged plan of development to the Commission and affected States and Federal agencies for their comments and recommendations which shall be submitted within six months after receipt of the report.

(b) After receipt of the comments of the Commission, affected States, and Federal agencies on such reconnaissance report, but not later than January 1, 1972, the Secretary shall transmit the report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

(c) The Secretary shall proceed promptly thereafter with preparation of a feasibility report on the first stage of said plan of development if he finds, on the basis of reconnaissance investigations pursuant to section 201, that a water supply surplus to the needs of the area of origin exists, benefits of the proposed first stage exceed costs, and repayment can be made in accordance with titles III and IV of this Act. Such feasibility report shall be submitted to the Commission and to the affected States and Federal agencies not later than January 1, 1973.

(d) After receipt of the comments of the Commission and affected States and Federal agencies on such feasibility report, but not later than June 30, 1973, the Secretary shall transmit his final report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

SEC. 204. There are hereby authorized to be appropriated such sums as are required to carry out the purposes of this title.

TITLE III—AUTHORIZED UNITS: PROTECTION OF EXISTING USES

SEC. 301. The Secretary shall construct, operate, and maintain the lower basin units of the Colorado River Basin project (herein referred to as the "project"), described in sections 302, 303, 304, 305, and 306.

SEC. 302. The main stream reservoir division shall consist of the Hualapai (formerly known as Bridge Canyon) unit, including a dam, reservoir, powerplant, transmission facilities, and appurtenant works, and the Coconino and Paria River silt-detention reservoirs: *Provided*, That (1) Hualapai Dam shall be constructed so as to impound water at a normal surface elevation of one thousand eight hundred and sixty-six feet above mean sea level, (2) fluctuations in the reservoir level shall be restricted, so far as practicable, to a regimen of ten feet, and (3) this Act shall not be construed to authorize any diversion of water from Hualapai Reservoir except for incidental uses in the immediate vicinity. The Congress hereby declares that the construction of the Hualapai Dam herein authorized is consistent with the Act of February 26, 1919 (40 Stat. 1175).

SEC. 303. (a) As fair and reasonable payment for the permanent use by the United States of not more than twenty-five thousand acres of land designated by the Secretary as necessary for the construction, operation, and maintenance of the Hualapai unit, said land being a part of the tract set aside and reserved by the Executive order of January 4, 1883, for the use and occupancy of the Hualapai Tribe of Arizona (1 Kappler, Indian Laws and Treaties, 804), \$16,398,000 shall be transferred in the Treasury, during construction of the unit, to the credit of the Hualapai Tribe from funds appropriated from the general fund of the Treasury to the Department of the Interior, Bureau of Reclamation, for construction of the project and, when so transferred, shall draw interest at the rate of 4 per centum per annum until expended. The funds so transferred may be expended, invested, or reinvested pursuant to plans, programs, and agreements duly adopted or entered into by the Hualapai Tribe, subject to the approval of the Secretary, in accordance with the tribal constitution and charter.

(b) As part of the construction and operation of the Hualapai unit, the Secretary shall (1) construct a paved road, having a minimum width of twenty-eight feet, from Peach Springs, Arizona, through and along Peach Springs Canyon within the Hualapai Indian Reservation, to provide all-weather access to the Hualapai Reservoir; and (2) make available to the Hualapai Tribe up to twenty-five thousand kilowatts and up to one hundred million kilowatt-hours annually of power from the Hualapai unit at the lowest rate established by the Secretary for the sale of firm power from said unit for the use of preferential customers: *Provided*, That the tribe may resell such power only to users within the Hualapai Reservation: *Provided further*, That the Hualapai Tribal Council shall notify the Secretary in writing of the reasonable power requirements of the tribe up to the maximum herein specified, for each three-year period in advance beginning with the date upon which power from the Hualapai unit becomes available for sale.

Power not so reserved may be disposed of by the Secretary for the benefit of the development fund.

(c) Except as to such lands which the Secretary determines are required for the Hualapai Dam and Reservoir site and the construction of the operating campsite and townsite, all minerals of any kind whatsoever, including oil and gas but excluding sand and gravel and other building and construction materials, within the areas used by the United States pursuant to this section are hereby reserved to the Hualapai Tribe: *Provided*, That no permit, license, lease, or other document covering the exploration for or the extraction of such minerals shall be granted by the tribe nor shall the tribe conduct such operations for its own account, except under such conditions and with such stipulations as are necessary to protect the interests of the United States in the construction, operation, and maintenance of the Hualapai unit.

(d) The Hualapai Tribe shall have the exclusive right, if requested in writing by the tribe, to develop the recreation potential of, and shall have the exclusive right to control access to, the reservoir shoreline adjacent to the reservation, subject to conditions established by the Secretary for use of the reservoir to protect the operation of the project. Any recreation development established by the tribe shall be consistent with the Secretary's rules and regulations to protect the overall recreation development of the project. The tribe and the members thereof shall have the nonexclusive personal rights to hunt and fish on the reservoir without charge, but shall have no right to excluded others from the reservoir except as to those who seek to gain access through the Hualapai Reservation, nor the right to require payments to the tribe except for the use of tribal lands or facilities: *Provided*, That under no circumstances will the Hualapai Tribe make any charge, or extract any compensation, or in any other manner restrict the access or use of the paved road to be constructed within the Hualapai Indian Reservation pursuant to this Act. The use by the public of the water areas of the project shall be pursuant to such rules and regulations as the Secretary may prescribe.

(e) Except as limited by the foregoing, the Hualapai Tribe shall have the right to use and occupy the area of the Hualapai unit within the Hualapai Reservation for all purposes not inconsistent with the construction, operation, and maintenance of the project and townsite, including but not limited to, the right to lease such lands for farming, grazing, and business purposes to members or nonmembers of the tribe and the power to dispose of all minerals as provided in paragraph (c) hereof.

(f) Upon a determination by the Secretary that all or any part of the lands utilized by the United States pursuant to paragraph (a) of this section is no longer necessary for purposes of the project, such lands shall be restored to the Hualapai Tribe for its full use and occupancy.

(g) No part of any expenditures made by the United States, and no reservation by or restoration to the Hualapai Tribe of the use of land under any of the provisions of this section shall be charged by the United States as an offset or counterclaim against any claim of the Hualapai Tribe against the United States other than claims arising out of the utilization of lands for the project: *Provided, however*, That the payment of moneys and other benefits as set forth herein shall constitute full, fair, and reasonable payment for the permanent use of the lands by the United States.

(h) All funds authorized by this section to be paid or transferred to the Hualapai Tribe, and any per capita distribution derived therefrom, shall be exempt from all forms of State and Federal income taxes.

(i) No payments shall be made or benefits conferred as set forth in this section until the provisions hereof have been accepted by the Hualapai Tribe through a resolution duly adopted by its tribal council. In the event such resolution is not adopted within six months from the effective date of this Act, and litigation thereafter is instituted regarding the use by the United States of lands within the Hualapai Reservation or payment therefor, the amounts of the payments provided herein and the other benefits set out shall not be regarded as evidencing value or as recognizing any right of the tribe to compensation.

Sec. 304. (a) The central Arizona unit shall consist of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative,

which system shall have a capacity of two thousand five hundred cubic feet per second (A) unless the definite plan report of the Bureau of Reclamation shows that additional capacity (1) will provide an improved benefit-to-cost ratio and (ii) will enhance the ability of the central Arizona unit to divert water from the main stream to which Arizona is entitled and (B) unless the Secretary finds that the additional cost resulting from such additional capacity can be financed by funds from sources other than the funds credited to the development funds pursuant to section 403 of this Act and without charge, directly or indirectly, to water users or power customers in the States of California and Nevada; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59); (4) Hooker Dam and Reservoir, which shall be constructed to an initial capacity of ninety-eight thousand acre-feet and in such a manner as to permit subsequent enlargement of the structure (to give effect to the provisions of section 304 (c) and (d)); (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) Unless and until otherwise provided by Congress, water from the natural drainage area of the Colorado River system diverted from the main stream below Lee Ferry for the central Arizona unit shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered wildlife management areas. It shall be a condition of each contract under which such water is provided under the central Arizona unit that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the central Arizona unit for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the central Arizona unit or (ii) waters stored or developed by any Federal reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the central Arizona unit or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this sentence, the agricultural, municipal and industrial waste water, return flow, seepage, sewage effluent and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the central Arizona unit, if not needed for use or reuse in such Federal reclamation project.

(c) The Secretary may require as a condition of any contract under which water is provided from the central Arizona unit that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in contracts with such contractors in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsections (e) and (f) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(d) In times of shortage or reduction of main stream water for the central Arizona unit (if such shortages or reductions should occur), contractors which have yielded water from other sources in exchange for main stream water supplied by that unit shall have a first priority to receive main stream water, as against other contractors supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(e) In the operation of the central Arizona unit, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until and shall continue only so long as delivery of Colorado River water to downstream Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(f) The Secretary shall further offer to contract with water users in New Mexico for water from the Gila River, its tributaries and underground water sources in amounts that will permit consumptive uses of water in New Mexico not to exceed an annual average in any period of ten consecutive years of an additional thirty thousand acre-feet, including reservoir evaporation. Such further increases in consumptive use shall not begin until and shall continue only so long as works capable of importing water into the Colorado River system have been completed and water sufficiently in excess of two million eight hundred thousand acre-feet per annum is available from the main stream of the Colorado River for consumptive use in Arizona to provide water for the exchanges herein authorized and provided. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(g) All additional consumptive uses provided for in subsections (e) and (f) of this section shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Number 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

SEC. 305. (a) Article II (B) (3) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340) shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream Colorado River water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada, diversions from the main stream for the central Arizona unit shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore construed and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of main stream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada shall not be required to bear shortages in any proportion greater than would have been imposed in the absence of this section 305(a). Nothing herein shall be construed to alter, amend, repeal, modify, or be in conflict with the agreement required by section 4(a) of the Boulder Canyon Project (45 Stat. 1057) and made by the State of California by act of its legislature (ch. 16, Calif. Stats. 1929, p. 38) so far as the benefits of said agreement are conferred upon the States of Colorado, Nevada, New Mexico, Utah, and Wyoming. This section shall not affect the relative priorities, among themselves, of water users in Arizona, Nevada, and California

which are senior to diversions for the central Arizona unit, or amend any provisions of said decree.

(b) The limitation stated in paragraph (a) shall cease whenever the President shall proclaim that works have been completed and are in operation, capable in his judgment of delivering annually not less than two million five hundred thousand acre-feet of water into the main stream of the Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado River system; and that such sources are adequate, in the President's judgment, so supply such quantities without adverse effect upon the satisfaction of the foreseeable water requirements of any State from which such water is imported into the Colorado River system. Such imported water shall be made available for use in accordance with subsection (c) of this section.

(c) To the extent that the flow of the main stream of the Colorado River is augmented by such importations in order to make sufficient water available for release, as determined by the Secretary pursuant to article II(B)(1) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340), to satisfy annual consumptive use of two million eight hundred thousand acre-feet in Arizona, four million four hundred thousand acre-feet in California, and three hundred thousand acre-feet in Nevada, respectively, the Secretary shall make such additional water available to users of main stream water in those States at the same costs and on the same terms as would be applicable if main stream water were available for release in the quantities required to supply such consumptive use, taking into account, among other things, (1) the nonreimbursable allocation to the replenishment of the deficiencies occasioned by satisfaction of the Mexican Treaty burden provided for in section 401, and (2) such assistance as may be available from the development fund established by title IV of this Act.

(d) Imported water made available for use in the lower basin to supply aggregate annual consumptive uses from the main stream in excess of seven million five hundred thousand acre-feet shall be offered by the Secretary for use in the States of Arizona, California, and Nevada in the proportions provided in article II(B)(2) of said decree. The Secretary shall establish prices therefor which take into account such assistance as may be available from the development fund established by title IV of this Act in excess of the demands upon that fund occasioned by the requirements stated in subsection (c) of this section. Within each State, opportunity to take such water shall first be offered to persons or entities who are water users as of the effective date of this Act, and in quantities equal to the deficiencies which would result if the total quantity available for consumptive use from the main stream in such State were only the quantity apportioned to that State by article II(B)(1) of said decree.

(e) Imported water made available for use in the upper basin of the Colorado River, directly or by exchange, shall be offered by the Secretary for contract by water users in the States of Colorado, New Mexico, Utah, and Wyoming in the proportions, as among those States, stated in the Upper Colorado River Basin compact, and at prices which take into account such assistance as may be available from the Upper Colorado River Basin fund, in excess of the demands upon the fund occasioned by the requirements of the Colorado River Storage Project Act.

(f) Imported water not delivered into the Colorado River system but diverted from the works constructed to import water into that system shall be made available to water users in accordance with the Federal reclamation laws.

SEC. 306. The main stream salvage unit shall include programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary.

SEC. 307. The Secretary shall construct, operate, and maintain such additional works as shall from time to time be authorized by the Congress as units of the project.

SEC. 308. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the project works authorized pursuant to this title shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 309. The Secretary shall integrate the Dixie project and southern Nevada water supply project heretofore authorized into the project herein au-

thorized as units thereof under repayment arrangements and participation in the development fund established by title IV of this Act consistent with the provisions of this Act.

SEC. 310. There is hereby authorized to be appropriated to carry out the purposes of this title the sum of \$1,167,000,000 based on estimated costs as of October 1963, plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indexes applicable to the types of construction involved.

**TITLE IV—LOWER COLORADO RIVER BASIN DEVELOPMENT FUND:
ALLOCATION AND REPAYMENT OF COSTS: CONTRACTS**

SEC. 401. Upon completion of each lower basin unit of the project herein or hereafter authorized, or separate feature thereof, the Secretary shall allocate the total costs of constructing said unit or features to (1) commercial power, (2) irrigation, (3) municipal and industrial water supply, (4) flood control, (5) navigation, (6) water quality control, (7) recreation, (8) fish and wildlife, (9) the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Water Treaty of 1944 with the United Mexican States (treaty series 994), (10) the additional capacity of the system of main conduits and canals of the central Arizona unit referred to in section 304(a), item (1), in excess of two thousand five hundred cubic feet per second, and (11) any other purposes authorized under the Federal reclamation laws. Costs of construction, operation, and maintenance allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by compliance with the Mexican Water Treaty (including losses in transit, evaporation from regulatory reservoirs, and regulatory losses at the Mexican boundary, incurred in the transportation, storage, and delivery of water in discharge of the obligations of that treaty) shall be nonreimbursable. All funds paid or transferred to Indian tribes pursuant to this Act, including interest on such funds in the Treasury of the United States, and costs of construction of the paved road, authorized in section 303(b) hereof, shall be nonreimbursable. The repayment of costs allocated to recreation and fish and wildlife enhancement shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213). Costs allocated to nonreimbursable purposes shall be nonreturnable under the provisions of this Act. Costs allocated to the additional capacity of the system of main conduits and canals of the central Arizona unit, referred to in section 304(a), item (1), in excess of two thousand five hundred cubic feet per second shall be recovered as directed in section 304(a).

SEC. 402. The Secretary shall determine the repayment capability of Indian lands within, under, or served by any unit of the project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

SEC. 403. (a) There is hereby established a separate fund in the Treasury of the United States, to be known as the Lower Colorado River Basin development fund (hereinafter called the "development fund"), which shall remain available until expended as hereafter provided for carrying out the provisions of title III.

(b) All appropriations made for the purpose of carrying out the aforesaid provisions of title III of this Act shall be credited to the development fund as advances from the general fund of the Treasury, and shall be available for such purpose.

(c) There shall also be credited to the development fund—

(1) all revenues collected in connection with the operation of facilities herein and hereafter authorized in furtherance of the purposes of this Act (except entrance, admission, and other recreation fees or charges and proceeds received from recreation concessionaires); and

(2) all Federal revenues from the Boulder Canyon and Parker-Davis projects which, after completion of repayment requirements of the said Boulder Canyon and Parker-Davis projects, are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of those projects.

(d) All revenues collected and credited to the development fund pursuant to this Act shall be available, without further appropriation, for—

(1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the project, within such separate limitations as may be included in annual appropriation Acts;

(2) payments, if any, as required by section 502 of this Act;

(3) payments as required by subsection (f) of this section; and

(4) payments to reimburse water users in the State of Arizona for losses sustained as a result of diminution of the production of hydroelectric power at Coolidge Dam, Arizona, resulting from exchanges of water between users in the States of Arizona and New Mexico as set forth in section 304 of this Act.

(e) Revenues credited to the development fund shall not be available for construction of the works comprised within any unit of the project herein or hereafter authorized except upon appropriation by the Congress.

(f) Revenues in the development fund in excess of the amount necessary to meet the requirements of clauses (1), (2), and (4) of subsection (d) of this section shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit of the project or separable feature thereof, authorized pursuant to title III of this Act which are allocated to irrigation, commercial power, or municipal and industrial water supply, pursuant to this Act, within a period not exceeding fifty years from the date of completion of each such unit or separable feature, exclusive of any development period authorized by law;

(2) the costs which are allocated to recreation or fish and wildlife enhancement in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213); and

(3) interest (including interest during construction) on the unamortized balance of the investment in the commercial power and municipal and industrial water supply features of the project at a rate determined by the Secretary of the Treasury in accordance with the provisions of subsection (h) of this section, and interest due shall be a first charge.

(g) To the extent that revenues remain in the development fund after making the payments required by subsections (d) and (f) of this section, they shall be available, upon appropriation by the Congress, to repay the costs incurred in connection with units hereafter authorized in providing (i) for the importation of water into the main stream of the Colorado River for use below Lee Ferry as provided in section 206(c) to the extent that such costs are in excess of the costs allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Mexican Water Treaty as provided in section 401, and (ii) protection of States and areas of origin of such imported water as provided in section 207(a).

(h) The interest rate applicable to those portions of the reimbursable costs of each unit of the project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such unit, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

(i) Business-type budgets shall be submitted to the Congress annually for all operations financed by the development fund.

SEC. 404. (a) Irrigation repayment contracts shall provide for repayment of the obligation assumed under any irrigation repayment contract with respect to any project contract unit or irrigation block over a basic period of not more than fifty years exclusive of any development periods authorized by law; contracts authorized by section 9(e) of the Reclamation Project Act of 1939 (53 Stat. 1196; 43 U.S.C. 485h(e)) may provide for delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes.

(b) Contracts relating to municipal and industrial water supply from the project may be made without regard to the limitations of the last sentence of

section 9(c) of the Reclamation Project Act of 1939 (53 Stat. 1194); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

SEC. 405. On January 1 of each year the Secretary shall report to the Congress, beginning with the fiscal year ending June 30, 1968, upon the status of the revenues from and the cost of constructing, operating, and maintaining the project and each unit thereof for the preceding fiscal year. The report of the Secretary shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

TITLE V—UPPER COLORADO RIVER BASIN AUTHORIZATIONS AND REIMBURSEMENTS

SEC. 501. (a) In order to provide for the construction, operation, and maintenance of the Animas-La Plata Federal reclamation project, Colorado-New Mexico; the Dolores, Dallas Creek, West Divide, and San Miguel Federal reclamation projects, Colorado, as participating projects under the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), and to provide for the completion of planning reports on other participating projects, subsection (2) of section 1 of said Act is hereby further amended by deleting the words "Pine River extension", and inserting in lieu thereof the words "Animas-La Plata, Dolores, Dallas Creek, West Divide, San Miguel". Section 2 of said Act is hereby further amended by deleting the words "Parshall, Troublesome, Rabbit Ear, San Miguel, West Divide, Tomichi Creek, East River, Ohio Creek, Dallas Creek, Dolores, Fruit Growers extension, Animas-La Plata", and inserting after the words "Yellow Jacket" the words "Basalt, Middle Park (including the Troublesome, Rabbit Ear, and Azure units), Upper Gunnison (including the East River, Ohio Creek, and Tomichi Creek units), Lower Yampa (including the Juniper and Great Northern units), Upper Yampa (including the Hayden Mesa, Wessels, and Toponas units)", and by inserting after the word "Sublette" the words "(including the Kendall Reservoir on Green River and a diversion of water from the Green River to the North Platte River Basin in Wyoming), Uintah unit and Ute Indian unit of the central Utah, San Juan County (Utah), Price River, Grand County (Utah), Ute Indian unit extension of the central Utah, Gray Canyon, and Juniper (Utah)". The amount which section 12 of said Act authorizes to be appropriated is hereby further increased by the sum of \$360,000,000 plus or minus such amounts, if any, as may be required, by reason of changes in construction costs as indicated by engineering cost indexes applicable to the type of construction involved. This additional sum shall be available solely for the construction of the projects herein authorized.

(b) The Animas-La Plata Federal reclamation project shall be constructed and operated in substantial accordance with the engineering plans set out in the report of the Secretary transmitted to the Congress on May 4, 1966, and printed as House Document 436, Eighty-ninth Congress: *Provided*, That the project construction of the Animas-La Plata Federal reclamation project shall not be undertaken until and unless the States of Colorado and New Mexico shall have ratified the following compact to which the consent of Congress is hereby given:

"ANIMAS-LA PLATA PROJECT COMPACT

"The State of Colorado and the State of New Mexico, in order to implement the operation of the Animas-La Plata Federal Reclamation Project, Colorado-New Mexico, a proposed participating project under the Colorado River Storage Project Act (70 Stat. 105), and being moved by considerations of interstate comity, have resolved to conclude a compact for these purposes and have agreed upon the following articles:

"ARTICLE I

"A. The right to store and divert water in Colorado and New Mexico from the La Plata and Animas River systems, including return flow to the La Plata River from Animas River diversions, for uses in New Mexico under the Animas-La Plata Federal Reclamation Project shall be valid and of equal priority with those rights granted by decree of the Colorado state courts for the uses of water

in Colorado for that project, providing such uses in New Mexico are within the allocation of water made to that state by articles III and XIV of the Upper Colorado River Basin Compact (63 Stat. 31).

"B. The restrictions of the last sentence of Section (a) of Article IX of the Upper Colorado River Basin Compact shall not be construed to vitiate paragraph A of this article.

"ARTICLE II

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States."

(c) The Secretary shall, for the Animas-La Plata, Dolores, Dallas Creek, San Miguel, West Divide, and Seedskadee participating projects of the Colorado River storage project, establish the nonexcess irrigable acreage for which any single ownership may receive project water at one hundred and sixty acres of class 1 land or the equivalent thereof, as determined by the Secretary, in other land classes.

(d) In the diversion and storage of water for any project or any parts thereof constructed under the authority of this Act or the Colorado River Storage Project Act within and for the benefit of the State of Colorado only, the Secretary is directed to comply with the constitution and statutes of the State of Colorado relating to priority of appropriation; with State and Federal court decrees entered pursuant thereto; and with operating principles, if any, adopted by the Secretary and approved by the State of Colorado.

(e) The words "any western slope appropriations" contained in paragraph (i) of that section of Senate Document Numbered 80, Seventy-fifth Congress, first session, entitled "Manner of Operation of Project Facilities and Auxiliary Features," shall mean and refer to the appropriation heretofore made for the storage of water in Green Mountain Reservoir, a unit of the Colorado-Big Thompson Federal reclamation project, Colorado; and the Secretary is directed to act in accordance with such meaning and reference. It is the sense of Congress that this directive defines and observes the purpose of said paragraph (i), and does not in any way affect or alter any rights or obligations arising under said Senate Document Numbered 80 or under the laws of the State of Colorado.

SEC. 502. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Fed. Reg. 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1987, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from the Lower Colorado River Basin development fund, as provided in paragraph (d) of section 403.

TITLE VI—GENERAL PROVISIONS: DEFINITIONS: CONDITIONS

SEC. 601. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River compact (45 Stat. 1057), the Upper Colorado River Basin compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or, except as otherwise provided herein, the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), or the Colorado River Storage Project Act (70 Stat. 105).

(b) The Secretary is directed to—

(1) administer his responsibilities under this Act in such manner that he, his permittees, licensees, and contractees shall in no way encroach upon, alter, or affect the Colorado River compact apportionment of waters to the upper and lower basin.

(2) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, be-

ginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River compact.

(3) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River compact.

(c) All Federal officers and agencies are directed to comply with the applicable provisions of this Act, and of the laws, treaty, compacts, and decree referred to in subsection (a) of this section, in the storage and release of water from all reservoirs and in the operation and maintenance of all facilities in the Colorado River system under the jurisdiction and supervision of the Secretary, and in the operation and maintenance of all works which may be authorized hereafter for construction for the importation of water into the Colorado River system. In the event of failure of any such officer or agency to so comply, any affected State may maintain an action to enforce the provisions of this section in the Supreme Court of the United States and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

(d) Nothing in this Act shall be construed to expand or diminish either Federal or State jurisdiction, responsibility, or rights in the field of water resources planning, development, or control; nor to displace, supersede, limit, or modify any interstate compact or the jurisdiction or responsibility of any legally established joint or common agency of two or more States, or of two or more States and the Federal Government; nor to limit the authority of Congress to authorize and fund projects.

Sec. 602. (a) In order to fully comply with and carry out the provisions of the Colorado River compact, the Upper Colorado River Basin compact and the Mexican Water Treaty, the Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of this Act, the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River compact, if any such deficiency exists and is chargeable to the States of the upper division, but in any event such releases, if any, shall terminate when the President issues the proclamation specified in section 305 (b) of this Act.

(2) Release to comply with article III(d) of the Colorado River compact, less such quantities of water delivered into the Colorado River below Lee Ferry to the credit of the States of the upper division from sources outside the natural drainage area of the Colorado River system.

(3) Storage of water not required for the release specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and probabilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III(e) of the Colorado River compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the Governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and

publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such State representatives as each Governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

SEC. 603. (a) Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with, or otherwise change the duties and powers of the Upper Colorado River Commission.

SEC. 604. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the project herein and hereafter authorized, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

SEC. 605. (a) All terms used in this Act which are defined in the Colorado River compact shall have meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree of the Supreme Court of the United States in Arizona against California, and others (376 U.S.C. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

[S. 1242, 90th Cong., first sess.]

AMENDMENT Intended to be proposed by Mr. ALLOTT (for himself and Mr. DOMINICK) to S. 1242, a bill to authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes, viz:

On page 9, line 7, after "ity" change the period to a comma and insert the following: "and (4) the Secretary is authorized and directed to continue to a conclusion the engineering and economic studies and negotiations with any non-Federal agencies with respect to proposals by non-Federal agencies to construct and operate the hydroelectric generating and transmission facilities to be installed at or in connection with Hualapai Dam and Reservoir, including pump storage facilities and, not later than eighteen months from the date of the enactment of this Act, report the results of such negotiations, including the terms of proposed agreements, if any, that may be reached, together with his recommendations thereon, which agreements, if any, shall not become effective until approved by Congress."

[S. 1409, 90th Cong., first sess.]

A BILL To authorize the construction, operation, and maintenance of the Colorado River Basin project, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COLORADO RIVER BASIN PROJECT: OBJECTIVES

SEC. 101. That this Act may be cited as the "Colorado River Basin Project Act".

SEC. 102. The Congress recognizes that the present and growing water shortages in the Colorado River Basin constitute urgent problems of national concern, and accordingly authorizes and directs the National Water Commission and the Water Resources Council, established by the Water Resources Planning Act (Public Law 89-80), to give highest priority to the preparation of a plan and program for the relief of such shortages, in consultation with the States and Federal entities affected, as provided in this Act. This program is declared to be for the purposes, among others, of regulating the flow of the Colorado River; controlling floods; improving navigation; providing for the storage and delivery of the waters of the Colorado River for reclamation of lands, including supplemental water supplies, for municipal, industrial, and other beneficial purposes; improving water quality; providing for basic public outdoor recreation facilities; improving conditions for fish and wildlife; and the generation and sale of hydroelectric power as an incident of the foregoing purposes.

TITLE II—SOUTHWEST INVESTIGATIONS AND PLANNING

SEC. 201. (a) The Council, in consultation with the Commission, acting in accordance with the procedure prescribed in section 103 of the Water Resources Planning Act, shall within one hundred and twenty days following the effective date of this Act establish principles, standards, and procedures for the program of investigations and submittal of plans and reports authorized by this section and section 203. The Secretary of the Interior (hereinafter referred to as the "Secretary"), under the direction of the Commission, in conformity with the principles, standards, and procedures so established, is authorized and directed to—

(1) prepare estimates of the long-range water supply available for consumptive use in the Colorado River Basin, of current water requirements therein, and of the rate of growth of water requirements therein to at least the year 2030;

(2) investigate sources and means of supplying water to meet the current and anticipated water requirements of the Colorado River Basin, including reductions in losses, importations from sources outside the natural drainage basin of the Colorado River system, desalination, weather modification, and other means;

(3) investigate projects within the lower basin of the Colorado River, including projects on tributaries of the Colorado River, where undeveloped water supplies are available or can be made available by replacement or exchange;

(4) undertake investigations, in cooperation with other concerned agencies, of the feasibility of proposed development plans in maintaining an adequate water quality throughout the Colorado River Basin;

(5) investigate means of providing for prudent water conservation practices to permit maximum beneficial utilization of available water supplies in the Colorado River Basin;

(6) investigate and prepare estimates of the long-range water supply in States and areas from which water may be imported into the Colorado River system, together with estimates of the probable ultimate requirements for water within those States and areas of origin, for all purposes, including, but not limited to, consumptive use, navigation, river regulation, power, enhancement of fishery resources, pollution control, and disposal of wastes to the ocean, and estimates of the quantities of water, if any, that will be available in excess of such requirements in the States and areas of origin for exportation to the Colorado River system; and

(7) investigate current and anticipated water requirements of areas outside the natural drainage areas of the Colorado River system which feasibly can be served from importation facilities en route to the Colorado River system.

(b) The Secretary is authorized and directed to prepare reconnaissance reports of a staged plan or plans for projects adequate, in his judgment, to meet the requirements reported under subsection (a) of this section, in conformity with section 202.

(c) The plan for the first stage of works to meet the future requirements of the areas of deficiency and surplus as determined from studies performed pursuant to this section shall include, but not be limited to, import works necessary to provide two million five hundred thousand acre-feet annually from north

coastal streams of the State of California for use from the main stream of the Colorado River below Lee Ferry, directly or by exchange, including satisfaction of the obligations of the Mexican Water Treaty and losses of water associated with the performance of that treaty. Plans for import works for the first stage shall also include facilities to provide water in such additional quantities, not to exceed two million acre-feet annually, as the Secretary finds may be required and marketable in areas which can be served by said importation facilities en route to the Colorado River system, directly or by exchange.

(d) The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty constitutes a national obligation. Accordingly, the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) and States of the lower division (Arizona, California, and Nevada) shall be relieved from all obligations which may have been imposed upon them by article III(c) of the Colorado River compact when the President issues the proclamation specified in section 305(b) of this Act.

(e) The Secretary shall submit annually to the Commission, the President, and the Congress reports covering progress on the investigations and reports authorized by this section.

SEC. 202. (a) In planning works to import water into the Colorado River system from sources outside the natural drainage areas of the system, the Secretary shall make provision for adequate and equitable protection of the interests of the States and areas of origin, including (in the case of works to import water for use in the lower basin of the Colorado River) assistance from the development fund established by title IV of this Act, to the end of that water supplies may be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.

(b) All requirements, present or future, for water within any State lying wholly or in part within the drainage area of any river basin and from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of that river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.

SEC. 203. (a) On or before December 31, 1970, the Secretary shall submit a proposed reconnaissance report on the first stage of the staged plan of development to the Commission and affected States and Federal agencies for their comments and recommendations which shall be submitted within six months after receipt of the report.

(b) After receipt of the comments of the Commission, affected States, and Federal agencies on such reconnaissance report, but not later than January 1, 1972, the Secretary shall transmit the report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

(c) The Secretary shall proceed promptly thereafter with preparation of a feasibility report on the first stage of said plan of development if he finds, on the basis of reconnaissance investigations pursuant to section 201, that a water supply surplus to the needs of the area of origin exists, benefits of the proposed first stage exceed costs, and repayment can be made in accordance with titles III and IV, of this Act. Such feasibility report shall be submitted to the Commission and to the affected States and Federal agencies not later than January 1, 1973.

(d) After receipt of the comments of the Commission and affected States and Federal agencies on such feasibility report, but not later than June 30, 1973, the Secretary shall transmit his final report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.

SEC. 204. There are hereby authorized to be appropriated such sums as are required to carry out the purposes of this title.

TITLE III—AUTHORIZED UNITS: PROTECTION OF EXISTING USES

SEC. 301. The Secretary shall construct, operate, and maintain the lower basin units of the Colorado River Basin project (herein referred to as the "project"), described in sections 302, 303, 304, 305, and 306.

SEC. 302. The main stream reservoir division shall consist of the Hualapai (formerly known as Bridge Canyon) unit, including a dam, reservoir, power-plant, transmission facilities, and appurtenant works, and the Coconino and Paria River silt-detention reservoirs: *Provided*, That (1) Hualapai Dam shall be constructed so as to impound water at a normal surface elevation of one thousand eight hundred and sixty-six feet above mean sea level, (2) fluctuations in the reservoir level shall be restricted, so far as practicable, to a regimen of ten feet, and (3) this Act shall not be construed to authorize any diversion of water from Hualapai Reservoir except for incidental uses in the immediate vicinity. The Congress hereby declares that the construction of the Hualapai Dam herein authorized is consistent with the Act of February 26, 1919 (40 Stat. 1175).

SEC. 303. (a) As fair and reasonable payment for the permanent use by the United States of not more than twenty-five thousand acres of land designated by the Secretary as necessary for the construction, operation, and maintenance of the Hualapai unit, said land being a part of the tract set aside and reserved by the Executive order of January 4, 1883, for the use and occupancy of the Hualapai Tribe of Arizona (1 Kappler, Indian Laws and Treaties, 804), \$16,398,000 shall be transferred in the Treasury, during construction of the unit, to the credit of the Hualapai Tribe from funds appropriated from the general fund of the Treasury to the Department of the Interior, Bureau of Reclamation, for construction of the project and, when so transferred, shall draw interest at the rate of 4 per centum per annum until expended. The funds so transferred may be expended, invested, or reinvested pursuant to plans, programs, and agreements duly adopted or entered into by the Hualapai Tribe, subject to the approval of the Secretary, in accordance with the tribal constitution and charter.

(b) As part of the construction and operation of the Hualapai unit, the Secretary shall (1) construct a paved road, having a minimum width of twenty-eight feet, from Peach Springs, Arizona, through and along Peach Springs Canyon within the Hualapai Indian Reservation, to provide all-weather access to the Hualapai Reservoir; and (2) make available to the Hualapai Tribe up to twenty-five thousand kilowatts and up to one hundred million kilowatt-hours annually of power from the Hualapai unit at the lowest rate established by the Secretary for the sale of firm power from said unit for the use of preferential customers: *Provided*, That the tribe may resell such power only to users within the Hualapai Reservation: *Provided further*, That the Hualapai Tribal Council shall notify the Secretary in writing of the reasonable power requirements of the tribe up to the maximum herein specified, for each three-year period in advance beginning with the date upon which power from the Hualapai unit becomes available for sale. Power not so reserved may be disposed of by the Secretary for the benefit of the development fund.

(c) Except as to such lands which the Secretary determines are required for the Hualapai Dam and Reservoir site and the construction of the operating campsite and townsite, all minerals of any kind whatsoever, including oil and gas and but excluding sand and gravel and other building and construction materials, within the areas used by the United States pursuant to this section are hereby reserved to the Hualapai Tribe: *Provided*, That no permit, license, lease, or other document covering the exploration for or the extraction of such minerals shall be granted by the tribe nor shall the tribe conduct such operations for its own account, except under such conditions and with such stipulations as are necessary to protect the interests of the United States in the construction, operation, and maintenance of the Hualapai unit.

(d) The Hualapai Tribe shall have the exclusive right, if requested in writing by the tribe, to develop the recreation potential of, and shall have the exclusive right to control access to, the reservoir shoreline adjacent to the reservation, subject to conditions established by the Secretary for use of the reservoir to protect the operation of the project. Any recreation development established by the tribe shall be consistent with the Secretary's rules and regulations to protect the overall recreation development of the project. The tribe and the members thereof shall have nonexclusive personal rights to hunt and fish on the reservoir without charge, but shall have no right to exclude others from the reservoir except as to those who seek to gain access through the Hualapai Reservation, nor the right to require payments to the tribe except for the use of tribal lands or facilities: *Provided*, That under no circumstances will the Hualapai Tribe make any charge, or extract any compensation, or in any other manner restrict the access or use of the paved road to be constructed within the Hualapai Indian

Reservation pursuant to this Act. The use by the public of the water areas of the project shall be pursuant to such rules and regulations as the Secretary may prescribe.

(e) Except as limited by the foregoing, the Hualapai Tribe shall have the right to use and occupy the area of the Hualapai unit within the Hualapai Reservation for all purposes not inconsistent with the construction, operation, and maintenance of the project and townsite, including, but not limited to, the right to lease such lands for farming, grazing, and business purposes to members or nonmembers of the tribe and the power to dispose of all minerals as provided in paragraph (c) hereof.

(f) Upon a determination by the Secretary that all or any part of the lands utilized by the United States pursuant to paragraph (a) of this section is no longer necessary for purposes of the project, such lands shall be restored to the Hualapai Tribe for its full use and occupancy.

(g) No part of any expenditures made by the United States, and no reservation by or restoration to the Hualapai Tribe of the use of land under any of the provisions of this section shall be charged by the United States as an offset or counterclaim against any claim of the Hualapai Tribe against the United States other than claims arising out of the utilization of lands for the project: *Provided, however*, That the payment of moneys and other benefits as set forth herein shall constitute full, fair, and reasonable payment for the permanent use of the lands by the United States.

(h) All funds authorized by this section to be paid or transferred to the Hualapai Tribe, and any per capita distribution derived therefrom shall be exempt from all forms of State and Federal income taxes.

(i) No payments shall be made or benefits conferred as set forth in this section until the provisions hereof have been accepted by the Hualapai Tribe through a resolution duly adopted by its tribal council. In the event such resolution is not adopted within six months from the effective date of this Act, and litigation thereafter is instituted regarding the use by the United States of lands within the Hualapai Reservation or payment therefor, the amounts of the payments provided herein and the other benefits set out shall not be regarded as evidencing value or as recognizing any right of the tribe to compensation.

Sec. 304. (a) The central Arizona unit shall consist of the following principal works: (1) a system of main conduits and canals, including a main canal and pumping plants (Granite Reef aqueduct and pumping plants), for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative, which system shall have a capacity of two thousand five hundred cubic feet per second (A) unless the definite plan report of the Bureau of Reclamation shows that additional capacity (i) will provide an improved benefit-to-cost ratio and (ii) will enhance the ability of the central Arizona unit to divert water from the main stream to which Arizona is entitled and (B) unless the Secretary finds that the additional cost resulting from such additional capacity can be financed by funds from sources other than the funds credited to the development fund pursuant to section 403 of this Act and without charge, directly or indirectly, to water users or power customers in the States of California and Nevada; (2) Orme Dam and Reservoir and power-pumping plant or suitable alternative; (3) Buttes Dam and Reservoir, which shall be so operated as to not prejudice the rights of any user in and to the waters of the Gila River as those rights are set forth in the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in *United States against Gila Valley Irrigation District and others* (Globe Equity Numbered 59); (4) Hooker Dam and Reservoir, which shall be constructed to an initial capacity of ninety-eight thousand acre-feet and in such a manner as to permit subsequent enlargement of the structure (to give effect to the provisions of section 304(c) and (d)); (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.

(b) Unless and until otherwise provided by Congress, water from the natural drainage area of the Colorado River system diverted from the main stream below Lee Ferry for the central Arizona unit shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, and, with the approval of the Secretary, State-administered

wildlife management areas. It shall be a condition of each contract under which such water is provided under the central Arizona unit that (1) there be in effect measures, adequate in the judgment of the Secretary, to control expansion of irrigation from aquifers affected by irrigation in the contract service area; (2) the canals and distribution systems through which water is conveyed after its delivery by the United States to the contractors shall be provided and maintained with linings, adequate in his judgment to prevent excessive conveyance losses; (3) neither the contractor nor the Secretary shall pump or permit others to pump ground water from lands located within the exterior boundaries of any Federal reclamation project or irrigation district receiving water from the central Arizona unit for any use outside such Federal reclamation project or irrigation district, unless the Secretary and the agency or organization operating and maintaining such Federal reclamation project or irrigation district shall agree or shall have previously agreed that a surplus of ground water exists and that drainage is or was required; and (4) all agricultural, municipal, and industrial waste water, return flow, seepage, sewage effluent, and ground water located in or flowing from contractor's service area originating or resulting from (i) waters contracted for from the central Arizona unit or (ii) waters stored or developed by any Federal reclamation project are reserved for the use and benefit of the United States as a source of supply for the service area of the central Arizona unit or for the service area of the Federal reclamation project, as the case may be: *Provided*, That notwithstanding the provisions of clause (3) of this sentence, the agricultural, municipal, and industrial waste water, return flow, seepage, sewage effluent, and ground water in or from any such Federal reclamation project, may also be pumped or diverted for use and delivery by the United States elsewhere in the service area of the central Arizona unit, if not needed for use or reuse in such Federal reclamation project.

(c) The Secretary may require as a condition in any contract under which water is provided from the central Arizona unit that the contractor agree to accept main stream water in exchange for or in replacement of existing supplies from sources other than the main stream. The Secretary shall so require in contracts with such contractors in Arizona who also use water from the Gila River system, to the extent necessary to make available to users of water from the Gila River system in New Mexico additional quantities of water as provided in and under the conditions specified in subsections (e) and (f) of this section: *Provided*, That such exchanges and replacements shall be accomplished without economic injury or cost to such Arizona contractors.

(d) In times of shortage or reduction of main stream water for the central Arizona unit (if such shortages or reductions should occur), contractors which have yielded water from other sources in exchange for main stream water supplied by that unit shall have a first priority to receive main stream water, as against other contractors supplied by that unit which have not so yielded water from other sources, but only in quantities adequate to replace the water so yielded.

(e) In the operation of the central Arizona unit, the Secretary shall offer to contract with water users in New Mexico for water from the Gila River, its tributaries, and underground water sources, in amounts that will permit consumptive use of water in New Mexico not to exceed an annual average in any period of ten consecutive years of eighteen thousand acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340). Such increased consumptive uses shall not begin until and shall continue only so long as delivery of Colorado River water to downstream Gila River users in Arizona is being accomplished in accordance with this Act, in quantities sufficient to replace any diminution of their supply resulting from such diversions from the Gila River, its tributaries, and underground water sources. In determining the amount required for this purpose full consideration shall be given to any differences in the quality of the waters involved.

(f) The Secretary shall further offer to contract with water users in New Mexico for water from the Gila River, its tributaries, and underground water sources in amounts that will permit consumptive uses of water in New Mexico not to exceed an annual average in any period of ten consecutive years of an additional thirty thousand acre-feet, including reservoir evaporation. Such further increases in consumptive use shall not begin until and shall continue only so long as works capable of importing water into the Colorado River system have been completed and water sufficiently in excess of two million eight hundred

thousand acre-feet per annum is available from the main stream of the Colorado River for consumptive use in Arizona to provide water for the exchanges herein authorized and provided. In determining the amount required for this purpose full consideration shall be given to any difference in the quality of the waters involved.

(g) All additional consumptive uses provided for in subsections (e) and (f) of this section shall be subject to all rights in New Mexico and Arizona as established by the decree entered by the United States District Court for the District of Arizona on June 29, 1935, in United States against Gila Valley Irrigation District and others (Globe Equity Numbered 59) and to all other rights existing on the effective date of this Act in New Mexico and Arizona to water from the Gila River, its tributaries, and underground water sources, and shall be junior thereto and shall be made only to the extent possible without economic injury or cost to the holders of such rights.

Sec. 305. (a) Article II (B) (3) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340) shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream Colorado River water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada, diversions from the main stream for the central Arizona unit shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of main stream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada shall not be required to bear shortages in any proportion greater than would have been imposed in the absence of this section 305(a). Nothing herein shall be construed to alter, amend, repeal, modify, or be in conflict with the agreement required by section 4(a) of the Boulder Canyon Project Act (45 Stat. 1057) and made by the State of California by act of its legislature (Chapter 16, California Statutes 1929, page 38) so far as the benefits of said agreement are conferred upon the States of Colorado, New Mexico, Utah, and Wyoming. This section shall not affect the relative priorities, among themselves, of water users in Arizona, Nevada, and California which are senior to diversions for the central Arizona unit, or amend any provisions of said decree.

(b) The limitation stated in paragraph (a) shall cease whenever the President shall proclaim that works have been completed and are in operation, capable in his judgment of delivering annually not less than two million five hundred thousand acre-feet of water into the main stream of the Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado River system; and that such sources are adequate, in the President's judgment, to supply such quantities without adverse effect upon the satisfaction of the foreseeable water requirements of any State from which such water is imported into the Colorado River system. Such imported water shall be made available for use in accordance with subsection (c) of this section.

(c) To the extent that the flow of the main stream of the Colorado River is augmented by such importations in order to make sufficient water available for release, as determined by the Secretary pursuant to article II(B)(1) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340), to satisfy annual consumptive use of two million eight hundred thousand acre-feet in Arizona, four million four hundred thousand acre-feet in California, and three hundred thousand acre-feet in Nevada, respectively, the Secretary shall make such additional water available to users of main stream water in those States at the same costs and on the same terms as would be applicable if main stream water were available for release in the quantities required to supply such consumptive use, taking into account, among other things, (1) the nonreimbursable allocation to the replenishment of the deficiencies occasioned by satisfaction of the Mexican Treaty burden provided for in section 401, and (2) such assistance as may be available from the development fund established by title IV of this Act.

(d) Imported water made available for use in the lower basin to supply aggregate annual consumptive uses from the main stream in excess of seven million five-hundred thousand acre-feet shall be offered by the Secretary for use in the States of Arizona, California, and Nevada in the proportions provided in article

II(B)(2) of said decree. The Secretary shall establish prices therefor which take into account such assistance as may be available from the development fund established by title IV of this Act in excess of the demands upon that fund occasioned by the requirements stated in subsection (c) of this section. Within each State, opportunity to take such water shall first be offered to persons or entities who are water users as of the effective date of this Act, and in quantities equal to the deficiencies which would result if the total quantity available for consumptive use from the main stream in such State were only the quantity apportioned to that State by article II(B)(1) of said decree.

(e) Imported water made available for use in the upper basin of the Colorado River, directly or by exchange, shall be offered by the Secretary for contract by water users in the States of Colorado, New Mexico, Utah, and Wyoming in the proportions, as among those States, stated in the Upper Colorado River Basin compact, and at prices which take into account such assistance as may be available from the Upper Colorado River Basin fund, in excess of the demands upon that fund occasioned by the requirements of the Colorado River Storage Project Act.

(f) Imported water not delivered into the Colorado River system but diverted from the works constructed to import water into that system shall be made available to water users in accordance with the Federal reclamation laws.

SEC. 306. The main stream salvage unit shall include programs for water salvage along and adjacent to the main stream of the Colorado River and for ground water recovery. Such programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife in the area, as determined by the Secretary.

SEC. 307. The Secretary shall construct, operate, and maintain such additional works as shall from time to time be authorized by the Congress as units of the project.

SEC. 308. The conservation and development of the fish and wildlife resources and the enhancement of recreation opportunities in connection with the project works authorized pursuant to this title shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213).

SEC. 309. The Secretary shall integrate the Dixie project and southern Nevada water supply project heretofore authorized into the project herein authorized as units thereof under repayment arrangements and participation in the development fund established by title IV of this Act consistent with the provisions of this Act.

SEC. 310. There is hereby authorized to be appropriated to carry out the purposes of this title the sum of \$1,167,000,000 based on estimated costs as of October 1963, plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indices applicable to the types of construction involved.

TITLE IV—LOWER COLORADO RIVER BASIN DEVELOPMENT FUND: ALLOCATION AND REPAYMENT OF COSTS: CONTRACTS

SEC. 401. Upon completion of each lower basin unit of the project herein or hereafter authorized, or separate feature thereof, the Secretary shall allocate the total costs of constructing said unit or features to (1) commercial power, (2) irrigation, (3) municipal and industrial water supply, (4) flood control, (5) navigation, (6) water quality control, (7) recreation, (8) fish and wildlife, (9) the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Water Treaty of 1944 with the United Mexican States (treaty series 994), (10) the additional capacity of the system of main conduits and canals of the central Arizona unit referred to in section 304(a), item (1), in excess of two thousand five hundred cubic feet per second, and (11) any other purposes authorized under the Federal reclamation laws. Costs of construction, operation, and maintenance allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by compliance with the Mexican Water Treaty (including losses in transit, evaporation from regulatory reservoirs and regulatory losses at the Mexican boundary, incurred in the transportation, storage, and delivery of water in discharge of the obligations of that treaty) shall be non-reimbursable. All funds paid or transferred to Indian tribes pursuant to this Act, including interest on such funds in the Treasury of the United States, and costs

of construction of the paved road, authorized in section 303(b) hereof, shall be nonreimbursable. The repayment of costs allocated to recreation and fish and wildlife enhancement shall be in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213) : *Provided*, That all of the separable and joint costs allocated to recreation and fish and wildlife enhancement at the Dixie project, Utah, and the main stream reservoir division shall be nonreimbursable. Costs allocated to nonreimbursable purposes shall be nonreturnable under the provisions of this Act. Costs allocated to the additional capacity of the system of main conduits and canals of the central Arizona unit, referred to in section 304(a), item (1), in excess of two thousand five hundred cubic feet per second shall be recovered as directed in section 304(a).

Sec. 402. The Secretary shall determine the repayment capability of Indian lands within, under, or served by any unit of the project. Construction costs allocated to irrigation of Indian lands (including provision of water for incidental domestic and stock water uses) and within the repayment capability of such lands shall be subject to the Act of July 1, 1932 (47 Stat. 464), and such costs as are beyond repayment capability of such lands shall be nonreimbursable.

Sec. 403. (a) There is hereby established a separate fund in the Treasury of the United States, to be known as the Lower Colorado River Basin development fund (hereinafter called the "development fund"), which shall remain available until expended as hereafter provided for carrying out the provisions of title III.

(b) All appropriations made for the purpose of carrying out the aforesaid provisions of title III of this Act shall be credited to the development fund as advances from the general fund of the Treasury, and shall be available for such purpose.

(c) There shall also be credited to the development fund—

(1) all revenues collected in connection with the operation of facilities herein and hereafter authorized in furtherance of the purposes of this Act (except entrance, admission, and other recreation fees or charges and proceeds received from recreation concessionaires); and

(2) all Federal revenues from the Boulder Canyon and Parker-Davis projects which, after completion of repayment requirements of the said Boulder Canyon and Parker-Davis projects, are surplus, as determined by the Secretary, to the operation, maintenance, and replacement requirements of those projects.

(d) All revenues collected and credited to the development fund pursuant to this Act shall be available, without further appropriation, for—

(1) defraying the costs of operation, maintenance, and replacements of, and emergency expenditures for, all facilities of the project, within such separate limitations as may be included in annual appropriation Acts;

(2) payments, if any, as required by section 502 of this Act;

(3) payments as required by subsection (f) of this section; and

(4) payments to reimburse water users in the State of Arizona for losses sustained as a result of diminution of the production of hydroelectric power at Coolidge Dam, Arizona, resulting from exchanges of water between users in the States of Arizona and New Mexico as set forth in section 304 of this Act.

(e) Revenues credited to the development fund shall not be available for construction of the works comprised within any unit of the project herein or hereafter authorized except upon appropriation by the Congress.

(f) Revenues in the development fund in excess of the amount necessary to meet the requirements of clauses (1), (2), and (4) of subsection (d) of this section shall be paid annually to the general fund of the Treasury to return—

(1) the costs of each unit of the project or separable feature thereof, authorized pursuant to title III of this Act which are allocated to irrigation, commercial power, or municipal and industrial water supply, pursuant to this Act, within a period not exceeding fifty years from the date of completion of each such unit or separable feature, exclusive of any development period authorized by law;

(2) the costs which are allocated to recreation or fish and wildlife enhancement in accordance with the provisions of the Federal Water Project Recreation Act (79 Stat. 213); and

(3) interest (including interest during construction) on the unamortized balance of the investment in the commercial power and municipal and industrial water supply features of the project at a rate determined by the Secre-

tary of the Treasury in accordance with the provisions of subsection (h) of this section, and interest due shall be a first charge.

(g) To the extent that revenues remain in the development fund after making the payments required by subsections (d) and (f) of this section, they shall be available, upon appropriation by the Congress, to repay the costs incurred in connection with units hereafter authorized in providing (i) for the importation of water into the main stream of the Colorado River for use below Lee Ferry as provided in section 206(c) to the extent that such costs are in excess of the costs allocated to the replenishment of the depletion of Colorado River flows available for use in the United States occasioned by performance of the Mexican Water Treaty as provided in section 401, and (ii) protection of States and areas of origin of such imported water as provided in section 207(a).

(h) The interest rate applicable to those portions of the reimbursable costs of each unit of the project which are properly allocated to commercial power development and municipal and industrial water supply shall be determined by the Secretary of the Treasury, as of the beginning of the fiscal year in which the first advance is made for initiating construction of such unit, on the basis of the computed average interest rate payable by the Treasury upon its outstanding marketable public obligations which are neither due nor callable for redemption for fifteen years from the date of issue.

(i) Business-type budgets shall be submitted to the Congress annually for all operations financed by the development fund.

SEC. 404. (a) Irrigation payment contracts shall provide for repayment of the obligation assumed under any irrigation repayment contract with respect to any project contract unit or irrigation block over a basic period of not more than fifty years exclusive of any development periods authorized by law; contracts authorized by section 9(e) of the Reclamation Project Act of 1939 (53 Stat. 1196; U.S.C. 485h(e)) may provide for delivery of water for a period of fifty years and for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits and from such other points of delivery as the Secretary may designate; and long-term contracts relating to irrigation water supply shall provide that water made available thereunder may be made available by the Secretary for municipal or industrial purposes if and to the extent that such water is not required by the contractor for irrigation purposes.

(b) Contracts relating to municipal and industrial water supply from the project may be made without regard to the limitation of the last sentence of section 9(c) of the Reclamation Project Act of 1939 (53 Stat. 1194); may provide for the delivery of such water at an identical price per acre-foot for water of the same class at the several points of delivery from the main canals and conduits; and may provide for repayment over a period of fifty years if made pursuant to clause (1) of said section and for the delivery of water over a period of fifty years if made pursuant to clause (2) thereof.

SEC. 405. On January 1 of each year the Secretary shall report to the Congress, beginning with the fiscal year ending June 30, 1968, upon the status of the revenues from and the cost of constructing, operating, and maintaining the project and each unit thereof for the preceding fiscal year. The report of the Secretary shall be prepared to reflect accurately the Federal investment allocated at that time to power, to irrigation, and to other purposes, the progress of return and repayment thereon, and the estimated rate of progress, year by year, in accomplishing full repayment.

TITLE V—UPPER COLORADO RIVER BASIN AUTHORIZATIONS AND REIMBURSEMENTS

SEC. 501. (a) In order to provide for the construction, operation, and maintenance of the Animas-La Plata Federal reclamation project, Colorado-New Mexico; the Dolores, Dallas Creek, West Divide, and San Miguel Federal reclamation projects, Colorado, as participating projects under the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), and to provide for the completion of planning reports on other participating projects, subsection (2) of section 1 of said Act is hereby further amended by deleting the words "Pine River extension", and inserting in lieu thereof the words "Animas-La Plata, Dolores, Dallas Creek, West Divide, San Miguel". Section 2 of said Act is hereby further amended by deleting the words "Parshall, Troublesome, Rabbit Ear, San Miguel,

West Divide, Tomichi Creek, East River, Ohio Creek, Dallas Creek, Dolores, Fruit Growers extension, Animas-La Plata", and inserting after the words "Yellow Jacket" the words "Basalt, Middle Park (including the Troublesome, Rabbit Ear, and Azure units), Upper Gunnison (including the East River, Ohio Creek, and Tomichi Creek units), Lower Yampa (including the Juniper and Great Northern units), Upper Yampa (including the Hayden Mesa, Wessels, and Toponas units)", and by inserting after the word "sublette" the words "(including the Kendall Reservoir on Green River and a diversion of water from the Green River to the North Platte River Basin in Wyoming), Uintah unit and Ute Indian unit of the central Utah, San Juan County (Utah), Price River, Grand County (Utah), Ute Indian unit extension of the central Utah, Gray Canyon, and Juniper (Utah)": *Provided*, That the planning report for the Ute Indian unit of the central Utah participating project shall be completed on or before December 31, 1971. The amount which section 12 of said Act authorizes to be appropriated is hereby further increased by the sum of \$360,000,000 plus or minus such amounts, if any, as may be required, by reason of changes in construction costs as indicated by engineering costs indexes applicable to the type of construction involved. This additional sum shall be available solely for the construction of the projects herein authorized.

(b) The Animas-La Plata Federal reclamation project shall be constructed and operated in substantial accordance with the engineering plans set out in the report of the Secretary transmitted to the Congress on May 4, 1966, and printed as House Document 435, Eighty-ninth Congress: *Provided*, That the project construction of the Animas-La Plata Federal reclamation project shall not be undertaken until and unless the States of Colorado and New Mexico shall have ratified the following compact to which the consent of Congress is hereby given:

"Animas-La Plata Project Compact

"The State of Colorado and the State of New Mexico, in order to implement the operation of the Animas-La Plata Federal Reclamation Project, Colorado-New Mexico, a proposed participating project under the Colorado River storage Project Act (70 Stat. 105), and being moved by considerations of interstate comity, have resolved to conclude a compact for these purposes and have agreed upon the following articles:

"Article I

"A. The right to store and divert water in Colorado and New Mexico from the La Plata and Animas River systems, including return flow to the La Plata River from Animas River diversions, for uses in New Mexico under the Animas-La Plata Federal Reclamation Project shall be valid and of equal priority with those rights granted by decree of the Colorado state courts for the uses of water in Colorado for that project, providing such uses in New Mexico are within the allocation of water made to that state by articles III and XIV of the Upper Colorado River Basin Compact (63 Stat. 31).

"B. The restrictions of the last sentence of Section (a) of Article IX of the Upper Colorado River Basin Compact shall not be construed to vitiate paragraph A of this article.

"Article II

"This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States."

(c) The Secretary shall, for the Animas-La Plata, Dolores, Dallas Creek, San Miguel, West Divide, and Seedskadee participating projects of the Colorado River storage project, establish the nonexcess irrigable acreage for which any single ownership may receive project water at one hundred and sixty acres of class I land or the equivalent thereof, as determined by the Secretary, in other land classes.

(d) In the diversion and storage of water for any project or any parts thereof constructed under the authority of this Act or the Colorado River Storage Project Act within and for the benefit of the State of Colorado only, the Secretary is directed to comply with the constitution and statutes of the State of Colorado relating to priority of appropriation; with State and Federal court decrees entered pursuant thereto; and with operating principles, if any, adopted by the Secretary and approved by the State of Colorado.

(e) The words "any western slope appropriations" contained in paragraph (1) of that section of Senate Document Numbered 80, Seventy-fifth Congress, first

session, entitled "Manner of Operation of Project Facilities and Auxiliary Features," shall mean and refer to the appropriation heretofore made for the storage of water in Green Mountain Reservoir, a unit of the Colorado-Big Thompson Federal reclamation project, Colorado; and the Secretary is directed to act in accordance with such meaning and reference. It is the sense of Congress that this directive defines and observes the purpose of said paragraph (1), and does not in any way affect or alter any rights or obligations arising under said Senate Document Numbered 80 or under the laws of the State of Colorado.

Sec. 502. The Upper Colorado River Basin fund established under section 5 of the Act of April 11, 1956 (70 Stat. 107), shall be reimbursed from the Colorado River development fund established by section 2 of the Boulder Canyon Project Adjustment Act (54 Stat. 755), for all expenditures heretofore or hereafter made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of reservoirs of storage units of the Colorado River storage project pursuant to the criteria for the filling of Glen Canyon Reservoir (27 Federal Register 6851, July 19, 1962). For this purpose \$500,000 for each year of operation of Hoover Dam and powerplant, commencing with the enactment of this Act, shall be transferred from the Colorado River development fund to the Upper Colorado River Basin fund, in lieu of application of said amounts to the purposes stated in section 2(d) of the Boulder Canyon Project Adjustment Act, until such reimbursement is accomplished. To the extent that any deficiency in such reimbursement remains as of June 1, 1967, the amount of the remaining deficiency shall then be transferred to the Upper Colorado River Basin fund from the Lower Colorado River Basin development fund, as provided in paragraph (d) of section 403.

TITLE VI—GENERAL PROVISIONS: DEFINITIONS: CONDITIONS

Sec. 601. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of the Colorado River compact (45 Stat. 1057), the Upper Colorado River Basin compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994), the decree entered by the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), or except as otherwise provided herein, the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774) or the Colorado River Storage Project Act (70 Stat. 105).

(b) The Secretary is directed to—

(1) make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and to the Governors of each State signatory to the Colorado River compact.

(2) condition all contracts for the delivery of water originating in the drainage basin of the Colorado River system upon the availability of water under the Colorado River compact.

(c) All Federal officers and agencies are directed to comply with the applicable provisions of this Act, and of the laws, treaty, compacts, and decree referred to in subsection (a) of this section, in the storage and release of water from all reservoirs and in the operation and maintenance of all facilities in the Colorado River system under the jurisdiction and supervision of the Secretary, and in the operation and maintenance of all works which may be authorized hereafter for construction for the importation of water into the Colorado River system. In the event of failure of any such officer or agency to so comply, any affected State may maintain an action to enforce the provisions of this section in the Supreme Court of the United States and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

(d) Nothing in this Act shall be construed to expand or diminish either Federal or State jurisdiction, responsibility, or rights in the field of water resources planning, development, or control; nor to displace, supersede, limit, or modify any interstate compact or the jurisdiction or responsibility of any legally established joint or common agency of two or more States, or of two or more States and the Federal Government; nor to limit the authority of Congress to authorize and fund projects.

Sec. 602. (a) The Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed under the authority of this Act, the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority:

(1) Releases to supply one-half the deficiency described in article III(c) of the Colorado River compact, if any such deficiency exists and is chargeable to the States of the upper division, but in any event such releases, if any, shall terminate when the President issues the proclamation specified in section 305(b) of this Act.

(2) Releases to comply with article III(d) of the Colorado River compact, less such quantities of water delivered into the Colorado River below Lee Ferry to the credit of the States of the upper division from sources outside the natural drainage area of the Colorado River system.

(3) Storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three lower division States and taking into consideration all relevant factors (including, but not limited to, historic streamflows, the most critical period of record, and probabilities of water supply), shall find to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River compact: *Provided*, That water not so required to be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the lower division to the uses specified in article III(e) of the Colorado River compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell.

(b) Not later than July 1, 1968, the criteria proposed in accordance with the foregoing subsection (a) of this section shall be submitted to the Governors of the seven Colorado River Basin States and to such other parties and agencies as the Secretary may deem appropriate for their review and comment. After receipt of comments on the proposed criteria, but not later than January 1, 1969, the Secretary shall adopt appropriate criteria in accordance with this section and publish the same in the Federal Register. Beginning January 1, 1970, and yearly thereafter, the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report describing the actual operation under the adopted criteria for the preceding compact water year and the projected operation for the current year. As a result of actual operating experience or unforeseen circumstances, the Secretary may thereafter modify the criteria to better achieve the purposes specified in subsection (a) of this section, but only after correspondence with the Governors of the seven Colorado River Basin States and appropriate consultation with such State representatives as each Governor may designate.

(c) Section 7 of the Colorado River Storage Project Act shall be administered in accordance with the foregoing criteria.

Sec. 603. (a) Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River compact shall not be reduced or prejudiced by any use of such water in the lower basin.

(b) Nothing in this Act shall be construed so as to impair, conflict with, or otherwise change the duties and powers of the Upper Colorado River Commission.

Sec. 604. Except as otherwise provided in this Act, in constructing, operating, and maintaining the units of the project herein and hereafter authorized, the Secretary shall be governed by the Federal reclamation laws (Act of June 17, 1902; 32 Stat. 388 and Acts amendatory thereof or supplementary thereto) to which laws this Act shall be deemed a supplement.

Sec. 605. (a) All terms used in this Act which are defined in the Colorado River compact shall have the meanings there defined.

(b) "Main stream" means the main stream of the Colorado River downstream from Lee Ferry within the United States, including the reservoirs thereon.

(c) "User" or "water user" in relation to main stream water in the lower basin means the United States, or any person or legal entity, entitled under the decree

of the Supreme Court of the United States in Arizona against California, and others (376 U.S. 340), to use main stream water when available thereunder.

(d) "Active storage" means that amount of water in reservoir storage, exclusive of bank storage, which can be released through the existing reservoir outlet works.

(e) "Colorado River Basin States" means the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

Senator ANDERSON. Following the statement by Senator Hayden, the Chair will call on the other members of the committee who may wish to make a statement before proceeding with our witness list.

I want to ask all witnesses who have not done so to file their prepared statements with the staff as soon as possible.

Senator Hayden, we are happy to recognize you.

STATEMENT OF HON. CARL HAYDEN, U.S. SENATOR FROM THE STATE OF ARIZONA

Senator HAYDEN. Mr. Chairman and members of the committee, my distinguished colleague, Senator Paul Fannin, joins with me in making these brief remarks in support of S. 1004, introduced by us and cosponsored by our distinguished colleagues, Senator Jackson, chairman of the full committee, and Senator Cannon of Nevada.

This is the fourth time I have appeared before this subcommittee in support of a bill to authorize our central Arizona project. While each of my previous bills were somewhat different, all called for one basic feature—a ditch from the Colorado River to bring water into central Arizona. The bill before you—while differing in some respects from the others—is still, basically, a bill to construct this same ditch from the Colorado River.

The membership of this subcommittee is the same as it was when I appeared before you in 1963 in support of S. 1658. A full record was made at that time. For any details needed, we refer you to the record on those hearings. We see no reason to take your time today duplicating that same record.

Let's get on with the hearing and not let ourselves be diverted by extraneous issues. I hope we can stick to the principal business at hand—which, I repeat, is to provide a way to bring Colorado River water into central Arizona.

Senator ANDERSON. Thank you, Senator Hayden.

I am glad you referred to the fact that we have passed similar bills on this question in the Senate.

(Senator Hayden and Senator Fannin were granted permission to file a supplemental statement and a brief in answer to that of California. The data follows:)

SUPPLEMENTAL STATEMENT OF HON. CARL HAYDEN AND HON. PAUL FANNIN, U.S. SENATORS FROM THE STATE OF ARIZONA

Mr. Chairman and Members of the Committee: During the hearing on S. 1004 and other Colorado River bills, Senator Fannin and I were accorded the privilege of extending our remarks and filing any supplemental matter which we believed would be material and helpful to the Committee in its consideration of the pending Colorado River legislation. To properly conclude our presentation in support of S. 1004, I submit this statement for the two of us.

Inasmuch as a full record was made before this Committee in 1963 in support of S. 1658, we felt that it was unnecessary to duplicate this same detail. However,

since S. 1004 differs in some respects from previous bills, the Committee should be reminded of these differences—and be reminded, briefly, of some of the history leading up to this present bill.

By now, every member of the Congress knows that the State of Arizona is in desperate need of supplemental water. Further, we all recognize that the Colorado River is Arizona's "last water hole."

S. 1004 is not necessarily a new or novel proposal. It represents—for me—the culmination of more than forty-five years of hope, hard work, and frustration—as Arizona has sought to secure and use its full share of Colorado River water.

HISTORICAL BACKGROUND

The Central Arizona Project was first conceived as a separate project calling for construction of the aqueduct from the Colorado River and—what was then called—Bridge Canyon Dam as the hydroelectric revenue producer to pay a part of the costs of the project and provide power for pumping. The Bureau of Reclamation found the project feasible as early as 1947. It was recommended and endorsed by the Department of the Interior in 1948. A bill authorizing the Central Arizona Project was passed by the Senate in 1950 and again in 1951. Studies made by the Bureau of Reclamation over the past twenty years consistently show that the project is feasible and necessary.

Throughout this period, California vigorously opposed authorization of the Central Arizona Project on many grounds, including the assertion that Arizona had no legal right to the water. In 1951 the House Committee on Interior and Insular Affairs concluded that Arizona's legal rights to Colorado River water should be adjudicated before the Congress authorized our project. What we were told would be a relatively simple and short case developed into twelve long years of bitter litigation—with the Supreme Court finally handing down the decision in 1963. An additional year was consumed in formulating and entering the final decree.

Following the decision confirming Arizona's claim to Colorado River water, we all looked forward to early favorable action by Congress on our long-overdue water project. But, during the years of litigation, water needs and water problems had grown in other parts of the Colorado River Basin—and, to meet these and future needs, the Secretary of the Interior presented his first Pacific Southwest Water Plan. In this plan the Central Arizona Project became only one element of a large, ambitious and highly controversial plan for regional water development. And once again—the Central Arizona Project was victimized by controversies not of Arizona's making.

Various regional proposals, since 1963, increased the scope of Colorado River Basin development. Last year, in an effort to reach Basin unanimity, representatives of all seven of the Basin states agreed on a set of principles and water problems were incorporated in H.R. 4671. This bill sought enactment of legislation designed to solve all the present and most—if not all—the future water supply problems of the Southwest—finally including even the problems of Kansas and Texas.

But as we dreamed of long-range, comprehensive, interregional development, sectional and regional controversies began to develop. In addition to all the other problems, the bills which endorsed regional development ran headlong into the unrelenting and unfair opposition of those who styled themselves "conservationists."

In S. 1004, we have sought to present a more modest approach to the solution of Arizona's immediate water crisis. By this proposal we seek to authorize the project works necessary to bring our share of Colorado River water into the central Arizona area and provide storage reservoirs for New Mexico and Arizona.

We recognize that regional and interregional planning provides the only long-range or permanent answer to the water supply problems of the West. But we also recognize that such planning presupposes further delay and the completion of time-consuming studies and analyses. Further, it presupposes the resolution of political and territorial differences which may not yet be ripe for solution.

MAJOR FEATURES OF S. 1004

The major features of the Central Arizona Project provided for in S. 1004 are:

1. Construction of a system of main conduits, canals and pumping plants, including the Granite Reef aqueduct of 3,000 c.f.s. capacity from Lake Havasu to Orme Dam or a suitable alternative in central Arizona.

2. Construction of Orme Dam and Reservoir and power-pumping plant or suitable alternative.
3. Construction of Buttes Dam and Reservoir.
4. Construction of Hooker Dam and Reservoir in the State of New Mexico to an initial capacity of 98,000 acre-feet.
5. Construction of Charleston Dam and Reservoir.
6. Construction of Tucson aqueducts and pumping plants.
7. Construction of the Salt-Gila aqueduct.
8. Construction of canals, regulating facilities, hydroelectric power plants off of the mainstream of the Colorado River and electrical transmission facilities.
9. Construction of related water distribution and drainage facilities and appurtenant works.

POWER GENERATION AND TRANSMISSION

At various times we have sought authorization of two major dams on the Colorado River. These were intended, primarily, to provide electricity to pump water out of the river into the central Arizona aqueduct—and, secondarily, to provide revenues for a basin development fund. Desirable as these two dams might be to provide funds for ultimate development of regional water supplies in the Colorado River Basin, it is not imperative that they be authorized at this point in time. S. 1004 embodies what we believe in an acceptable alternative plan of accomplishing the first step—i.e., providing pumping power for the Central Arizona Project.

Through this bill we recommend that the pumping requirements of the project be met by a cooperative venture between the United States and the public and private utilities in the area. Under this plan, these utilities would jointly construct and operate a large thermal generating plant—with a part of the output being dedicated to serve the pumping needs of the project.

S. 1004 authorizes the Secretary of the Interior to make arrangements with the owner-operators of the steam plant for the acquisition of a portion of the capacity and associated energy for use in the operation of the Central Arizona Project. This type of cooperative enterprise between the publicly-owned and privately-owned utilities in the Southwest has already been tried and proven under the sponsorship of a planning organization known as Western Energy Supply and Transmission Associates (WEST). A group of its members—composed of both public agencies and private utilities—now have under construction at Four Corners two large thermal generating plants of the type contemplated in the bill with two more to be commenced in Southern Nevada, along the Colorado River, in the immediate future—and others yet to come.

To acquire pumping power under the plan contemplated in S. 1004, the United States would prepay power costs by periodically advancing funds for construction as needed. The Federal payment would be measured by the ratio of the anticipated project power needs to the total plant capacity. After completion of construction, the United States would then pay, each month, its proportionate share of the actual cost of administrative and general expense as well as fuel, operating, maintenance and replacement costs—just like the other participants.

The advantages to the Government and to project water users are obvious. First, for all practical purposes, the United States would have all the rights and privileges of the other participant. The so-called "purchase" resulting from prepayment is at actual cost with no profit to any of the other participants. By taking advantage of a large-scale thermal plant and low-cost fuel, the United States would be acquiring power and energy for pumping at a much lower price than it would be required to pay to any of the area's public or private utilities through a conventional purchase—or even through a trade of hydro peaking power for lower cost steam power. Furthermore, that minimal portion of the output intermittently not needed to meet the pumping needs of the project could be sold to commercial users and the revenues thus derived devoted to the aid of the water project. To the extent that the Government uses this generating capacity for pumping irrigation water, it would be reimbursable without interest in the same manner as any other irrigation features of Federal reclamation projects.

The proposal also makes adequate provision for transmission lines by permitting either the construction of Federal lines or the acquisition of capacity in lines jointly used by the plant owners and the Government. In either event, the Govern-

ment would retain firm rights to use that portion of the transmission capacity required to operate the Central Arizona Project.

COMPARISON WITH ADMINISTRATION BILL

In most major features, S. 1004 is similar to the Administration proposal set forth in S. 1013, as introduced by Senator Jackson by request of the Administration. There are, however, certain provisions in the Administration bill to which we do not subscribe. First, the Administration proposal would limit the size of the Granite Reef Aqueduct to 2,500 c.f.s. Our proposal calls for minimum canal sizing of 3,000 c.f.s. which will permit Arizona to take its share of Colorado River surplus water—which the engineers say will be available in the early years of the project—and thus improve our badly depleted groundwater reservoirs for use in later years of shortage. Moreover, if eventual augmentation of the flow of the Colorado River is sometime realized—or if California should obtain an economical alternate source and thus reduce its diversions from the Colorado River—the larger capacity canal could at that time again be used to full capacity, thus avoiding construction of costly duplicating facilities.

Second, we have not included Marble Canyon damsite in the boundaries of the Grand Canyon National Park as recommended by the Secretary—nor have we at this point even suggested a moratorium on the development of Hualapai damsite. If the State of Arizona should be forced to proceed on its own—without the help of the Federal Government—we must retain these hydroelectric damsites to produce the necessary revenues to finance such a State project. Further, if S. 1004 is enacted, one or both of these damsites should be reserved for a limited period of time until the long-range plans for the area have been better evaluated.

WATER SUPPLY

Considerable testimony was introduced during the hearings on the subject of water supply of the Colorado River, much of which created more confusion in the matter of water supply. Despite this testimony, all of the hydrologists agree that while there is not enough water in the Colorado River basin to supply the entire needs in perpetuity of that basin, the Central Arizona Project is financially and economically feasible under the water supply analyses presented by the Bureau of Reclamation.

There was more than a suggestion during the hearing that Arizona's use of its Lower Basin entitlement would in some way amount to a use of Upper Basin water. It was stated that the only water available for the Central Arizona Project is the unused portion of Upper Basin water. We should make it perfectly clear at this point that Arizona has no designs on the water supply of the Upper Basin nor the water supply of any state in the Upper Basin. Under the Boulder Canyon Project Act and the decision and decree of the Supreme Court in *Arizona v. California*, the water apportioned to the Lower Basin under the Santa Fe Compact is divided among Arizona, California, and Nevada. In this legislation, Arizona seeks only to use its own water entitlement, which includes its share of any surpluses which, from time to time, may exist in the Lower Basin.

THE CALIFORNIA PRIORITY ISSUE

We have already advised the Committee of our position with reference to this issue. S. 1004 does not offer any guarantee of minimum deliveries to California—or anyone—in times of shortage. Arizona water users should not be required to pay this kind of tribute for California's support here in the Congress. Arizona is satisfied to leave the allocation of shortages to the Secretary's judgment under the circumstances then existing—just as the Congress left it in 1929 (Boulder Canyon Project Act), and just as the United States Supreme Court left it in 1963 (*Arizona v. California*, 373 U.S. 546).

A document entitled "Brief on the Protection of Existing Projects Against the Proposed Central Arizona Project (California Limited to 4.4 Million Acre-Feet Per Annum)" has been filed with the Committee by California attorneys. To close the record of these proceedings without pointing out that this California Brief is erroneous and misleading would be a mistake. At my request, Counsel for the Arizona Interstate Stream Commission have prepared an answering brief which is not only technically accurate but is also readable and understandable. We attach it to this statement for the advice of the Committee.

CONCLUSION

All of our Western states—and in recent years most other states of the nation—urgently need the assistance and cooperation of the Federal Government in connection with their differing water problems. Some states look to the Corps of Engineers, some to the Department of Agriculture, and others to Interior and its Bureau of Reclamation for this needed assistance. Over the years this Committee has endorsed and recommended many such projects, and the Appropriations Committee has recommended the appropriation of needed funds for their construction. Just last month the Congress considered and passed legislation to authorize a large desalting plant in the Los Angeles area with a non-reimbursable Federal contribution of some \$70 million. This plant will produce some 150 million gallons of fresh water each day for use in Southern California. Much resource development legislation, important to every state is now pending before Congress.

There are those who have suggested that the Arizona delegation oppose all such legislation and appropriations until our own urgent water needs have been recognized and taken care of. But this is not the way our country developed and became a great nation. This is not the way our country's water projects—whether for navigation, flood control or badly needed irrigation—have come into being. This is not the way our great national highways, our rivers and harbors, and our air transportation system were developed.

I have always cooperated with my colleagues from other parts of the nation in helping resolve these important problems and the needs of their particular states. I am confident that during the progress of this legislation—so critical to the needs of my State—that I will, in turn, have their cooperation and good wishes.

In the fifty-five years which I have served in the Congress of the United States it has been my observation that regional and sectional controversies and disputes between individual states can be amicably and satisfactorily resolved only if each side is willing to "give" just a little—and if each side is willing to select realistic goals which we may reach by cooperation and compromise.

We believe S. 1004 is a step in that direction—and that its enactment will be a major step toward ultimately resolving many, if not all, of the water problems of the Southwest.

In light of the immediate critical water shortages we face in central and southern Arizona—and the disastrous consequences of further delay, we are optimistic that this Committee and this Congress will look favorably upon our proposal.

We solicit—and we welcome—the support and cooperation of all members of the Congress in enacting this badly needed legislation.

BRIEF OF ARIZONA IN ANSWER TO THAT SUBMITTED BY CALIFORNIA ON THE PROTECTION OF EXISTING USES IN CALIFORNIA AND THE GRANTING OF A 4.4 PRIORITY

In the document entitled "Brief on the Protection of Existing Projects Against the Proposed Central Arizona Project (California Limited to 4.4 Million Acre-Feet Per Annum)" California attorneys seek to prove that the protection of existing California uses to the extent of 4.4 million acre-feet per annum is sound—"legally, equitably, economically and morally." This memorandum is a reply to that argument.

1. THE LEGAL BASES

A statement that the protection of California's existing uses to the extent of 4.4 million acre-feet per annum is "legally sound" is a pronouncement that under *existing law* California is entitled to that priority.

This is not correct.

As a matter of fact, a careful analysis of pages 4 through 7 of the California brief will clearly show that California does not even assert that it has a priority under "existing law." What California does say is that the Congress of the United States has plenary power over the water of the Colorado River and that if this Congress should decide to reverse itself (under the law enacted by the Boulder Canyon Project Act) and to reverse the decision of the Supreme Court

of the United States in the case of *Arizona v. California*, 373 U.S. 546, it has the constitutional authority to do so. Subject to certain existing water rights, there is no disagreement about the ultimate power of Congress in this regard.

However, Arizona does strongly disagree with the assertion—or implication—that under existing law of the river, California is legally entitled to the protection of all its existing uses—simply because it got to the Colorado River first and developed these uses during the period when the two states were contesting each other's claims to the waters of the Colorado River in both the Congress and the Courts.

As the Supreme Court clearly pointed out, what the Congress of the United States did in enacting the Boulder Canyon Project Act was to provide a scheme of "statutory division" of the waters of the river below Lee Ferry. In making this "statutory division," the Congress recognized that the Santa Fe Compact had basically apportioned the use of 7.5 million acre-feet per year to the Lower Basin states, together with the right to increase lower basin uses by an additional 1,000,000 acre-feet per annum (Article III(a) and (b)).

The Court stated:

"We have concluded, for reasons to be stated, that Congress in passing the Project Act intended to and did create its own comprehensive scheme for the apportionment among California, Arizona, and Nevada of the main-stream waters of the Colorado River, leaving each State its tributaries. Congress decided that a fair division of the first 7,500,000 acre-feet of main-stream water would give 4,400,000 acre-feet to California, 2,800,000 to Arizona, and 300,000 to Nevada; Arizona and California would each get one-half of any surplus."

Nowhere in the Court's decision, nor in the Statute, is there any hint or implication that California's allocation of 4.4 is in some way on a higher plain than Arizona's 2.8 or Nevada's 300,000. (In passing, we should point out that California makes no claim of priority against Nevada—although from a legal standpoint the issue is identical.)

Subject to protection of present perfected rights, the Congress granted no priority to any state because of that state's "existing uses." When this question was placed before the Supreme Court, in *Arizona v. California*, the Court decided that under the Boulder Canyon Project Act the Secretary has the power to determine how the water is to be divided among the states in time of shortage—under the circumstances then existing. California argued before the Court that it had a legal priority for existing uses. The Court held that it did not. That is the law of the river today.

Under the section of the opinion of the Court entitled "Apportionment and Contracts in Time of Shortage," beginning at page 592 of the opinion the Court discusses the problem of shortages and priorities and says at page 593:

"While pro rata sharing of water shortages seems equitable on its face, more considered judgment may demonstrate quite the contrary. Certainly we should not bind the Secretary to this formula. We have held that the Secretary is vested with considerable control over the apportionment of Colorado River waters. And neither the Project Act nor the water contracts require the use of any particular formula for apportioning shortages. While the Secretary must follow the standards set out in the Act, he nevertheless is free to choose among the recognized methods of apportionment or to devise reasonable methods of his own. This choice, as we see it, is primarily his, not the Master's or even ours. And the Secretary may or may not conclude that a pro rata division is the best solution."

Thus it is clear that the California position before this subcommittee that it has a "legal basis" for its claim to a priority over Arizona—if not Nevada—is not legally sound.

2. THE EQUITABLE BASES

Counsel for California next urge that its existing uses should receive protection in this legislation because, under the doctrine of "equitable apportionment" (top of page 8, California brief) or under the doctrine of "prior appropriation" (bottom of page 8, California brief) it is equitably entitled to that protection.

California urged both of these arguments to the Supreme Court of the United States in *Arizona v. California*. The Supreme Court flatly and unconditionally rejected them both. Said the Court at page 594 of its opinion:

"For the same reasons we cannot accept *California's contention* that in case of shortage each State's share of water should be determined by the judicial doctrine of *equitable apportionment* or by the law of *prior appropriation*. These principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress, with full power to do so, has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency under a statutory scheme." (Emphasis added.)

The wisdom of Congress in leaving the question of priorities to the Secretary, is obvious. Shortages may occur over a period of years interspersed with surplus. What is "equitable" or fair in one year may not be so in another. The problem of water shortage in the southwest is to a substantial extent a problem of proper distribution of the existing supply. When the Colorado River is short, California may have an overabundance of water from its other tremendous reservoirs, such as the Feather River supply to Southern California (in excess of 2 million acre-feet per annum); Imperial Irrigation District waste into the Salton Sea (approximately one million acre-feet per annum); the Eel River supply; desalination from the Pacific Ocean; etc. The "equitable" apportionment or distribution of existing supply under those "existing circumstances" might well persuade the Secretary that Arizona and New Mexico projects without such similar reserves should be preferred. In any event, the decision is for the Secretary upon a survey of the situation or the circumstances then existing. An apportionment of water in time of shortage should not be "inequitably" locked in by an inflexible statutory directive not capable of prompt accommodation to the existing circumstances.

3. THE ECONOMIC BASES

The text of California's economic argument seems to be the sentence which reads—

"You should not destroy existing projects serving established economies in order to build a new project."

This leaves the strong implication that "established economies" within the service area of Metropolitan Water District will be destroyed if Congress authorizes construction of the Central Arizona Project. Surely, no one really believes this—and it is just as conceivable that the Colorado River aqueduct will be permitted to dry up and be "destroyed"—with no effort being made to augment the water supply of the Colorado River Basin.

"On the other hand, no one will deny that the "established economies" of Southern Arizona will be drastically curtailed—if not "destroyed"—if the Central Arizona Project is not promptly commenced.

The California economic argument is simply that California finds it extremely profitable to continue to use the 700,000 acre-feet which would be diverted for use in Arizona and New Mexico under S. 1004—and is therefore justified in exerting its political muscle in an effort to continue its use of this water as long as possible. The logical extension of this argument is that if California had been successful in developing "existing uses" for the entire 7.5 million acre-feet of Lower Basin water, Arizona, Nevada and New Mexico would never obtain any water at all.

California often asserts her willingness to protect areas of origin, and to return to the northwest or to Northern California water obtained by augmentation when uses are developed for it in those areas of origin. Consistency, if any virtue, would now seem to require a return to Arizona of its statutory allocation of Colorado River water when Arizona is legally entitled to it and capable of using it. If or when a shortage does occur, which requires the Secretary to apportion a lesser quantity, Arizona is willing to take her chances on the "equities" as they then appear. We believe California should do no less.

4. THE MORAL BASIS

California lawyers establish the "moral" basis for their position by the fears expressed by Arizona officials in 1930 and 1943 that if California ever put Arizona's water to use it would be extremely difficult to recover it.

It is always easy for the party in possession to find some moral self-justification for retaining that which has already been obtained. True, Arizona's officials

have long been concerned over Southern California's penchant to take and keep all available water in the Southwest. This concern is not peculiar to Arizona. It is no secret that Western states have been concerned about the same thing. It is no secret that Southern California has consistently opposed all new development on the Colorado River—in both the upper and lower basin. The expression of that concern by officials of these inland states does not create a "moral justification" for California to retain water to which she clearly has no legal right—nor to claim a priority over other states that neither the Congress nor the Supreme Court has found justified.

CONCLUSION

In 1947 Arizona first came to Congress to ask for a project to enable Arizona to use her entitlement of water. California with its strong representation in the Congress successfully opposed Arizona's request. In 1951 the Congress directed Arizona to go to the Supreme Court of the United States to obtain a settlement of its dispute with California over its entitlement, before Congress would further consider the matter. Arizona did so immediately; and after years of difficult and expensive litigation, the Court finally approved Arizona's water right. The day after the decision (June 4, 1963) Senator Hayden and Senator Goldwater introduced a bill asking for a project. Now, after almost four more years of further delay, California asks the Congress to enact new legislation giving California a 4.4 priority over Arizona which would change the Boulder Canyon Project Act as enacted by Congress and overrule the decision of the very Court to which Arizona was sent by the Congress to obtain an impartial non-political decision.

The position taken by California today is not the position which was taken by responsible authorities in California at the time the lawsuit was concluded. In Senate Report No. 1330, 88th Congress, Second Session, Page 3, the Committee Report on S. 1658 stated:

"Shortly after the Supreme Court decision, the Honorable Edmund G. Brown, Governor of the State of California, announced that California having lost the Supreme Court case . . . 'Would not try to accomplish by obstruction what she had failed to accomplish by litigation.'"

Arizona—with the Colorado River as its only water source—does not ask California for a priority; California—with its various alternative sources—should not, in good conscience, seek a priority from Arizona as a price for political support in the Congress. Arizona asks only that the matter of allocating water in times of shortage be left exactly as the Congress of the United States and the Supreme Court of the United States—in their wisdom—decided it should be left.

Respectfully submitted,

OZELL M. TRASK,
RALPH E. HUNSAKEE,
Council, Arizona Interstate Stream Commission.

POSITION OF SENATORS HAYDEN AND FANNIN WITH RESPECT TO THE CALIFORNIA PRIORITY ISSUE

S. 1004, unlike some other bills concerning the Central Arizona Project, offers no guarantee of minimum deliveries to California in times of shortage. It would leave the allocation of shortages to the Secretary's judgment under the circumstances then existing—which is the way the Supreme Court left it.

The California Senators will agree that this has been a troublesome issue. At one point we suggested as a compromise that a 4.4 priority be accorded to California for a period of twenty-five years—but not in perpetuity. We believed that this would give California assurance of a dependable water supply during the period that our mutual long-term water problems were being worked out. However, our suggestion was not acceptable.

Our unwillingness to agree to a 4.4 million acre-feet California priority in perpetuity is neither an arbitrary nor an unreasonable position. An unconditional priority to California in perpetuity has the potential of placing on Arizona—and the other so-called inland states—the entire burden of augmenting the water supply of the Colorado River in preparation for the years of short supply in the Colorado River Basin. The people of Arizona must look solely to the Colorado River system for their water needs—while the citizens of Southern California look

not only to the Colorado River and the abundant water in the northern part of their own State—but to the entire Pacific Ocean. It may well be that the people of the thickly populated coastal plain of Southern California will find these alternate sources ultimately less expensive and more adequate than a program to augment the Colorado River—in which event they would have little, if any, interest in aiding the inland states with the obviously difficult and expensive task of supplementing the water supply of the Colorado River. If, under these circumstances, California were to be guaranteed an annual minimum of 4.4 million acre-feet, the water supply of the Central Arizona Project would be progressively curtailed to provide a permanent supply of 4.4 million acre-feet for California out of the Colorado River—notwithstanding the fact that the people of the California coastal plain may have solved their water problems by looking to alternate sources. It is our belief this would be inequitable—and would be one of the circumstances to which the Secretary would give consideration if the allocation is left to him to determine at the time shortages occur.

This is unquestionably the type of thing the Supreme Court had in mind when it refused to accept the Special Master's recommendation that shortages be prorated under a suggested rigid formula. The Court said:

"* * * While pro rata sharing of water shortages seems equitable on its face, more considered judgment may demonstrate quite the contrary. * * * This choice, as we see it, is primarily his, not the Master's or even ours. And the Secretary may or may not conclude that a prorata division is the best solution."

In further justification of leaving the decision to the Secretary's judgment, under circumstances then existing, the Court said:

"It must be remembered that the Secretary's decision may have an effect not only on irrigation uses but also on other important functions for which Congress brought this great project into being—flood control, improvement of navigation, regulation of flow, and generation and distribution of electric power. Requiring the Secretary to prorate shortages would strip him of the very power of choice which we think Congress, for reasons satisfactory to it, vested in him and which we should not impair or take away from him. * * *"

and in its concluding remarks on this issue, the Court said:

"None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation. * * *"

A 4.4 priority to California—on California terms—actually changes and reverses the decision of the Court. The basic question in the litigation arose from California's assertion that the prior appropriation doctrine should apply to the Colorado River—thus conferring a priority for existing California projects over the Central Arizona Project yet to be built in Arizona.

The Supreme Court of the United States clearly held that the law of prior appropriation does not apply to the waters of the Colorado River below Lee Ferry. The Court said:

"* * * For the same reasons we cannot accept California's contention that in case of shortage each State's share of water should be determined by the judicial doctrine of equitable apportionment or by the law of prior appropriation. These principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress, with full power to do so, has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency under a statutory scheme."

This decision came as a result of a directive of the Congress to both Arizona and California to submit their differences about the division of these waters to the highest court—as a prerequisite to further legislation by the Congress.

Now—if the Congress agrees to this California demand and imposes on Arizona the burden of guaranteeing the delivery of four million four hundred thousand acre-feet each year to California from Arizona's own scarce supply—it will have effectively reversed the United States Supreme Court on this basic issue of the law suit. Further, such action by the Congress would have the effect of amending the Boulder Canyon Project Act—so carefully examined and interpreted by the Special Master and the Court. The Court has ruled. We suggest that the Con-

gress—and hopefully, the State of California—should be willing to accept and abide by the Court's decision. The Congress should unequivocally reject this California proposal to legislate away Arizona's hard fought, precious victory.

The Congress having selected the Court to be the arbiter of this problem—and the Court having decided it after twelve long years of litigation—it now seems inappropriate for the Congress to consider California's plea that the decision be reversed by congressional edict.

We are willing to rely on the Secretary of the Interior—whoever he may then be—to exercise his good judgment when the years of short supply begin to come along. This may work to Arizona's advantage—or its disadvantage—depending on the circumstances existing in the Southwest at that time.

Adjustments in times of shortage depend on the over-all water supply as it exists at that particular date. Establishment of priorities by act of Congress is not suited to making these adjustments as they occur from time to time.

We are firmly convinced that the solution which the Congress reached in enacting the provisions of the Boulder Canyon Project Act—a solution which the Supreme Court affirmed—namely to leave the adjustment to the judgment of the Secretary—is the only intelligent, statesmanlike way of resolving the problem, “* * * in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation.”

Senator ANDERSON. Senator Jackson.

STATEMENT OF HON. HENRY M. JACKSON, U.S. SENATOR FROM THE STATE OF WASHINGTON

Senator JACKSON. Mr. Chairman, legislation to authorize the central Arizona project has had a long and frustrating history before this committee, before the Senate, and in the House of Representatives. I am hopeful that it will be possible to reach agreement on a central Arizona project bill during the 90th Congress.

In the past I have supported legislation to authorize the central Arizona project and allow Arizona to use its share of Colorado River water. This year I have joined with Senator Hayden as a cosponsor of his bill, S. 1004. I have also introduced the administration's bill to authorize the central Arizona project, S. 1013. These bills are very similar, and I believe they provide a sound basis on which to reach agreement. Both bills eliminate many of the controversial and difficult issues which have made the passage of previous legislation dealing with Colorado River projects unrealistic.

The Senate has passed, and the House is now considering legislation to establish a National Water Commission. I am hopeful that this legislation will also be enacted during the 90th Congress so that the Commission may undertake its studies and recommend how the Nation's and the Southwest's water problems may be solved.

Thank you, Mr. Chairman.

Senator ANDERSON. Our good friend from California is here, and a very valuable member of this committee. I will be happy to have a statement from him.

STATEMENT OF HON. THOMAS H. KUCHEL, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator KUCHEL. Thank you, sir.

Mr. Chairman and gentlemen, this hearing will concern the present and future water shortages of a vast semiarid portion of the Western United States. It is, therefore, of supreme importance to all of the States in the Pacific Southwest. No one here today needs to be told that

the States of the Colorado River Basin face a water crisis. Each of them, Colorado, Wyoming, Utah, New Mexico, Nevada, Arizona, and California, has at least one U.S. Senator sitting on this committee. But we sit not simply as representatives of our separate States. Mr. Chairman, we are U.S. Senators, and I hope in passing judgment on this problem we will reflect an attitude of deep concern for, and an earnest desire to assist all the States of the Colorado River Basin.

The bills before this committee represent two distinctly different kinds of solution to the problem. The Allott bill, S. 1242, the Moss bill, S. 1409, a bill which I have introduced, S. 861—all embody a regional approach of which the national administration has been a fervent champion in prior years. The other bills before the committee seek to treat the symptoms of scarcity in a single State, but shirk the greater national responsibility to face up to the specter of growing shortages throughout the basin. I sincerely hope this committee will recommend legislation along the lines formulated by the seven Colorado River Basin States last year, and with minor differences, carried over into the Allott, Moss, and the bill which I introduced.

I ask consent, Mr. Chairman, that the resolution adopted by the Colorado River Board of California on March 1 of this year and my statement before the Irrigation and Reclamation Subcommittee of the House Committee on Interior and Insular Affairs on March 13 of this year be included as a part of the record at this point.

Senator ANDERSON. Without objection that will be done.

(The resolution and statement referred to follow:)

RESOLUTION OF THE COLORADO RIVER BOARD OF CALIFORNIA

The Colorado River Board of California recommends enactment of S. 861, 90th Congress, introduced by Senator Kuchel of California and Senator Moss of Utah, and counterpart bills in the House, as introduced by Congressman Hosmer (HR 6271) and others. These bills agree in principle with those introduced by Chairman Aspinall of the House Committee on Interior and Insular Affairs and Chairman Johnson of that Committee's Subcommittee on Irrigation and Reclamation.

The foregoing bills all embody the following features, which the Colorado River Board has repeatedly endorsed, and which were contained in the bill reported out by the House Committee in the 89th Congress:

1. Recognition of the necessity for meaningful steps to augment the inadequate flows of the Colorado River.
2. Adequate protection for the states and areas of origin of water exported to the Colorado, including full protection of the priorities of those areas in perpetuity.
3. Recognition of the Mexican Treaty burden as a national obligation, and that an appropriate share of the cost of importing water should be allocated to the performance of that Treaty. Whenever importations are accomplished to the extent of 2.5 million acre feet annually, both basins should be relieved of the danger of curtailment of their own uses to perform the Nation's Treaty obligations to Mexico.
4. Balancing of the operation of Lake Mead and Lake Powell, so that the benefits of wet years and the burdens of drought shall be equitably distributed between Upper Basin and Lower Basin reservoirs. We recommend the language of the Kuchel-Moss-Hosmer bills in this respect.
5. Authorization for construction of the five projects in Colorado.
6. Reimbursement of the Upper Colorado River Basin fund for payments out of that fund to compensate reduction of the power operations at Hoover Dam occasioned by filling of Lake Powell.
7. Authorization for construction of Bridge Canyon (Hualapai) Dam and Power Plant, and creation of a basin account to help finance the Central Arizona Project and importation works, fed by revenues from Hualapai Dam and by revenues from Hoover, Davis and Parker Dams after they have paid out.

8. Authorization for the construction of the Central Arizona Project, as part of the regional plan, but on the condition that if the water supply of the Colorado River is insufficient to satisfy the requirements of the projects already in existence or heretofore authorized by Congress for construction in Arizona, California and Nevada, then shortages shall be borne as provided in those bills. The effect is that California must bear the first burden of shortage, sacrificing nearly one million acre feet of constructed capacity whenever the supply shrinks to 7.5 million acre feet annually; but that the Central Arizona Project shall bear the next share of the shortage if the supply shrinks below 7.5 million acre feet before imported water arrives. To this end the priorities of existing and authorized projects will be protected as against the proposed Central Arizona Project, but only until works have been constructed to import at least 2.5 million acre feet annually. The protection to existing and authorized projects in Arizona and Nevada would be unrestricted in quantities, but the protection to California's existing projects would be restricted to 4.4 million acre feet annually, to give effect to a limitation to which California agreed at the time of enactment of the Boulder Canyon Project Act.

The Colorado River Board of California recommends against enactment of the bill recommended by the Secretary of the Interior in his report on the Aspinall bill. The Secretary's proposal fails to protect the interests of any state other than Arizona. It abandons the regional solutions proposed by the Secretary in the last Congress, and which the seven states accepted in the bill (HR 4671) reported out of committee in the 89th Congress.

California followed and supported the Secretary's leadership then, and regrets his abandonment of it now. California has not changed her position. We hope that unity among the seven states can be reestablished under the leadership of Chairman Aspinall within the framework of the principles the seven states agreed upon last year which this resolution restates.

STATEMENT OF HON. THOMAS H. KUCHEL, A U.S. SENATOR FROM THE STATE OF CALIFORNIA

I am honored to appear before this Committee of the House of Representatives today to voice California's continued and enthusiastic support for regional planning to help solve the water shortages of all the states in the Colorado River Basin.

You have before you several bills which would accomplish this result. One is H.R. 3300, introduced by your distinguished Chairman, Mr. Aspinall of Colorado. My colleague, Chairman Johnson of this Subcommittee, has introduced a similar bill, H.R. 744. In the Senate, Senator Moss of Utah and I have introduced S. 861. The differences between the Aspinall bill and S. 861 are matters of detail, which I believe can be readily adjusted. My distinguished friend, long-time member of your Committee, Congressman Craig Hosmer of California, has introduced H.R. 6271, which is identical to S. 861. Several members of our California delegation have followed Congressman Hosmer's example. The Aspinall approach is a continuing recognition of the regional, rather than the parochial, approach to the solution of the Basin's water shortages. It perseveres in the water statesmanship which united the seven basin states in the last Congress, and which I hope will be revived in the 90th Congress. It is the only road to success.

I believed this when I introduced the first regional planning bill in the 89th Congress, S. 1019. My confidence in this solution was reinforced when 35 of my California colleagues in the House, and all three of Arizona's Congressmen, introduced exact counterparts of it. It was confirmed when this distinguished Committee on Interior and Insular Affairs, by a two-thirds majority, reported favorably one of these counterparts, H.R. 4671, introduced by Congressman Udall of Arizona, in the 89th Congress.

The essential elements of the regional plan, the "one-for-all, all-for-one" plan, as contrasted with the "go-it-alone" point of view, are all contained in the Aspinall-Johnson-Hosmer-Kuchel-Moss bills.

The vital features are:

(1) We propose early, vigorous and meaningful steps to augment the inadequate flows of the Colorado River. We propose, as a first step, that the Secretary of the Interior, functioning under guidelines established by the National Water Resources Council and the proposed National Water Commission, investigate

long-range water supply and demand, determine how much should be imported, determine what sources can furnish this without injury to the areas of origin, and what importation projects can be recommended to Congress for authorization.

Do we not, in this wonderful Nation of ours, seek to prevent waste wherever it occurs? Should not our government determine where the great rivers in this country, which annually dump vast amounts of fresh water into the seas might be used to slake its people's thirst, if the area of origin were first carefully protected? The Northwest California streams, and the mighty Columbia river system, the possibilities of desalting seawater, all should be inventoried with the utmost care, for each one of them will help sustain Americans in future times.

There is an impending water shortage in the Colorado River Basin. It is not imaginary. It is very real. And no amount of investigation or delay will make it go away.

(2) We insist on adequate protection for the states and areas of origin of water exported to the Colorado, including full protection of the priorities of those areas, in perpetuity. California may well be such an area of origin. The Columbia Basin, if that is the area of origin, requires the same protection.

(3) We ask recognition of the Mexican Treaty burden as a national obligation, and that an appropriate share of the cost of importing water be allocated to the performance of that Treaty. The Budget Bureau agreed to this principle in the 89th Congress. We agree with the Upper Basin States that whenever importations into the river system are accomplished to the extent of 2.5 million acre-feet annually, both basins should be relieved of the danger of curtailment of their own uses to perform the Nation's treaty obligations to Mexico. The 2.5 million acre-feet includes 1.5 million acre-feet of water which must be delivered to Mexico at the border, and 1 million acre-feet of losses between Lee Ferry and the border.

(4) We agree on the necessity of balancing the operation of Lake Mead and Lake Powell, so that the benefits of wet years and the burdens of drought shall be equitably distributed between Upper Basin and Lower Basin reservoirs. The two reservoirs should go up and down together.

(5) We agree upon the authorization for construction of five Upper Basin projects.

(6) We agree to reimbursement of the Upper Colorado River Basin fund for prior payments out of that fund to compensate reduction of the power operations at Hoover Dam occasioned by filling of Lake Powell. The bills spell out the method.

(7) We agree upon the authorization for construction of Bridge Canyon (Hualapai) Dam and Power Plant, and for creation of a basin account to help finance the Central Arizona project and importation works, fed by revenues from Hualapai Dam and by revenues from Hoover, Davis and Parker Dams after they have paid out. I have gone along on the elimination of Marble Canyon Dam. But if this source of revenue is removed, I have proposed that Arizona, not the development fund, pay the cost of any increase in size of the Central Arizona aqueduct above the 1,800 c.f.s. project described by the Bureau of Reclamation in its cost estimate last year.

(8) We agree to the authorization for the construction of the Central Arizona Project, as part of the regional plan. But we agree only on the condition that, if the water supply of the Colorado River is insufficient to satisfy the requirements of the projects already in existence or heretofore authorized by Congress for construction in Arizona, California and Nevada, these existing uses shall be protected. This is subject to the limitation on California's protection imposed by the Boulder Canyon Project Act. The effect is that when the supply drops to 7.5 million acre-feet, the Metropolitan Water District of Southern California will lose nearly 700,000 acre-feet of its present supply before Arizona loses any water at all. However, the Central Arizona Project shall bear the next share of the shortage if the supply drops below 7.5 million acre-feet annually before imported water arrives. To this end the priorities of existing and authorized projects will be protected as against the proposed Central Arizona Project, but only until works have been constructed to import at least 2.5 million acre-feet each year. This is the quantity which must be added to the river to assure availability in the Lower Basin of the 7.5 million acre-feet apportioned by the Supreme Court, if and when the Upper Basin depletes the flow at Lee Ferry to the minimum allowed by the Compact. The protection thus given to an existing and authorized project in Arizona and Nevada would be unrestricted in quantity. But the protection to California's existing projects would be limited to 4.4 million acre-feet annually.

I may add, with respect to the exact language now in our bill protecting existing uses, that it was the acceptance of this compromise by Arizona's Gov-

ernor and three Congressmen in the 89th Congress, at the urging of Secretary Udall, that enabled California to support construction of the Central Arizona Project. This language simply recognizes the century-old foundation of western water rights, the protection of existing uses on which California relied in building a half-billion dollars worth of projects. Without this agreed language, we would have to oppose the Central Arizona Project with all the means at our command.

I have summarized the points to which California agreed last year, as did Arizona's delegation in this House, the Secretary of the Interior and, finally, this distinguished House Committee by a two-thirds vote. California has not changed her basic position. We supported this program then. We support it now. I am happy to say that these principles are supported in California, with complete unity, by Governor Reagan, Attorney General Lynch, the Colorado River Board of California, and the State's Director of Water Resources. I annex to my statement a telegram from Governor Reagan endorsing S. 861, as well as a resolution adopted by the Colorado River Board of California on March 1, 1967.

We Californians are also united in opposing enactment of the bill which Secretary Udall has now proposed as a substitute for the plan which he helped formulate and which he so warmly endorsed last year. The Secretary's new proposal fails to protect any State other than Arizona. He abdicates his responsibility to deal with the most crucial issue, the Basin's water shortages, by investigating means to relieve them. He deletes the priority protection for existing projects. He gives up on Bridge Canyon, as well as Marble Canyon dams, sacrificing what he said last year would amount to more than \$1 billion of earnings to help finance importations as well as the Central Arizona Project. Gone is the regional development fund.

I well remember when Secretary Udall in January, 1965, led the way to an amicable agreement between Arizona and California. We agreed to help one without damaging the other. We agreed that the Central Arizona Project should be built and that prior use should be respected. But we did far more. We agreed that we should prepare for the future and make more water available to every Basin state as the supply in the river dwindled and as the thirst mounted. That kind of an approach was almost near Congressional approval last year. I thought it would be this year, and now I express my hope that it will and that Secretary Udall will return to to the fold.

Senator ANDERSON. Senator Bible.

STATEMENT OF HON. ALAN BIBLE, U.S. SENATOR FROM THE STATE OF NEVADA

Senator BIBLE. Thank you, Mr. Chairman.

I shall be very brief. I hope that 1967 is the year that we finally resolve this very complicated and intricate problem. I was associated with many of the problems of the Colorado River during my days as the legal adviser of our State commission.

I think the time has long passed when these matters should be solved and I am glad we are getting together to solve them. The executive director of the Colorado River Commission of Nevada will appear here on Thursday and at that time I shall look forward to presenting him and presenting the official views of the State of Nevada.

Thank you very much, Mr. Chairman.

Senator ANDERSON. Senator Allott, do you have a statement?

STATEMENT OF HON. GORDON ALLOTT, U.S. SENATOR FROM THE STATE OF COLORADO

Senator ALLOTT. Thank you, Mr. Chairman.

My statement will be a little longer than those that have been made. This matter is of such great importance that I feel compelled to give it.

We have before our subcommittee today an array of bills, all of which propose to further develop the water resources of the Colorado River Basin. I believe, without a doubt, that the Colorado River is the most controversial body of water in the Western Hemisphere, if not in the world. Those of us who have been close to its problems have come to realize that the Colorado River may soon be the first major river in the world to have its entire water supply controlled by man and put to use in such a way that not one drop will ever again be discharged to the ocean. On any river system, water resource problems, like any other commodity in limited supply, tend to become increasingly complicated as the water resource becomes more scarce. Increasingly complex decisions are required. The Colorado River is no exception.

The Colorado River Basin is an important segment of this great Nation. Its area, which embraces parts of seven States, is rich in mineral and land resources—and in space. Its area is about one-twelfth that of the 48 contiguous United States. Due to the great imbalance that exists between the water supply and other natural resources, the people of the region have always had to face greater difficulties than in other sections of the country in bringing their resources together for the creation of wealth, homes, and the means of making a living. Those who are familiar with the great Southwest can attest to the fact that the results of their efforts are staggering. But the surface has only been scratched. If we can continue to make water available in the region at the time and in the places where it will be needed for further constructive development of the other vast resources, past accomplishments will seem pale by comparison. Aiding in the accomplishment of this task is the responsibility of this committee and the Congress, not only for the State of Arizona, but for the entire Pacific Southwest.

Mr. Chairman, in an effort to place a few of the problems pertaining to the proposed legislation before us in their proper perspective, I wish to briefly review a few pertinent informational details. The Colorado River has probably been the subject of more interstate compacts, interstate litigation, and interstate and intrastate disputes than any other river in history. For many years the waters of this river have been the subject of innumerable court battles within my own State of Colorado. Most of the flow of the Colorado River originates in Colorado. In fact, according to the records of the Upper Colorado River Commission over 70 percent of the virgin flow as measured at Lee Ferry, Ariz., the point of delivery to the Lower Basin, is produced on the high mountains of Colorado. In spite of this apparent picture of abundance, Colorado, through the medium of interstate compacts, has shared large portions of her water resources with her neighbors and is now attempting to put to beneficial use some of the last components of water available to her under compact apportionments. This situation has been brought about by the vagaries of nature that deceived the negotiators of the Colorado River compact into believing that there were 18 to 20 million acre-feet of water annually available from the river instead of less than 15 million as determined by later, more accurate and reliable studies. In 1953, the firm of Leeds, Hill & Jewett made a study of the availability of water for the State of Colorado. That report disclosed that in contrast to

the 7.5 million acre-feet believed by the Colorado River compact negotiators to be available to the Upper Basin, there are only about 6.2 million acre-feet of water that can be consumptively used in the Upper Basin if 7.5 million acre-feet are allowed to annually pass Lee Ferry.

In 1965, under the sponsorship of the Upper Colorado River Commission, the internationally operating firm of Tipton & Kalmbach, Inc., prepared a report entitled "Water Supplies of the Colorado River Available for Use by the States of the Upper Division and for Use From the Main Stem by the States of Arizona, California, and Nevada in the Lower Basin." This report shows that with all existing or authorized storage reservoirs, and providing for deliveries to the Lower Basin of 75 million acre-feet in every period of 10 years, only 6.3 million acre-feet of water per year remains for consumptive use in the Upper Basin. Colorado's share of this figure would amount to 3,234,000 acre-feet, including reservoir evaporation, as contrasted with 3,855,000 acre-feet, if there were 7.5 million acre-feet for Upper Basin use as apportioned by the compact. When we objectively analyze these conditions in the light of past river history and the increasing demands for water by our downstream sister States we find it most difficult to support any further downstream water development unless certain other measures are included in the same or concurrent legislation.

I am citing these facts to show that Colorado and the other States of the basin have water problems as well as does Arizona. We, in Colorado, have the strongest sympathy for our neighbors in Arizona—but the problems of the Colorado River Basin are not the problems of Arizona alone. They are the problems of seven States. Therefore, a single-State approach to their resolution is out of the question. The approach must be regional in concept and physical scope. Nothing but a broad, regional plan has any chance for success because on this water-deficient river, which is rapidly being depleted to the last drop, there are too many interrelated problems, involving too many States, too many interests, and too many people. Each is vigorously protecting its present and future welfare. A single nail is not sufficient to hold a house together. Single-phase legislation, although it may be a step forward in a long journey, will not suffice to meet the national responsibility to provide a regionwide solution to the water problems of the Pacific Southwest.

The Secretary of the Interior met the issue head on in his 1963 report entitled "Future Water Resource Development in the Lower Colorado River Basin," when he said:

The inadequacy of the Colorado River system to meet this region's continuing and rapidly growing water needs is already evident.

From personal observation of the Colorado River Basin I can tell you that the Secretary at that time knew what he was talking about. The Secretary's further conclusion that the availability of additional Colorado River water to Arizona "is no solution at all to the regional water problems (because) it merely temporarily moves the shortage from one place to another" is also valid.

Due to the extremely serious nature of the many interstate facets to the regional problems, since 1963 my colleagues in Congress have been urging the water people in the Upper Basin to work with their counterparts in the lower basin to develop a truly comprehensive basin-

wide plan to alleviate the Southwest's water problems. Although we did not agree with all of it, we were encouraged by the Secretary of the Interior's report entitled "The Pacific Southwest Water Plan," of late 1963, because it incorporated a regional approach. I know from personal contact with many of them, that since 1963 representatives of the seven basin States, the Upper Colorado River Commission, and many water and power agencies have worked many thousands of man-hours and traveled thousands of miles in attempting to develop the terms of legislation that could be supported by all seven basin States. The results of their agreements and compromises were supported by all States last year before the House of Representatives in H.R. 4671. This bill did not reach the Senate in the 89th Congress. However, in the 90th Congress, my bill, S. 1242, which is before this committee, and H.R. 3300, which is sponsored by my colleague, Congressman Aspinall, and is now pending in the House, incorporates a regional approach to a Southwest problem and contains the basic elements of the seven-State compromise of last year. And I might say that basically, Mr. Chairman, also the bills offered by Senator Moss and Senator Kuchel are in the same category.

Mr. Chairman, it should also be pointed out that S. 861 and S. 1409, introduced by my esteemed colleagues, Senator Kuchel, of California, and Senator Moss, of Utah, respectively, and my bill, S. 1242, while there are differences in some minor details which I believe can be adjusted, also incorporate the basic elements of the former seven-State compromise achieved during the 89th Congress. In fact, all of these bills are very close to H.R. 3300, except that my Senate colleagues and I have omitted the creation of the National Water Commission, since, as you know, S. 20 has already been passed by the Senate.

Since last year we in Colorado have continued to review our position with respect to two major problems that may have contributed to the failure of Congress to enact a Colorado River Basin project law last year. The first of these problems was the proposed authorization of Marble Canyon and Hualapai Dams. The second was the proposed feasibility study of a plan to import water from outside sources into the Colorado River system. On these two points, after much sober reflection, and in spite of serious disagreement among the citizens of Colorado and the Upper Basin States, we have again modified our position. We now agree to the elimination of Marble Canyon Dam from this legislation, but Hualapai Dam must be retained since it is the rock upon which the regional approach rests.

Congress must recognize the serious water problems of the entire Southwest and authorize a meaningful, early study of possible ways to augment the water supply of the Colorado River, and that provision for such a study must be included as part of legislation to authorize a Colorado River Basin project.

The construction of Hualapai Dam is extremely important to the resolution of the impending, regionwide water crisis of the seven Southwest States. The excess revenues from the sales of Hualapai hydroelectric energy will permit the establishment of a development fund which will (1) doubly insure the repayment of costs of the central Arizona project, (2) insure repayment of the costs of the Dixie project in Utah, (3) provide for repayment of costs of essential water

saving enterprises, such as channelization of the river, phreatophyte control, canal lining, project rehabilitation, et cetera, and (±) assist in augmentation of the water supply of the basin whether it be by importation, weather modification, desalination, or other means. A Colorado River Basin project without Hualapai Dam and a basin fund may be likened to a cart without a horse. Any proposal to defer construction of Hualapai in the face of existing facts and circumstances is begging the issue. The construction of Hualapai Dam and the changing of the boundaries of the Grand Canyon National Park to include the Marble Canyon area, as first proposed by Congressman Wayne Aspinall, chairman of the House Interior Committee, is a sensible and reasonable solution to the Hualapai Dam problem. Enactment of Senator Dominick's bill, S. 1243, which I am cosponsoring, in conjunction with the terms of S. 1242, S. 861, or S. 1409 will accomplish the same purpose.

It has recently been called to my attention that the Department of Water and Power of the City of Los Angeles has suggested and will submit testimony on the construction of pump-storage, peaking power facilities in conjunction with Hualapai Dam. I understand that the proposal also includes a partnership arrangement under which the public and private utilities of the Southwest would pay for installation of the generating facilities and provide transmission service at great savings in capital cost to the Federal Government. The plan will also increase accruals of revenues to the development fund. Although I realize that all details of this proposal cannot be known at this time, I believe it may constitute one way of maximizing the benefits to be derived from the damsite and water resource. Therefore, I have submitted an amendment to my bill which will permit the construction of Hualapai Dam and direct the Secretary of the Interior to study all aspects of the proposal of the City of Los Angeles, including marketing agreements, engineering feasibility, economics, et cetera, and to report back to the Congress before construction of the electrical generating works is initiated.

In view of all the prevailing circumstances and implications surrounding this legislation, I cannot support any Colorado River Basin project legislation that does not incorporate the authorization of a meaningful study of water importation and the Hualapai Dam. These two features are the pillars upon which rests the success of a regional plan for the Southwest's water future.

Other basic elements of S. 1242, S. 861, and S. 1409 are of vital importance to my State of Colorado. At this point I wish to briefly examine some additional features of S. 1242 that are essential parts of a regional approach to the solution of the water problems either present or imminent in the seven States of the Colorado River Basin.

(1) Title I explains the objectives of the bill. These objectives are regionwide—not localized to one State. Congress recognizes that there are water problems in the entire basin and directs the National Water Commission and the Water Resources Planning Council to give highest priority to plans for their relief.

(2) Title II provides for planning and investigation in the Southwest. Estimates of water availability and water needs of both areas of use and areas of origin would be made. The Secretary of the Interior

is directed to prepare a reconnaissance report of a staged plan of development to meet the needs defined in the investigations. The plan for the first stage should, among other things, include provision for 2.5 million acre-feet of water to meet the burden of the Mexican Water Treaty as a national obligation and make up losses of about a million acre-feet in the Lower Basin associated with the delivery of that water to Mexico. The Mexican Treaty obligation of 1.5 million acre-feet per year has become a bitter bone of contention as the available water in the river has been reduced by added uses every year. Colorado has insisted that uses of water from the Gila River in Arizona should be counted as part of the Lower Basin's apportionment. The Lower Basin States disagree and place a different interpretation upon the compact. We have considered that a clarification of this issue is necessary before any new Lower Basin projects are constructed in order to protect ourselves against any imposition of claims for water to fill the Mexican Treaty requirements. As negotiations with the Lower Basin States progressed it became apparent the internal conditions in Arizona were such that it was impossible for her representatives to reach agreement with the Upper Basin concerning accounting for waters used from the Gila River. If, under an import scheme, 2.5 million acre-feet can be brought into the river, this dispute will dissolve in the imported water. If even a study of such a plan is not possible, there will be another major lawsuit on the Colorado River commencing at the first occasion that terms of the Mexican Treaty are invoked by the Secretary and development in the Upper Basin is precluded. This is as inevitable as night following the day.

Only after reporting back to the Congress and findings that certain very stringent criteria are met can the Secretary proceed beyond a reconnaissance report on an import plan. Furthermore, the strongest and broadest criteria possible are provided to protect areas of origin which also will benefit materially from any plan that may be ultimately adopted.

(3) Title III would authorize construction of the Hualapai Dam about which I have already commented. It would also authorize the central Arizona project, including Hooker Dam in New Mexico. The aqueduct for the central Arizona project would be capable of transporting 2,500 cubic feet of water per second which is more than adequate to deliver the necessary supply. This part of the bill also includes a priority for 4.4 million acre-feet of water per year from the Lower Basin supply for the State of California. There is some disagreement as to whether this obligation would fall upon the Upper Basin in years of shortage. This is not the intention of the bill because it is strictly a matter of agreement between Arizona and California. As added insurance, however, I have included a provision to make it clear that any benefits of section 4(a) of the Boulder Canyon Project Act that the other States now possess shall not be disturbed in any way by the priority for 4.4 million acre-feet granted by Arizona to California under the terms of the bill.

Under this title the Dixie project in the State of Utah would be integrated into the Lower Basin development fund.

(4) Title IV would create a Lower Basin development fund and provides for cost allocations and repayment. As I have emphasized pre-

viously, this development fund is the heart of the entire regional program. Without the development fund, the regional program cannot exist.

(5) Title V is of paramount importance to my State of Colorado and the entire Upper Basin development program. Five reclamation projects would be authorized for construction in western Colorado. These are the Animas-La Plata, the Dolores, the Dallas Creek, the West Divide, and the San Miguel projects. These five projects are participating projects of the Colorado River storage project and have been on drawing boards for many years. Their water supply is well within the apportionment of water by the applicable compacts to the State of Colorado. Payout studies by the Department of the Interior show that repayment of costs from the Upper Colorado River Basin fund is well within Colorado's share of that fund. Department officials will supply engineering, financial, and economic details with reference to these projects. Needless to say, I support them wholeheartedly.

Senate Document No. 80 of the 75th Congress has long been the causative agent of many intrastate disputes between the east and west slopes of Colorado. Representatives of both sides of the Continental Divide, after seemingly endless negotiations, have agreed upon an interpretation that is included in section 501(e) of my bill.

Another subject of bitter dispute between the Upper and Lower Basins of the river is laid to rest in section 502. This section provides for a method of repayment to the Upper Basin fund of money that has been diverted therefrom to pay for diminutions in generation at Hoover Dam attributed to the filling of reservoirs of the Colorado River storage project. This section is the result of long and detailed negotiations between the representatives of the Upper and Lower Basin States.

(6) Title VI is another very important part of the bill so far as relations among the seven basin States is concerned. It took many months of detailed computation, studies, and negotiations by some of the most able water engineers and lawyers in the West and in the Department of the Interior to formalize the reservoir operating principles of section 602. I wish to thank and congratulate all of these capable people who participated in this most difficult task. The operating criteria are fair and reasonable to both basins. They do not violate any of the principles of either the Colorado River compact or the Upper Colorado River Basin compact. They do, however, provide direction to the Secretary with respect to how to operate storage reservoirs under the terms of the compacts and yet allow for sufficient flexibility that extraordinary changing conditions can be successfully met.

Mr. Chairman, in the above six enumerated items I have briefly mentioned those basic elements that are absolutely essential to a sound and reasonable approach to the resolution of the water problems of the Pacific Southwest. Without them I cannot support this legislation, because, if a regional approach is not to be had when all seven individual States either have serious problems now or on the horizon, then all States should wait until a program of sufficiently broad scope can be developed to assure them that some are not to have the water resource problems rectified at the expense of the others.

By now, the committee has probably ascertained that I cannot support the administration's proposal as expressed in S. 1004, or S. 1013.

After suggesting a regionwide remedy for the ills of a water-deficit river in his Pacific Southwest water plan in 1963 and then supporting a seven-State agreement in H.R. 4671 in 1966, it is beyond comprehension why the Secretary of the Interior suddenly suffered a blackout of foresight and reverted to a one-State approach a year later. With a clear conscience I could not join this about-face maneuver. The Secretary's proposal will not even cure the water problems of his own State of Arizona, because it will not supply enough additional water to replace all that is being "mined" from the ground. Arizona and the Southwest deserve better treatment than this. The administration plan does not provide for a Lower Basin development fund that would be adequate to aid in paying for other essentials of a regional program. Besides its inadequacy the proposal is not in the best national interest because it places the Federal Government in the business of thermal generation of electric energy. In spite of what you may be told by other witnesses, keep in mind that if the Federal Government is to prepay \$92 million for a share of capacity in a powerplant, the Government is in the thermal power business and is going to have a great deal to say about its operation and control. The Government would be getting into the thermal power business by the back door.

I concur in the views expressed by Colorado's Governor John Love, with respect to this year's administration plan at the House hearings on March 17, when he said:

Contrary to what was stated to this committee a few days ago, the Administration's proposal does not constitute a basis on which a comprehensive long-range solution to the many, varied and complex water problems of the basin can be developed and carried forward. The proposal advanced by the Secretary is actually a short-fused time bomb which will lead to destructive competition among the states of the Colorado River Basin. It proposes a piecemeal solution to a part of the problem of only one state.

I wish to thank you, Mr. Chairman, and my colleagues on the committee for this opportunity to express my views on the legislation now before it. I am sure that if this committee can endure the rigors of negotiating in the same constructive spirit as has been exhibited by the representatives of the water and power interests of the seven States in arriving at that seven-State supported compromise bill of last year, we can develop regional legislation of which the Southwest and the Nation can be proud.

Senator KUCHEL. Mr. Chairman, may I make a brief comment. I want to say, Mr. Chairman, that I have never heard a more lucid, scholarly statement by a distinguished member of this committee and a lawyer, in the field of water, than I have just listened to now and I want to congratulate my able friend from Colorado for what he has said, because in my judgment it will be of great value in this committee and the Congress wrestling with this problem. I congratulate him.

Senator ALLOTT. I thank the Senator very much.

Senator ANDERSON. Senator Moss.

STATEMENT OF HON. FRANK E. MOSS, U.S. SENATOR FROM THE STATE OF UTAH

Senator Moss. Mr. Chairman, thank you for this opportunity.

This committee has sat many hours over many years dealing with this problem. I want to say to begin with that I concur with the state-

ment made by the Senator from Colorado. The bill that I have introduced is very similar to the one that he has introduced and also the one the Senator from California has introduced.

We are faced with the task this morning of choosing between an increasing number of solutions to an old, but rapidly worsening situation. This problem is Arizona's lack of water, and I might say not only Arizona's lack of water but the lack of water for the other basin States. Two sets of bills provide a solution to this problem. Senator Hayden's bill and the administration bill would authorize the central Arizona project. The Kuchel, Allott, and Moss bills would authorize a series of projects and studies to meet the water needs of the Southwest. The reason we are taking this approach is not to aid passage of any "pet" reclamation projects or to guarantee excessive use of water. The reason for this regional approach is to settle issues, inseparably linked to Arizona's use of Colorado River water, that have resulted in controversy and litigation.

The first need at this hearing is to review the arithmetic of the situation. The decree in *Arizona v. California* confirms 7,500,000 acre-feet to the Lower Basin and an equal amount to the Upper Basin. The share of the Lower Basin is then divided into 4.4 million acre-feet to California, 300,000 acre-feet to Nevada, and 2.8 million to Arizona. This, of course, equals 7.5 million acre-feet. Now we have to add to that the 1.5 million acre-feet that must be delivered to Mexico under the terms of the Mexican Water Treaty. We also have to add the 1 million that is lost in evaporation between Lee Ferry and the border. Add these two amounts to the 7.5 million and it totals 10 million acre-feet. But, Mr. Chairman, that much water simply is not there.

Therefore, there is no way that the central Arizona project can be considered feasible unless there is some means of augmenting the flow of the Colorado River. What the administration's central Arizona project will do is borrow water from the Upper Basin States. However, if it makes sense for Arizona to import water from the Upper Basin States, it also makes sense to borrow water from water-surplus areas.

The struggle of the last 50 years for the waters of the Colorado River will not be solved without finding new sources of water. While schemes such as weather modification might some day be possible, no one can plan to irrigate with that water, and the need for water is immediate. Therefore, a study of water importation must be part and parcel of any new projects in the lower basin.

Interbasin transfer of water has been transformed into some sort of scare word in some quarters. There is nothing unique in interbasin transfers. Colorado River water is now being transferred into the Missouri River Basin, into the Rio Grande River Basin, and into the Great Basin. There should be nothing startling in the proposal to bring water from either the Columbia or northern California to supplement the flow of the Colorado. Indeed, one could say that the need for the importation is to satisfy a treaty with Mexico, not to meet any new uses. Therefore, importation would be to meet a national obligation—not a State or regional obligation.

I have proposed in the bill which I introduced that we look first to northern California's coastal region as a source of water importation. This would require development of water projects much sooner in this

part of California than would otherwise be necessary, but this could be of considerable benefit to the area of origin. It was the water association of this area in northern California that suggested that this might be the best way to solve the shortage in the Colorado River. The fact that the water comes from the State that is itself deeply concerned with the Colorado River, may allay some fears of representatives of the Northwest.

Mr. Ely, representing the State of California in the recent House hearings, stated:

We are prepared to have the Secretary, the Commission, anybody else look at a plan to take from the streams of northern California, two and a half million acre-feet for the rescue of the entire Colorado River Basin by putting that quantity into the main stream, even though the amount we get back out of it is less than 20 percent of what we contribute.

I think that is a commendable and statesmanlike position. In a sense, it embodies the real effort of the basin States to resolve their differences, to compromise, and to work out a regional bill. To discard this unity, so laboriously achieved, will not free the Central Arizona project from controversy. Nothing could be more controversial than building a project for which there is not enough water.

There are several minor features in S. 1409, which differ from the "consensus" bill as introduced by Senators Allott and Kuchel. While minor to the overall bill they are very important in Utah. Section 501(a) contains language which would enable the State of Utah and the Secretary of the Interior to fulfill their commitments to the Ute Indian Tribe. The Ute Indian Tribe of the Uintah and Ouray Indian Reservation has agreed to defer the development of a portion of their acreage until the Ute Indian Unit of the Central Utah project is constructed, if this is done within a reasonable time. The water which might have been used on these lands will now be available for use in the Bonneville unit of the Central Utah project. By reason of this agreement, it is necessary for the Ute Indian unit to be given a priority in planning, so that the report on this unit be completed by 1972. My bill so provides. This bill also restores language contained in H.R. 4671 pertaining to the Dixie project in southern Utah and provides for the integration of the Dixie project into a lower basin fund.

I would also like to add my support for the concept of revision of the boundaries of Grand Canyon National Park as contained in S. 1300 introduced by Senator Jackson. This should calm the fears of those who are legitimately interested in preserving stretches of free flowing river.

Mr. Chairman, Arizona is in desperate need of its water. But rivers and streams do not respect political divisions and this river basin must be considered as an entity. The failure to meet our water needs on a regional basis will merely prolong a crisis that will be before the committee and again and again. I am hopeful we can report a bill that will meet this problem by a comprehensive river basin plan. Let us provide a workable solution to this vexing problem, not further compound our dilemma.

Senator ANDERSON. Thank you Senator Moss.

Senator JORDAN?

Senator JORDAN. No statement.

Senator ANDERSON. Senator Fannin.

**STATEMENT OF HON. PAUL J. FANNIN, A U.S. SENATOR FROM THE
STATE OF ARIZONA**

Senator FANNIN. Mr. Chairman, I feel very privileged to have the opportunity to join my senior colleague in the statement that he has made this morning. I will not amplify upon that statement. At this time, Mr. Chairman, with your permission, I would like to submit a statement from Hon. Jack Williams, Governor of Arizona.

I would also like to submit resolutions from a larger number of Arizonans supporting the project. These resolutions come from various cities in our State, the league of cities and towns, numerous chambers of commerce, the presidents of our three universities, prominent groups and organizations and associations from throughout our State.

Senator ANDERSON. The first statement from the Governor will be included in the record. We will consider the other matters.

(Governor Williams' statement follows. The various resolutions are found beginning p. 748.)

STATEMENT OF HON. JACK WILLIAMS, GOVERNOR OF ARIZONA

Mr. Chairman and Committee Members, no governor of my State could appear before any committee of the Congress for a more important purpose than support of the Central Arizona Project. Our Senators, Carl Hayden and Paul Fannin, have made a joint statement to you in which I whole-heartedly concur and my own statement shall, therefore, be rather brief.

Long before I became Governor of the State of Arizona I was aware of the chronic and acute water problems which beset my State. Since early childhood I have lived on land that was reclaimed from the desert by application of the National Reclamation Program to the Salt River Valley. I am a product of the social and economic development which began with an assured water supply from the Salt River Project for 250,000 acres of land.

Throughout history, agriculture has been the mother of civilizations, and Arizona is no exception. Phoenix, a village of 11,000 people in 1910 when a dependable water supply first became available, is now home to nearly 600,000 people. Manufacturing, which was practically non-existent in Arizona in 1910, now produces an annual income of more than one billion dollars. Agricultural income is about half that amount.

The point is that water for farms started the whole dynamic process that has made Arizona the important part of our Nation that it is today but it is equally, if not even more, important now and in the future for urban and industrial uses.

Arizona's economy is in a period of transition from a primary dependency on agriculture and mining to a greater significance of light manufacturing, distributive industries, and trade. We are achieving a better balance among the factors of our income-producing economic activities. This, of course, means that a gradual change in the end uses of our extremely limited water resources is taking place, but this change of use cannot be depended upon alone to solve our problem.

At present, Arizona's municipal and industrial uses of water are estimated to be about 500,000 acre-feet annually. But, a recent survey made by the Arizona Interstate Stream Commission indicates that by the year 2000—only 33 years from now—the demand for municipal water in the three counties of the central part of the State alone, will have increased by half a million acre-feet. In other words, about 30 years from now our municipal water needs for direct use by people will be more than one million acre-feet per year.

Somehow, we must provide for that primary need for water by people, and at the same time maintain what we can of our relatively small farm patch, and it is a patch compared with most other states. Of Arizona's 72 million acre land area, we are able to irrigate only about a million and a quarter acres. We ask for no more at this time than to maintain as much as possible of that garden spot in our desert for as long a time as possible, while accommodating the increasing demands for water for our growing cities and industries.

The Central Arizona Project is designed to accomplish full utilization of my State's share of Colorado River water without increasing irrigated acreages.

In developing as we have, we have depended upon that Project becoming a reality. We have used our precious groundwater to keep alive until the day when our water from the Colorado River is brought into us.

For the last 20 years we have actively sought authorization of our Project. This Committee well knows of Arizona's eleven-year pursuit of her right in the Court and of the final outcome which gave us that right. We are now again before you asking to have that legal right transmuted from words on paper to wet water for our people.

We have come through the entangling web of very broad regional planning back to something less ambitious, but evidently more politically practical. We do not, thereby, abandon the principle of basin-wide cooperation as a long-range goal among good neighbors. Rather, we propose now to make the solution of Arizona's very urgent need a first and significant step toward the broader but some less pressing need of the region as a whole.

I agree with Governor Reagan, of California, that a way must and will be found for reasonable men to solve a common water problem in a spirit of co-operation and mutual understanding. I admire the courage and initiative with which California leaders have proceeded to meet the challenge of future water needs in their state by developing its own internal sources of supply.

In Arizona, we have done the same thing, except that having no available unused surface water to develop as a public function, we have depended upon a free enterprise development of groundwater. Admittedly this has led to an overuse of what has been demonstrated to be an exhaustible resource. But it has kept Arizona alive and growing, always with the thought in mind that it was an interim expediency pending the authorization of a project to bring in Colorado River water.

I am sympathetic, too, with the ambitions and rights of our Upper Basin friends, who depend upon the same Colorado River for their future well being. Our Arizona allocations of water from the River are not inferior to theirs, however. We ask only our share of water and then we pledge our support for whatever program can be equitably devised to augment the supply of water available to all seven of the States of the Basin.

The method of such augmentation will surely be arrived at in time without damaging another region. Most certainly, the technological capabilities which have made it possible for this Nation to harness the atom and reach for the moon are capable of solving water shortages in the southwest during the next few decades.

I know that Arizona has been accused of running off in all directions since last year and of having no one well defined policy toward water development. This simply is not true. Our policy is very clear indeed.

We want and are diligently seeking congressional authorization of the Central Arizona Project. We are pragmatic about it in that we will take that authorization in almost any practical, fair and reasonable form that our Senators and Representatives and the Congress devise. I subscribe to that policy as Governor, the State's legislative leaders subscribe to it, as do the Arizona Interstate Stream Commission and the Arizona Power Authority. A federal reclamation project is best for Arizona and for the other States of the Basin. We have been on the outside looking in while the national reclamation program has moved rapidly forward in California and the other Colorado Basin States. Not since 1947 has a major water project been authorized to serve Arizona's water needs.

But, in desperation, Arizona can no longer follow a single approach to its problem. Though we fervently hope that the Congress will act favorably this year, we are also studying the alternatives available to us.

The 28th State Legislature in March of this year enacted S. B. 204, authorizing a State Water and Power Plan, and giving our Stream Commission and Power Authority the necessary power and responsibility for developing and implementing the project. The Commissions will not act upon the plan until after December 15th of this year, so that the will of the Congress toward the bills now before you may first be known.

We are not telling the people of Arizona that the way will be easy for a non-federal project. We have made it abundantly clear to them that a federal project is the more desirable one. We understand that financing and construction of a State-controlled project may put a heavy burden upon all of our resources and energies. In return, our citizens, speaking through their political representatives at home, have made it clear that if a federal project is not forthcoming, they want to have a State plan in readiness.

This is our official Arizona policy, and it seems to me to be quite clear and well defined. There is nothing strange or untried about it. Indeed, it appears to me to be the policy which has been pursued very successfully by our friends in California for many years, where a vast system of State, federal and joint state and federal works already exists and is still being planned.

Gentlemen, I recommend and urge that you authorize a Central Arizona Project now, as quickly as possible. Arizona desperately needs it to maintain her contributions to the Nation and her place in the sun.

Senator ANDERSON. Senator Bennett.

Senator BENNETT. Mr. Chairman, I am not a member of the committee. I see Senator Hatfield on my left. Should he be given the privilege of a statement before I am called upon?

Senator ANDERSON. You may go ahead with your statement, Senator Bennett.

STATEMENT OF HON. WALLACE F. BENNETT, A U.S. SENATOR FROM THE STATE OF UTAH

Senator BENNETT. I appreciate the opportunity, even though I am not a member of the committee, to appear under these circumstances, to present my view on the various lower Colorado River project proposals that are before you.

I appreciate the opportunity, even though I am not a member of the committee, to appear under these circumstances, to present my views on the various lower Colorado River project proposals that are before you.

At the outset I would like to say that I think we should take a constructive approach helping to provide additional water to meet the needs of our friends from Arizona and California. There is one basic problem we face, however, which has already been discussed by others who have talked this morning.

The natural flow of the Colorado River soon will be inadequate to meet all the demands of the entire Colorado River Basin in which Utah has a major stake.

I fully support Utah's position and I will support the Colorado River Basin Act, which includes the central Arizona project which the committee is now considering, provided that the following legislative safeguards are included:

1. Congressional authorization of studies to augment the water supply of the Colorado River Basin.

2. Inclusion of an equitable criteria for the coordinated long-range operation of the Colorado River storage reservoirs.

3. Language making it clear that the Lower Basin projects shall in no way affect the division of water between the Upper Basin and Lower Basin States established by compact.

4. Language establishing that the planning report on the Ute Indian unit will be finished by 1972.

5. Language including the Dixie project and authorizing it to participate in the development fund.

6. The Upper Colorado River Basin fund be reimbursed for all expenditures diverted from it to meet so-called deficiencies in generation of power at Hoover Dam during the filling period of Glen Canyon Reservoir.

The State of Utah feels that we must have these legislative safeguards in any Lower Basin legislation so that Utah will have the right to proceed with the development of its entitlement of Colorado River water.

Of the five bills the committee has before it today, my examination and, in the opinion of Utah's water officials, the bill which best protects Utah's interests is S. 1409 introduced by my colleague, Senator Moss, who also is a member of this committee.

The other four bills have some excellent features, however, they also have some drawbacks from the point of view of the State of Utah, and some of them could be detrimental to my State.

I would like to expand on a few of my points so that the committee can be fully aware of what the State's position is.

First, the authorization of the necessary studies and completion of a reconnaissance report on plans to import water from sources outside the Colorado River Basin is very important. We particularly would like to see authorization for the preparation of a feasibility report on the importation of 4.5 million acre-feet of water from the north coastal streams of the State of California with 2 million acre-feet designated for uses en route and 2.5 million acre-feet allocated to the satisfaction of the Mexican treaty obligation and water losses in the Lower Colorado River Basin.

My second point, calling for an equitable criteria for the coordinated long-range operation of the Colorado River storage reservoirs is self-explanatory and is covered adequately in section 602 of S. 1409. Such criteria is important to the State of Utah in that it provides legislative recognition of vital provisions of the Colorado River compact and the Colorado River Storage Project Act.

Third, I hope that any legislation makes it clear that any guarantee made to the State of California can in no way add to the Lower Basin claim against the upper basin or adversely affect the interests of the Upper Basin.

My fourth point concerns the Ute Indian unit of the central Utah project which should be given priority in planning so that the planning report will be completed prior to 1972. This will enable the State of Utah and the Secretary of the Interior to fulfill their commitments to the Ute Indian Tribe of the Uinta and Ouray Indian Reservation.

The reason for this deadline is so that we hope we will not end up with another Dixie project which has been undergoing planning for the better part of half a century, and so that we don't end up with another 20- or 25-year planning period, as happened for the Bonneville unit of the central Utah project. The agreement with the Indian tribes ends in the year 2005. When you consider that a 15- or 20-year construction period is ahead of us there really is not much time to spend studying and restudying the problem before we get on with the task of construction so that the commitment can be met.

Fifth, any legislation must integrate the previously authorized Dixie project into the Colorado River Basin project and authorize it to participate in the development fund. As the committee knows, we authorized this project in the 88th Congress only to discover that because of technical difficulties the damsites have had to be shifted. The people of southern Utah have been waiting for the Dixie project since

the turn of the century and when we thought it was going to become a reality soon, the technical problems were discovered, causing more and more delays. If the project is included in the Lower Basin Act where it can receive the benefits of the development fund making Dixie feasible, many of the southern Utah water problems will be solved.

In addition, I should point out that I consider it necessary that all of the separable and joint costs allocated to recreation and fish and wildlife in the Dixie project shall be made nonreimbursable.

In order, among other items, to have Dixie included in the legislation we must have the high Hualapai Dam. This would also assure repayment for the importation of water and to establish the development fund to help pay for the augmentation of the Colorado River supply by whatever means may prove effective such as weather modification, desalinization, and so forth.

In that connection I would support an amendment to authorize that the Secretary of Interior be directed to study the feasibility of installing a pump-storage, peaking-power generating facility and transmission line at Hualapai. In addition he should report back to Congress after a certain specified time with any agreements that he may have reached with public and private utilities in the marketing area for paying for the cost of these installations and for marketing and transmitting the power.

My sixth and final point concerns reimbursement of deficiencies. The State of Utah insists, and I agree, that the Upper Colorado River Basin fund be reimbursed for all expenditures made to meet so-called deficiencies in generation at Hoover Dam during the filling period of Glen Canyon Reservoir.

Mr. Chairman, it is obvious from the position outlined here that I cannot support S. 1013, the administration bill. I feel and I think Utahans agree with me that the administration bill abrogates all of the agreements that have been reached among the seven States of the Colorado River Basin and their regional plan of development to help alleviate the ills associated with the water problems of the entire basin.

I found it rather strange that, after advocating the Pacific Southwest water plan and testifying in favor of H.R. 4671 in the 89th Congress—which included a basinwide Pacific Southwest regional approach to the water problems of the Colorado River Basin—the Secretary of Interior and the administration suddenly reversed themselves in the 90th Congress. They now are supporting a bill that will not even remedy the adverse water plight of the Secretary of Interior's own home State of Arizona.

Mr. Chairman, as I said at the outset, I would like to see that our friends and neighbors from California and Arizona be given every chance to develop the Lower Colorado River. However, in the interest of the State of Utah, I also think that we must have our own safeguards.

I had the honor to represent Utah when the Colorado River Storage Project Act was enacted and signed into law in 1956. I sincerely hope that, if these safeguards are included, I will have the additional honor of representing Utah when the Lower Colorado River Basin Project Act is enacted.

Thank you, Mr. Chairman. I appreciate this chance to appear. Since I am a fugitive from another committee, I would ask permission to withdraw at this time.

Senator ANDERSON. We are glad to see you come in, Senator.

Senator BENNETT. Thank you very much.

Senator ANDERSON. Senator Hatfield.

Senator HATFIELD. No statement.

Senator ANDERSON. Does the Representative, Mr. Udall, have a statement?

Mr. UDALL. No statement.

Senator MOSS. May I make a comment, Mr. Chairman? This illustrates the urgency we feel in the State of Utah, and I do appreciate my colleague coming before this committee to make this statement today, and to support, as he does, the points that I made earlier here.

Senator BENNETT. I appreciate that.

Senator ANDERSON. Senator Magnuson, of Washington, is unable to be here. He has submitted a statement.

(The statement referred to follows:)

STATEMENT OF HON. WARREN G. MAGNUSON, A U.S. SENATOR FROM THE
STATE OF WASHINGTON

Mr. Chairman: I appreciate the opportunity to appear before your Committee today and present testimony on the central Arizona project.

There can be no doubt that the State of Arizona is faced with water problems. Its people can no longer rely on ground water for all their needs. I have long supported Senator Hayden's efforts to obtain authorization for the central Arizona project so as to insure that Arizona can receive water to which it is legally entitled.

The history of this project has been long and arduous. As long ago as the 81st and 82nd Congress, Senator Hayden was instrumental in gaining Senate approval for the project. However, the legal argument over apportionment of the Colorado River water held up further Congressional consideration of the project until the United States Supreme Court, in a 1963 decision, established Arizona's legal rights to Colorado River water. If the State of Arizona is to make use of this water which is rightfully hers, under the *Arizona v. California* case, this project is necessary.

Arizona's plight has received the full attention of this Committee in the past. As recently as 1964 the Interior Committee reported a bill which would have authorized the central Arizona project.

Arizona's need for the central Arizona project reflects the problems inherent in developing land which is semi-arid. But our Nation's concern with water supply can no longer be this limited. Water has now become a national problem. Pollution, waste, drought, and floods do not respect geographical or political boundaries.

This Committee has recognized the national scope of our water problems by favorably reporting Senator Jackson's bill, S. 20, to establish a National Water Commission. I am proud to have co-sponsored that bill with Senator Jackson and over 50 other Senators.

The duties assigned to the National Water Commission reflect the national scope of water problems. The Commission is to establish projections of water requirements and identify the alternative ways of meeting these requirements. Consideration must be given to conservation, to more efficient use of existing supplies, to increased usability by reduction of pollution, interbasin transfers, desalting,

weather modification and waste water purification and reuse. This is a large assignment, but it is necessary if we are to bring order out of chaos in our quest for solutions to future water resource problems.

The Senate has unanimously passed S. 20, and I am certain that this Committee shares my hope that the House of Representatives will take early action on this important legislation.

While there can be no doubt that immediate approval of the project is necessary, I am concerned with the scope of some of the bills now before the Committee. A number of provisions are under consideration today which I do not believe are in the national interest.

I refer at this point to Senate bills S. 861, 1409, and 1242. These bills do not limit themselves to the authorization of the central Arizona project. Instead, they attempt to set up a Colorado River Basin Project Act which would affect the entire Western United States.

These bills would have Congress tell the National Water Commission that it is to give highest priority to plans and programs for the relief of water shortage in the Colorado River Basin. In addition, the Secretary of the Interior, under direction of the National Water Commission, would be directed to investigate sources of and means to augment the Colorado River water supply including importation from outside sources. These bills then go on to enumerate the need for some 8.5 million acre feet of imported water.

Mr. Chairman, I find it a bit ridiculous to establish a National Water Commission which is to determine where and what type of water shortage exists and then start telling it what its first order of business must be. Before the Commission has even had an opportunity to determine if there is a water shortage in the Colorado Basin, we would, under these bills, be telling it to plan water importation.

The National Water Commission, as envisioned in S. 20, is to consider all possible alternatives to resolving the Nation's and the Southwest's water problems. Weather modification, desalination and other alternatives must be fully considered. The Commission must also consider economic and social consequences of water resource development, including such things as regional economic growth and environmental influences. All of these basic duties and responsibilities would be distorted under these bills, because they set priorities, furnish a timetable and designate certain areas of the country for specific studies. If a truly national, objective and independent National Water Commission is to be established, then we should rely upon its expertise and sound judgment to develop priorities in finding solutions to our national water resource problems. We may be assured that the problems of the southwest will have a high priority.

I am, therefore, opposed to attaching these Water Commission and importation provisions to a bill authorizing the central Arizona project. Arizona has an immediate need for this project. The question of augmentation of existing waters is a long-range water supply problem which must be left to the National Water Commission to handle as part of its overall studies.

I do not feel qualified to comment on the specific details regarding the various proposals for constructing the central Arizona project. Nor is it appropriate for me, at this time, to recommend to the committee solutions to the problems of conservation versus economic development.

I am sure that the committee will do all in its power to insure that alteration of the lower Colorado River environment is held to a minimum.

Of the bills before you, only Senator Hayden's, S. 1004, and the Administration bill, S. 1013, concentrate exclusively on the development of the central Arizona project. I would hope that the committee will see clear to report a bill which reflects the best of S. 1004 and S. 1013.

Mr. Chairman, the people of the Northwest are concerned with the possibility that short-range solutions will be permitted to prevail in water resource programs. While they fully support Arizona in its attempts to procure that water

to which it is legally entitled, the Northwest is not ready to accept the idea that interbasin transfer studies are desirable as a necessary part of this project.

Mr. Chairman, let me again thank you for this opportunity to present testimony today.

Senator ANDERSON. Senator Dominick of Colorado has submitted a statement for the record.

(The statement referred to follows:)

STATEMENT OF HON. PETER H. DOMINICK, A U.S. SENATOR FROM THE STATE OF COLORADO

Mr. Chairman and Members of the Subcommittee: Thank you for permitting me to present this statement on the pending legislation for the Colorado River Basin Project. It is encouraging to see these hearings come so early in the 90th Congress. As you recall, central Arizona project legislation was reported favorably by the Bureau of Reclamation to Congress in 1947, twenty years ago. In fact the Senate has twice passed legislation which would authorize the Central Arizona project, once in 1950 and again in 1951, but neither measure was approved by the House of Representatives. We experienced a lull in legislation on this subject with the commencement of the Arizona v. California litigation in 1952. However, since the announcement of the U.S. Supreme Court opinion in 1963, and its decree in 1964, proposals are again flourishing. With the exception of the Department of Interior's 1967 position, we have been able to make strides consistently towards a basin-wide, long-range program—a Colorado River Basin Project, rather than a central Arizona project. The issues were resolved in H.R. 4671, the seven state compromise reported out by the House Interior Committee August 11, 1966. I would hope the gains we have made have not been lost, that this Congress will resolve two decades of legislative controversy.

The basin surrounding the Colorado River is one of the major basins of our country. It drains an area of approximately 242,000 square miles, encompassing portions of seven states. The Colorado River, some 1400 miles in length, has its headwaters in the high mountains of Colorado. But the River has tributaries in Wyoming, Utah, Nevada, New Mexico and Arizona as well as in the state of its origin.

At the outset of my remarks I wish to make it clear that Colorado stands united on the issues now presented to this subcommittee. I fully support the views previously presented by Senator Allott and by Governor Love. If I may, I would like to call to the attention of the subcommittee four basic principles for Colorado River Basin legislation which have been endorsed by the General Assembly of the State of Colorado in a Joint Memorial. Such principles support legislation which would:

1. Permit states in the Upper Colorado River Basin to deliver water at Lee Ferry without impairment of their own uses;
2. Return to the credit of said states funds which have been or may be expended from the Upper Colorado River Basin Fund to compensate for power deficiencies at Hoover Dam;
3. Program the augmenting of the Colorado River water supply; and
4. Provide for continuing water resource development in the Upper Basin States, including the immediate authorization for construction of five participating reclamation projects in Colorado.

With these principles, I am in accord. I cannot support any legislation which does not embody them.

Frankly, Mr. Chairman, Colorado has found itself to be the victim of a rather inequitable situation to date. It has been estimated that based on the historical flow of the River over the past 35 years, if the first 7.5 million acre-feet available are allowed to flow past Lee Ferry, there would be 6.3 million acre-feet remaining for allocation among the Upper Division states. I want to emphasize

I do not concede that the first 7.5 million acre-feet available necessarily must go to the Lower Basin. I merely use these figures to show that even assuming such to be the case, Colorado has been short-changed. If we further assume the loss of about 700,000 acre-feet through evaporation at Flaming Gorge, Glen Canyon and Curecanti Reservoirs, there remain approximately 5.6 million acre-feet for use by the Upper Basin states. By the terms of the 1948 Upper Basin Compact, Colorado is entitled to 51.75%, Utah 23%, Wyoming 14% and New Mexico 11.25% of the allocation to the Upper Basin. Therefore, Colorado's entitlement would be 2,898,000 acre-feet of the 5.6 million acre-feet. Colorado depletions before the 1956 Colorado River Storage Project Act amounted to approximately 1,700,000 acre-feet. The 1956 Act authorized 38,000 acre-feet for Colorado: including for Florida—16,000; for Paonia—10,000; for Silt—6,000; for Smith Fork—6,000; and nothing for Pine River. Total authorizations to Colorado since the 1956 Act are 134,000 acre-feet as follows: Colorado share of Savery-Pot Hook—26,000; Bostwick Park—4,000 Fruitland Mesa—28,000; and the Fryingpan-Arkansas—70,000; plus 6,000 for Ruedi Reservoir, Municipal and Industrial uses. The combined authorizations for Colorado under the 1956 Act and since that time are 172,000 acre-feet. The startling fact is that the comparable figure for Utah (whose entitlement is only 23%) is 225,000; for Wyoming (whose entitlement is only 14%) is 199,000; and for New Mexico (whose entitlement is only 11.25%) is 374,000. Colorado's authorizations are less than any of the other three Upper Basin states, even though our entitlement is greater than the other three combined. I am informed that existing Colorado depletions as of 1966 are estimated at 1,786,000 acre-feet and that uncompleted authorized federal projects amount to 140,000 acre-feet. The 1,926,000 acre-feet are well within Colorado's entitlement.

We in Colorado are more than a little water conscious. The headwaters of at least four of this country's major river systems arise within our borders: the Colorado, the Arkansas, the Rio Grande, and the Platte (a tributary of the Missouri). The Colorado court cases dealing with intrastate water issues are legion, a good portion of which concern appropriations from the Colorado River and its tributaries. Our legislature has been making efforts to solve conflicts between surface and ground water users. Of necessity we have been a party in many interstate disputes. In fact within the past two years, three of our neighboring states to the East and South have filed suit against Colorado in the U.S. Supreme Court regarding waters originating in Colorado. Certainly Arizona is not alone in having water problems notwithstanding the implications of S. 1004 and S. 1018 to the contrary.

It was with this background that Colorado was stunned when the Department of the Interior announced its short-sighted, one-sided program in February of this year. I believe the pattern of the 1967 House hearings, as well as what has been presented in the present Senate hearings, emphatically illustrates Interior's proposals have done more to disrupt than to soothe. It has been noted before but bears re-emphasizing that as recently as 1963, in a report to the House Interior Committee entitled "Future Water Resources Development in the Lower Colorado River Basin," the Secretary of the Interior said: "The inadequacy of the Colorado River system to meet this region's continuing and rapidly growing water needs is already evident." In blazing contrast to his present position, the Secretary admitted that the availability of additional quantities of Colorado River water to Arizona "is no solution at all to the regional water problems. It merely temporarily moves the shortage from one place to another." Interior's words are equally applicable today. Interior's program is not a basin-wide solution. It is strictly a temporary re-allocation of shortages:

It should be kept in mind that Colorado provides an estimated 70% of the virgin or undepleted flow of the River at Lee Ferry. Naturally, we are vitally interested in the development of the Colorado River Basin. Indeed, no state of the basin has endeavored with greater diligence or with a greater spirit of

compromise to resolve the basin conflicts into a new Colorado River Basin project. Yet, there is a limit. There will be no Colorado support for legislation which is not founded upon a basin-wide rationale.

An integral and inseparable element of any basin-wide plan acceptable to Colorado is the inclusion of the five Colorado reclamation projects. Representatives of water conservancy districts connected with these projects have already testified before this Subcommittee.

Parenthetically, I would not that the multi-purpose West Divide project near Rifle is but a short distance from the rich oil shale deposits in the northwest region of our state, I do not mean to detract from the other four projects nor to imply a greater significance for one than for another. However, in view of recent hearings and developments on the subject of oil shale, I am prompted to make brief comment. The feasibility report on the project estimates a period of approximately ten years following project authorization would be required for advance planning and major construction activities. Existing studies have shown that the water now available is inadequate to support an oil shale industry with its attendant municipal needs. With the announcement of the proposed 5-point oil shale program in January, 1967, and proposed leasing regulations May 7, 1967, further delay in the authorization of this project may seriously hamper oil shale development. This is not to say that the West Divide Project is designed as an oil shale project, for the needs of municipalities in the area are imminent, and the agricultural benefits and recreational facilities to be provided are in demand.

Mr. Chairman, these five Colorado projects have certain common factors. Each of the five was given priority in the completion of planning reports under the Colorado River Storage Project Act of 1956. Eleven years ago that Act, which was designed to permit the Upper Basin states to develop their full share of entitlements under the Colorado River Compact, directed the Secretary to conduct feasibility studies on a number of projects including these. Although the five have been under study for some twenty years, Bureau of Reclamation feasibility studies were more recently commenced and were completed between 1963 and 1966. In all five cases the feasibility reports concluded they were feasible from an engineering standpoint and economically justified. Each of these projects is multi-purpose in design as well as being located in a generally semi-arid area of the state. Additionally, the House Interior Committee, in H. Report No. 1849, dated August 11, 1966, said: "The Committee concludes that the five upper basin projects which will be authorized in this act are needed and will greatly enhance the economies of the areas which they will serve . . . They meet all of the standards and criteria established by the Committee and the Congress for authorization."

If authorized, these five projects would add a total of 384,000 acre-feet to Colorado's authorizations. Even with this added depletion, Colorado would be well within its share as allocated by the 1948 Upper Basin Compact.

I see no rational logic in the Administration's suggestion that three of the five projects be deferred pending review by a yet to be created National Water Commission. And while the Administration tacitly endorses the Animas-La Plata and Dolores projects by making it known it would not oppose them if included, these two are conspicuously absent from all Administration-sponsored bills on this subject before the 90th Congress. Frankly, Mr. Chairman, this is a prime example of the Administration's disregard for the interests and desires of the citizens of Colorado as well as the content of its own feasibility reports. The equities and entitlements on the River are known. These projects are within those limits and are internal considerations of the state of Colorado. They are not proper subjects for review by a National Commission. I wholeheartedly concur with the statement of Governor John A. Love before the House Interior Committee March 17, 1967, wherein he said:

"We have asked ourselves, and we ask you, Why should the State of Colorado be singled out for such special consideration by a proposed National Water Commis-

sion? If our development must halt pending a study of our problems by such a commission, then we think in all fairness that water development throughout the United States should meet a similar fate, whether it be the Central Arizona Project, projects in the Pacific Northwest, or Federal projects anywhere in this country."

The details of S. 1242, of which I am a co-sponsor, have already been presented to this Subcommittee. I will not repeat them here, but I want to re-emphasize that it contains the basic elements of the seven-state compromise found last year in H.R. 4671. I also make reference to my bill (S. 1243) which, although it is not specifically listed as a part of these hearings, necessarily must be considered. S. 1243 would extend the boundaries of the Grand Canyon National Park to the North, South and West. Such an extension would encompass the former Marble Canyon dam site. It would also include the Vermillion Cliffs formation west of the present park. Earlier in these hearings, Secretary Udall mentioned S. 1300, a boundary extension bill which would add only 28,300 acres to the park. My bill would affect some 80,000 acres. Not only would S. 1243 enlarge Grand Canyon National Park, but it would place lands now within Grand Canyon National Monument and certain portions of the west end of Grand Canyon National Park under laws now governing the Lake Mead National Recreation Area. The result would be a park and recreation area about 375 miles long, following the Colorado River. Clearly, my bill as a companion to S. 1242, or either S. 861 or S. 1409 with some minor changes, would provide a solution to the controversy over dam sites which has surrounded this project.

As was previously pointed out in these hearings, Colorado has modified its position in two respects since the end of the 89th Congress. First, despite serious disagreement among our own citizens, we have solidified our position to the extent of recommending the substitution of a reconnaissance study rather than a feasibility study on the subject of water augmentation to the Basin. Second, we have agreed to recommend elimination of the proposed Marble Canyon Dam.

Though some would have us believe otherwise, there can be no reasonable doubt as to the need for water augmentation of this water-deficient basin. It is commonly accepted that the negotiators of the Colorado River Compact in 1922, in allocating 7.5 million acre-feet to the Upper Basin and 7.5 million acre-feet to the Lower Basin, over-estimated the average annual virgin or undepleted flow at Lee Ferry, believing the quantity to be some 17 million or more acre-feet. Previous Senate and House hearings are replete with figures on historical flows. Annual virgin flows at Lee Ferry have fluctuated widely since 1896, varying from 5.6 million to 24 million acre-feet. Of course, for any degree of reliability some system of averaging must be used and different long term averages have been computed according to various base periods. Parenthetically, I might add that only four years ago, we completed one of the lowest ten-consecutive-year periods on record (1954-63) when the average annual virgin flow was only 11.8 million acre-feet. The other period was 1931-1940. Frankly, I believe the real significance conclusion is that even though the long term annual average since 1896 is about 14.9 million acre-feet, the progressive 10 year average of virgin flow from 1933 through 1965 has remained below this figure.

Noteworthy for careful consideration by this Subcommittee are the conclusions of the House Interior Committee in reporting out H.R. 4671 on August 11, 1966:

It seems to the Committee that this presently thriving, prosperous area of our Nation is on a collision course with economic disaster unless this water gap can be closed by augmentation of the Colorado River Basin water supplies * * *.

"If economic disaster in the Lower Colorado River Basin is to be avoided, then studies of all possible means of augmentation of Colorado River water supplies must be initiated at once and expedited to the greatest possible extent * * *.

"This particular water development program has added urgency because of the desperate water supply situation existent throughout the Colorado River Basin."

I have heard the argument expressed that a National Water Commission study is to be favored over a regional study by Interior for the reason that Interior has already acknowledged there is a need for augmentation. Clearly there is a need. The crux of the problem is whether augmentation is to come from importation, weather modification, desalinization, a combination of one or more of these, or otherwise. I don't believe a study by any national water commission is the proper solution. S. 20, which passed the Senate February 6, 1967, directs a national commission to review present and anticipated water problems, make projections of water requirements and identify alternative manners of meeting requirements throughout the United States—all within five years. That is a rather sizeable assignment. But the Colorado River Basin needs an in-depth, concentrated water augmentation study *now*. No other river basin is in such critical shape. Moreover, water problems tend to be regional or sectional, and unique to particular areas of the country. Solutions obviously will have some geographical limits.

Each time the word "importation" is mentioned, shudders run through the hearts of the distinguished Senators from our northwestern states. Let the record be clear that this is one Senator who is looking more and more to the potential usefulness of weather modification for augmentation. I say this because it seems to me weather modification may be one practical solution. Importation raises some terrific problems, and desalinization would seem to be somewhat curtailed by mileage limitations from salt water bodies.

Colorado, due to the nature of its geography and topography is particularly adapted to becoming another source of water under a weather modification program. Such a program could reasonably be expected to increase precipitation significantly in the locality where conducted. Benefits would inure to the entire Colorado River Basin.

The tremendous potential of weather modification was demonstrated during Senate Commerce Committee hearings in 1965 and 1966, and in hearings before this Committee last year. I was delighted to sit as chairman for the portion of the Commerce Committee hearings held on S. 23 and S. 2916 in my home state of Colorado in March and April of 1966. S. 2916 was reported by the Commerce Committee and passed the Senate, but unfortunately the House failed to act on the bill. I was a co-sponsor of both S. 23 and S. 2916 in the 89th Congress and am currently a co-sponsor of S. 373, a bill similar to S. 2916. I am presently drafting legislation which would establish a three-year pilot project in weather modification for specific areas within the Upper Colorado River Basin. While I do not envision weather modification as a total solution to the water problems of the Colorado River Basin, I do envision it as making a significant contribution in solving the crisis.

All we ask for at this time is a reconnaissance study of the various possibilities for augmentation. We seek no commitment that one method of augmentation be substituted for another or that recommendations be confined to a single solution.

In testimony during this hearing the Secretary of the Interior has again recommended deferral of the Hualapai dam pending review by a National Water Commission. The Secretary asserts deferral of a decision on the Hualapai need not affect authorization of the central Arizona project, nor would it be critical to long range plans for the Colorado River Basin. I submit such a deferral will affect authorization and I question whether the Secretary at this point has long range plans for any part of the Basin other than Arizona.

Aside from the other benefits arising from the construction of Hualapai, and our desire not to waste the vast source of energy evidenced by the falling waters of the Colorado River, this dam is most important to the creation of an adequate development fund to assist in the future augmentation programs we all know will be necessary. The people of Colorado must receive some assurance that the Colorado River Project will create such a fund.

This Subcommittee has received testimony on Interior's proposed prepayment power arrangements with non-federal interests for the output of a projected thermal power plant. I have a table furnished to me by Mr. Ival Goslin, Executive Director of the Upper Colorado River Commission, which compares the Hualapai dam as planned by the Bureau of Reclamation and the power prepurchase plan of the Secretary of the Interior. I would ask that this table be included in the record at this point in my remarks.

Central Arizona project—Comparison of Hualapai Dam and power prepurchase plans

	Federal prepayment, 400-megawatt plant	Hualapai, 1,500 megawatts
Construction cost (exclusive of aqueduct system).....	¹ \$91,950,000	² \$539,839,000
Annual cost:		
50-year amortization of capital costs.....	2,835,000	³ 18,734,000
O.M. & R.....	⁴ 6,566,000	⁵ 8,032,000
Total annual cost.....	9,401,000	³ 26,766,000
Power rates (mills per kilowatt hour): ⁶		
Irrigation pumping.....	3	2.5
M. & I. pumping.....	5	3.8
Commercial power.....	5	6.0
Irrigation water rate (per acre-foot).....	\$10	\$10
M. & I. water rate (per acre-foot) ⁴	\$56	\$50
Payout period, power feature (year):		
Standing alone.....	38	38
With Hoover, Parker-Davis revenues ⁶	23	30
Development fund: ⁷		
Year 2025, including Hoover, Parker-Davis.....	\$499,983,000	\$768,166,000
Contribution of project power component.....	0	(370,109,000)
Year 2047, including Hoover, Parker-Davis.....	1,233,301,000	1,849,343,000
Contribution of project power component.....	(109,557,000)	(845,300,000)

¹ Breakdown of costs (power prepayment arrangements):

Construction.....	\$91,950,000
Powerplant.....	(42,000,000)
Shared transmission.....	(22,300,000)
Federal-built transmission.....	(27,650,000)
O.M. & R.....	6,566,000
Powerplant.....	(5,858,000)
Shared transmission.....	(216,000)
Federal-built transmission.....	(492,000)

² Multipurpose structure, includes costs for fish and wildlife and recreation:³ Based on power allocation only.⁴ Differences in energy rates:

Irrigation pumping energy: Rates under both plans were set to recover O.M. & R. plus a portion of investment costs. O.M. & R. is much higher under the fossil fuel plan—consequently, the higher rate is required.

M. & I. pumping energy: Rates are set to recover total costs of producing energy including interest during construction and interest on the unpaid balance during the payout period. The prepayment proposal is basically a more costly plan than the Hualapai plan and requires a higher mill rate to achieve repayment. Under the prepayment proposal, the 5 mill rate is slightly in excess of minimum payout requirements, and this excess results in an accelerated power payout.

Commercial energy: The rates of 5 mills and 6 mills reflect primarily a difference in plant factors associated with power generation. The prepayment proposal assumes an 85-percent plant factor while commercial energy is available from the Hualapai plant at about a 36-percent plant factor. More installed capacity is required to produce a given amount of energy with a low plant factor than is required with a high plant factor. Consequently, a composite kilowatt-hour rate to recover both energy and capacity charges will be higher with a low plant factor powerplant than with a high plant factor powerplant.

⁵ Municipal and industrial water rate differences: In both cases the M. & I. function contributes surpluses to meet irrigation deficits. Although sufficient power revenues are available from power under the Hualapai plan to cover all irrigation deficits, the \$50 rate which is slightly in excess of costs has been traditionally used. Under the prepayment proposal an increase over the \$50 is required in order to meet the irrigation deficit. The \$56 rate was determined necessary to meet this increased requirement.

⁶ Power feature payout with Hoover, Parker-Davis revenues (earlier payout of prepayment proposal). Hoover, Parker-Davis revenues, when incorporated into the revenues available to repay power facility costs, constitute a much larger portion of repayment revenues under the prepayment proposal than under the Hualapai plan. When these additional revenues become available in 1991, the unpaid power balance would be \$74,154,000 under the prepayment proposal and \$335,899,000 under the Hualapai plan. After combining Hoover, Parker-Davis revenues of approximately \$12,600,000 with project revenues, annual payments of about \$16,000,000 would accomplish payout in an additional 5 years on the steamplant, and the Hualapai plan would require an additional 12 years with annual payments of approximately \$33,000,000.

⁷ Development fund:

Under the Federal prepayment plan, the development fund accumulation in year 2025 represents the contribution from surplus Hoover, Parker-Davis revenues only. All central Arizona project revenues are devoted to project repayment. During the project repayment period, the prepaid power arrangements contributed \$72,337,000 in surplus revenues to assist in repayment of irrigation costs of the central Arizona project. After the year 2025, central Arizona project surplus revenues are deposited in the development fund, together with those from Hoover, Parker-Davis. During the period 2025-47, surplus revenues from the prepaid power arrangements would total \$109,557,000.

Under the Hualapai plan, all Hualapai power revenues would go into the development fund and repayment of Hualapai would come from the fund. By the year 2025, development fund revenues, in addition to repaying Hualapai power costs and providing \$101,743,000 financial assistance to irrigation repayment, would amount to a balance of \$768,166,000. Of this, \$370,109,000 would be the contribution of Hualapai power revenues. If the financial assistance to irrigation were charged specifically against Hualapai revenues,

Mr. Chairman, this table shows a comparison of the financial aspects of the power features as envisioned in S. 1242 with Hualapai Dam as planned by the Bureau of Reclamation and the powerplant of S. 1013, plus a development fund into which would be integrated the Hoover, Parker, and Davis revenues after 1991. The assumption is made that Hoover, Parker, and Davis revenues *will be available* to go into a development fund. The Administration bill *does not so specify*. One might reasonably ask, what happens if Congress decides otherwise?

The table is also based upon the assumption that Hoover power rates will be raised from the present average rate of about 2.64 mills per kwh to about 4 mills per kwh.

The most important information revealed by the table pertains to the size of the Development Fund under the two alternatives: (1) prepaid purchase plus Hoover, Parker and Davis revenues, and (2) Hualapai Dam plus Hoover, Parker, and Davis revenues.

Under the prepaid purchase plan, at year 2025 (approximately 50th year), the powerplant has contributed *nothing* to a Development Fund, while Hoover, Parker and Davis provided \$499,983,000. In contrast, under the Hualapai plan at year 2025 the Fund would have a balance of \$768,166,000 of which \$370,109,000 or 48% would come from the Hualapai hydro-powerplant. The net advantage, of course, amounts to \$370,109,000 in favor of Hualapai.

Twenty-two years later (year 2047) under the prepaid purchase plan the fund would have \$1,233,301,000 of which only \$109,557,000 or 8.8% would have come from thermal power revenues. However, the Hualapai would have a fund of \$1,849,343,000. Of this sum \$845,300,000 or almost 46% would be as a result of the Hualapai hydro-power revenues.

Frankly, although both plans standing alone would pay out their power features within 38 years, under the prepaid power plan all Central Arizona Project revenues have to be devoted to project repayment and \$72,337,000 in surplus revenues must be directed to assist in repayment of irrigation costs. Note that the balance in the development fund is zero.

Under the Hualapai plan, all revenues go into a development fund and repayment is made from that fund. By year 2025 the Development fund in addition to repaying Hualapai power costs and providing \$101,743,000 from M and I revenues to financially assist irrigation, would have a balance of \$768,166,000. Between the years 2025 and 2047 Hualapai would contribute an additional \$475,191,000 to the development fund. The \$101,743,000 assistance to irrigation results from the fact that under the Hualapai plan, the \$50 rate for M & I water has an excess revenue component in it. On the other hand, under the prepaid power plan, the M & I water rate must be \$56 unless an ad valorem tax is imposed on the project beneficiaries.

Clearly, the prepay power plan is poor economics in comparison to Hualapai. In the year 2025 Hualapai would have contributed \$370 million to a development fund for the Basin, whereas the prepay power plan contributes nothing. By 2047 Hualapai would contribute \$845 million to the fund, as opposed to a mere \$110 million from the prepay power plan. Few good hydro-electric sites are left. Let us use efficiently those which we do have available.

Mr. Chairman, the moratorium on construction at the Hualapai site imposed in 1964 by Public Law 88-491 expired December 31, 1966. I am advised that applications are pending before the Federal Power Commission requesting permission to begin construction of hydro-electric powerplants on behalf of non-federal public agencies. If we do not utilize the site, it is possible the Federal Power Commission may issue licenses for construction. It makes good sense to authorize the Hualapai and utilize its many advantages including creation of an adequate development fund.

The proposal submitted during these hearings by the Los Angeles Department of Water and Power is admirable. It envisions a unique partnership between the

Footnote continued from preceding page.

this figure would be \$101,743,000 less, or \$268,366,000. Between the years 2025 and 2047 the contribution of revenues from Hualapai would be an additional \$475,191,000.

The following summary is a direct comparison of the power contributions of the 2 plans, encompassing both contributions in financial assistance to irrigation and to the development fund in general:

Plan	Year 2025	Year 2047
Federal prepayment.....	\$72,237,000	\$181,894,000
Hualapai.....	370,109,000	845,300,000

government and private and public utilities of the southwestern United States. The concept of pumping water back into the reservoir during off-peak periods for later release with water required for down-stream use as demand reaches its peak puts to greater use water which otherwise might flow into Mexico. Additionally, it appears great savings to the taxpayer may occur, and deposits into the development fund would be increased. Figures presented by the Los Angeles Department of Water and Power indicated the present projected cost of the Hualapai of \$540 million could conceivably be reduced to as low as \$254 million, while at the same time increasing power capacity from 1500 to 5000 megawatts. I am considering supporting an amendment to S. 1242 which will direct the Secretary to study these proposals and report back to Congress before construction on the hydro-electric generating and transmission facilities can be started and which would preclude any construction on the Hualapai Dam and appurtenant hydro-electric generating facilities until the Secretary certifies to Congress that there will be available revenues adequate to pay all operation and maintenance costs incurred by the United States and repay all reimbursable costs within 50 years.

Again, thank you Mr. Chairman and Members of the Subcommittee for allowing me to comment on this legislation. Let us get on with the task at hand.

Senator ALLOTT. I think everyone has before him an analysis of the five bills before the committee, which was prepared by Mr. Paul L. Billhymer, general counsel of the Upper Colorado River Commission. I would like to ask consent that this comparative analysis be placed in the record from the forepart of the proceedings. Perhaps immediately following my remarks.

Senator ANDERSON. Without objection that will be done. I hope we don't include too many exhibits in the record.

Senator JACKSON. It is understood that it is an analysis by whom?

Senator ALLOTT. It is an analysis prepared at the request of the Upper Colorado River Commission by Paul L. Billhymer, general counsel.

Senator JACKSON. Is this it? I am informed that this is the staff analysis.

Senator ANDERSON. Senator, will you submit that analysis along with the staff analysis. I think we will put them both in the record.

(The documents referred to follow:)

UPPER COLORADO RIVER COMMISSION, SALT LAKE CITY, UTAH

PREFACE

The attached chart compares certain Bills that have been introduced in the Senate in the First Session of the 90th Congress to authorize a Colorado River Basin Project and/or a Central Arizona Project. These Bills are:

S. 861 by Senator Kuchel of California

S. 1004 by Senator Hayden of Arizona

S. 1013 by Senator Jackson of Washington by request of the Administration

S. 1242 by Senator Allott of Colorado

S. 1409 by Senator Moss of Utah

The purpose of the Chart is to provide a ready reference for comparative purposes. For this reason it is advisable to have the full texts of the Bills available when using the chart in the event a detailed check of differences is desired.

Minor differences in wording may have been overlooked or ignored. Those differences in wording that have been included are a matter of judgment as to importance. This is another reason why the reader may desire to have the texts of the Bills in order that an independent exercise of judgment can be made.

S. 1242 (Allott) was chosen as the base Bill with which others were compared for no particular reason other than that it is similar to H.R. 3300 (Aspinall) of the 90th Congress and to H.R. 4671 of the 89th Congress which was used as the base Bill in a previous comparison chart made by our office.

PAUL L. BILLHYMER,
General Counsel.

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
TITLE I				
Colorado River Basin Project: Objectives	Same	Omitted	Omitted	Same as S. 1242
SEC. 101		SEC. 1	SEC. 1	
Short title, "Colorado River Basin Project Act."	do	Short title, "Central Arizona Project Act."	Short title, "Central Arizona Project Act."	Do.
SEC. 102	do	Omitted	Omitted	Do.
Congress recognizes the water shortage in the Colorado River Basin and directs the National Water Commission and Water Resources Council to give highest priority to plans and programs for relief of such shortage. Consultation is to be with State and Federal entities affected. Purposes of the program are, among others, to (1) regulate flow of the Colorado River; (2) control floods; (3) improve navigation; (4) provide storage and water delivery for reclamation of lands, supplemental supplies, and municipal and industrial supplies; (5) improve water quality; (6) provide basic outdoor recreation; (7) improve fish and wildlife conditions; and (8) provide for generation and sale of hydroelectrical power.				
TITLE II				
Southwest Investigations and planning	do	do	do	Do.
SEC. 201	(a) Same	do	do	(a) Same as S. 1242.
(a) The Council consulting with the Commission under sec. 103 of the Water Resources Planning Act within 120 days from effective date of this act shall establish principles, standards, and procedures for the investigations, plans, and reports authorized by this section and sec. 203. The Secretary, under Commission direction and conforming to the established procedures, is authorized and directed to—				
(1) Estimate Colorado River Basin long-range water supply available for consumptive use, current water requirements, and growth rate of water requirements to year 2030.	(1) Same	do	do	(1) Same as S. 1242.

(2) Investigate sources and means of supplying Colorado River system water requirements including loss reduction, importation from outside sources, desalination, weather modification, and other means;	(2) Same.....	do.....	(2) Same as S. 1242.
(3) Investigate undeveloped Colorado River water projects, including tributaries, for replacement or exchange;	(3) Same.....	do.....	(3) Same as S. 1242.
(4) Investigate, with other agencies, the feasibility of plans for maintaining adequate water quality in the Colorado River system;	(4) Same.....	do.....	(4) Same as S. 1242.
(5) Investigate means of providing prudent water conservation practices in Colorado River system;	(5) Same.....	do.....	(5) Same as S. 1242.
(6) Investigate available water supply from outside sources for import, including the ultimate needs of these areas of origin for all purposes, and estimating availability of supply for import into the Colorado River system;	(6) Same.....	do.....	(6) Same as S. 1242.
(7) Investigate needs of areas outside Colorado River system for feasibility study by enroute importation.	(7) Same.....	do.....	(7) Same as S. 1242.
(b) Secretary is directed to make a reconnaissance report with staged plan to satisfy sec. 201(a) in conformity with sec. 202;	(b) Same.....	do.....	(b) Same as S. 1242 with "this judgment", reading "this judgment",
(c) Plan of 1st stage is to include, but not as a limit, import works for 2,500,000 acre-feet annually to the Colorado River below Lee Ferry for use including satisfaction of the Mexican Treaty and losses associated therewith, and such plan may include (1) up to 2,000,000 acre-feet annually in the Colorado River for use in the lower basin; (2) up to 2,000,000 acre-feet annually in the Colorado River system for the upper basin, directly or by exchange; and (3) up to 2,000,000 acre-feet annually to serve enroute users if the Secretary finds need and marketability.	(c) Same.....	do.....	(c) 1st-stage plan calls for the importation of 4,500,000 acre-feet from northern California of which 2,500,000 acre-feet is for the Colorado River below Lee Ferry for the Mexican Treaty and losses and 2,000,000 acre-feet for enroute. No provision is made for importation of the quantities set forth in items (1), (2), and (3) of sec. 201(c) of S. 1242.
(d) Congress declares Mexican Treaty obligation is a national obligation. Upper and lower division is relieved of the III(c) Colorado River compact obligation whenever sec. 306(b) proclamation is made.	(d) Same.....	do.....	(d) Same as S. 1242.
(e) Secretary is to make annual progress reports to the Commission, President, and Congress.	(e) Same.....	do.....	(e) Same as S. 1242.

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
TITLE II—continued				
SEC. 202				
(a) Areas of origin of water from which water is to be taken are to be protected by the Secretary in any plan and assistance from development fund made.	(a) Same.....	Omitted.....	Omitted.....	(a) Same as S. 1242.
(b) Water uses within area of origin shall have 1st priority unless changed by interstate agreement.	(b) Same.....	do.....	do.....	(b) Same as S. 1242.
SEC. 203				
(a) By Dec. 31, 1970, the Secretary shall submit the reconnaissance report on the 1st stage to the Commission, affected States, and Federal agencies for comments and recommendations which are to be made within 6 months of receipt of the report.	(a) Same.....	do.....	do.....	(a) Same as S. 1242.
(b) After receiving the comments and recommendations, but not later than Jan. 1, 1972, the Secretary shall transmit the report and all comments to the President, and, through him, to the Congress. All shall be printed as a House or Senate document.	(b) Same.....	do.....	do.....	(b) Same as S. 1242.
(c) Secretary to thereafter prepare a feasibility report on 1st stage if he finds water supply surplus exists in excess of area of origin needs, benefits exceed costs, and repayability under titles III and IV exist. Such report is to be submitted to the Commission and affected States and Federal agencies not later than Jan. 1, 1973.	(c) Same.....	do.....	do.....	(c) Same as S. 1242.
(d) After receipt of comments on feasibility report, but by June 30, 1973, the Secretary shall send report to the President and, through him, to the Congress. All shall be printed as a House or Senate document.	(d) Same.....	do.....	do.....	(d) Same as S. 1242.
SEC. 204				
Authorizes the appropriation of such sums as are necessary for carrying out the purposes of title II.	Same.....	do.....	do.....	Same as S. 1242.
TITLE III				
Authorized units: Protection of existing uses.....	do.....	do.....	do.....	Do.

SEC. 301

Secretary authorized to construct, operate, and maintain lower basin units of the Colorado River Basin project described in secs. 302, 303, 304, 306, and 308.

SEC. 302

Hualapai Dam on the main stream is to be built so as to have a surface elevation of not more than 1,866 ft. above mean sea level. Fluctuations of the reservoir level are restricted to 10 ft. No diversions are allowed from such reservoir except for incidental use in the immediate vicinity. Such construction is consistent with act of Feb. 26, 1919.

SEC. 303

- (a) \$16,308,000 to be transferred to Hualapai Tribe, drawing 4 percent for 23,000 acres to be used for the Hualapai unit.
- (b) Provides for paved road to Hualapai Reservoir. Allows the Hualapai Tribe up to 25,000 kw. for tribal resale on reservation only. Tribal council to notify Secretary of tribal requirements for 3-year periods in advance, beginning with date of availability of power. Power not reserved may be sold by Secretary for benefit of development fund.
- (c) Except for dam and reservoir site, operating campsite, and townsite, all minerals other than sand and gravel and building materials within the areas used by the United States are reserved to the tribe. Protection is to be afforded U.S. interest in the Hualapai unit in any leases, permits, license, etc., for mineral exploration and extraction issued by the tribe.
- (d) If written request is made by Hualapai Tribe, they are to have exclusive rights to develop the recreation potential and control access to shoreline. The tribe cannot charge or restrict use of access road. Use of water areas of project under control of Secretary.
- (e) Land area of the unit may be used by the tribe subject to the construction and operation of the project and townsite.
- (f) Land no longer needed for project reverts to tribe.
- (g) No payment hereunder, or reservation by tribe, or restoration to tribe may be used as offset to any other tribal claim against the United States. Payment constitutes full, fair, and reasonable payment for use of tribal lands by the United States.

do	do	do	Do.
Same with the addition of a provision restricting power of Federal Power Commission to issue a license between Glen Canyon Dam and Lake Mead.	do	Omitted. (NOTE.—Sec. 7 makes the Federal Power Act inapplicable to the reach of the Colorado River from Glen Canyon to Lake Mead unless otherwise provided by Congress.)	Do.
(a) Same	do	Omitted	(a) Same as S. 1242.
(b) Same	do	do	(b) Same as S. 1242.
(c) Same with minor wording change.	do	do	(c) Same as S. 1242.
(d) Same	do	do	(d) Same as S. 1242.
(e) Same	do	do	(e) Same as S. 1242.
(f) Same	do	do	(f) Same as S. 1242.
(g) Same	do	do	(g) Same as S. 1242.

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
<p>(b) Funds transferred to tribe and any per capita distribution thereof shall be exempt from State and Federal income taxes.</p> <p>(i) No payment shall be made until the provisions of this act have been accepted by resolution by the Hualapai Tribe. If such resolution is not adopted within 6 months, litigation instituted regarding acquisition of tribal lands. Payments offered herein and other benefits set out are not to be used as evidence of value or recognizing any tribal rights to compensation.</p>	<p>(h) Same.....</p> <p>(i) Same.....</p>	<p>Omitted.....</p> <p>do.....</p>	<p>Omitted.....</p> <p>do.....</p>	<p>(b) Same as S. 1242.</p> <p>(i) Same as S. 1242.</p>
<p>(a) Central Arizona unit shall consist of (1) main canal from Lake Havasu of 2,500 c.f.s. capacity, subject to enlargement if report shows improved benefit-cost ratio, enhancement of Arizona to divert its water, and can be financed outside basin fund and at no additional cost to water and power users in California and Nevada; (2) Orme Dam and Reservoir; (3) Buttes Dam and Reservoir which is to be operated subject to the Globe decree; (4) Hooker Dam and Reservoir with capacity of 98,000 acre-feet subject to enlargement; (5) Charleston Dam and Reservoir; (6) Tucson aqueducts and pumping plants; (7) Salt-Gila aqueduct; (8) canals, regulating facilities, powerplants, and electrical transmission facilities; (9) related water distribution and drainage works; and (10) appurtenant works.</p> <p>(b) Water will not be available for lands not having a recent irrigation history except Indian lands, national wildlife refuges, approved State wildlife refuges. Contracts are to be conditioned (1) so control can be provided for irrigation expansion from aquifer; (2) to provide for canal lining; (3) ground water located within the boundaries is not to be used unless there is surplus and drainage is required; and (4) all waste water in the service area is reserved to the United States.</p>	<p>(a) Same except main conduit is set at basic size of 1,800 c.f.s.</p>	<p>Sec. 2(a) comparable to sec. 304(a) of S. 1242 except the aqueduct size is 3,000 c.f.s. without provision for enlargement.</p>	<p>Sec. 2(a) is the same as sec. 2(a), S. 1004, except the aqueduct size is set at 2,500 c.f.s. and there is no provision for the enlargement to Hooker Dam.</p>	<p>(a) Same as S. 1242.</p>
	<p>(b) Same.....</p>	<p>Sec. 2 (c) and (e) cover in altered wording the material of sec. 304(b), S. 1242.</p>	<p>Sec. 2 (c) and (e) are the same as sec. 2 (c) and (e) in S. 1004.</p>	<p>(b) Same as S. 1242.</p>

SEC. 304

(c) Secretary may require acceptance of main stream water as exchange. Gln users may be required to accept main stream water so that New Mexico can increase its uses. Such exchange and replacements are not to add economic injury or costs to Arizona users.	(c) Same-----	Sec. 2(f) covers the requirement for contractors accepting main stream water in exchange.	(c) Same as S. 1242.
(d) Protection afforded exchange users in times of shortage.	(d) Same-----	Sec. 2(g) provides protection in times of shortage for those contractors accepting exchange water.	(d) Same as S. 1242.
(e) Secretary is to offer contracts to New Mexico users in amounts not to exceed 18,000 acre-feet for consumptive use above that decreed to New Mexico in <i>Arizona v. California</i> when there is water from the main stream available to Arizona users for replacement.	(e) Same-----	Sec. 2(h) is altered wording covers the material of sec. 304(e) of S. 1242.	(e) Same as S. 1242.
(f) If more than 2,800,000 acre-feet annually from the main stream is available to Arizona, the Secretary shall contract with New Mexico for an additional 30,000 acre-feet.	(f) Same, with the addition of 2d paragraph containing material of subsec. (g) of S. 1242.	Omitted	(f) Same as S. 1242.
(g) All (e) and (f) uses in New Mexico are subject to the Globe decree and all other Arizona-New Mexico uses as of the date of this act.	This language is included as last paragraph of subsec. (f) of S. 861.	In modified language this is the last sentence of sec. 2(h).	(g) Same as S. 1242. (a) Same as S. 1242.
SEC. 305			
(a) Protects California users to extent of 4,400,000 acre-feet in times of shortage. Arizona and Nevada users prior to central Arizona also protected. Nevada users are not to have their shortage burden increased by this provision. This provision not to alter Boulder Canyon. Project Act. 4(a) benefits to Colorado, Nevada, New Mexico, Utah, and Wyoming. Relative priorities of Arizona, Nevada, California users with priority to central Arizona project not affected.	(a) Same except the sentences providing for the continuation of any benefits to the upper basin by sec. 4(b) Boulder Canyon Project Act, is omitted.	Sec. 2(h) has a last sentence which protects Globe decree users and prior Arizona and New Mexico users.	(a) Same as S. 1242.
(b) California 4. protection ceases when President issues this proclamation and the sufficiency of the imported water to satisfy 7,500,000 acre-feet consumptive use in the lower basin.	(b) Same-----	do	(b) Same as S. 1242.
(c) Provides for the distribution in lower basin of Colorado River water as augmented by importation to satisfy 7,500,000 acre-feet consumptive use at same cost and at same terms as if Colorado River water were available, taking into consideration nonrefundable allocation to pay for deficiencies occasioned by Mexican Treaty, and assistance available from the basin fund.	(c) Same-----	do	(c) Same as S. 1242.

TITLE IV

Lower Colorado River Basin development fund: Allocations and repayment of costs; Contracts.

SEC. 401

Provision for cost allocation upon the completion of each unit: (1) commercial power; (2) irrigation; (3) municipal and industrial power; (4) flood control; (5) navigation; (6) water quality control; (7) recreation; (8) fish and wildlife; (9) Mexican Treaty performance costs; (10) central Arizona unit additional capacity over 2,500 c.f.s. referred to in sec. 304(a); and (11) other Federal reclamation law purposes. Mexican Treaty costs shall be non-reimbursable. Payments to Indian tribes and the 303(b) paved road are nonreimbursable. Recreation and fish and wildlife enhancement costs repayments are to be made according to Federal Water Project Recreation Act. Nonreimbursable costs are to be nonreturnable. Capacity above 2,500 c.f.s. for central Arizona unit main conduit are to be recoverable as per sec. 304(a).

SEC. 402

Secretary to determine repayment capacity of Indian lands. Those costs within repayment capacity are subject to Leavitt Act and those beyond repayment capacity are nonreimbursable.

SEC. 403

- (a) Creates a Lower Colorado River Basin development fund to carry out title III.
- (b) All title III appropriations are advances to such fund from the general fund of the Treasury.
- (c) Other credits to the fund are: (1) revenues from the units except recreation fees; (2) surplus revenues after payment from Boulder Canyon-Parker-Davis projects.
- (d) Revenues collected and credited to the fund are available without further appropriation for (1) O. & M. and replacement costs subject to annual appropriation act limitation; (2) payment to Upper Colorado River Basin fund (sec. 502); (3) subsec. (f) payments; and (4) power losses at Coolidge Dam because of exchange uses in New Mexico as per sec. 304.
- (e) Revenues are not available for construction except as per appropriation by Congress.

Do.	Omitted	do	do
Same as S. 1242 with a "proviso" added reading: "That all of the separable and joint costs allocated to recreation and fish and wildlife enhancement at the Dixie project, Utah, and the main stream reservoir division shall be nonreimbursable."	do	do	do
Same as S. 1242.	Sec. 4 is the same as sec. 4 of S. 1004.	do	do
(a) Same as S. 1242.	Omitted	do	do
(b) Same as S. 1242.	do	do	do
(c) Same as S. 1242.	do	do	do
(d) Same as S. 1242.	do	do	do
(e) Same as S. 1242.	do	do	do

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
TITLE IV—Continued				
SEC. 403—Continued				
Revenues in excess of clauses (1), (2), and (4) of subsec. (d) are to be paid to general fund of the Treasury to return (1) within 50 years costs allocated to irrigation, commercial power, or municipal and industrial water supply; (2) costs for recreation, fish and wildlife according to Federal Water Project Recreation Act; and (3) interest on commercial power and M. & I. water supply features. Interest is a 1st charge.	(f) Same.——In 403(f)(3) there seems to be an error in the reference to "subsec. (f)" which should be "subsec. (h)."	Omitted.	Omitted.	(f) Same as S. 1242.
(e) Revenues in excess of (d) and (f) requirements are to be available upon appropriation for (1) costs to provide for mainstream importation below Lee Ferry per sec. 206(c) to the extent such costs are in excess of the Mexican Treaty costs; (2) protection of the area of origin as per sec. 207(a). (NOTE.—206(c) reference should be 201(c); sec. 207(a) reference should be 202(a).)	(e) Same with corrected section references being "201(c)" for "206 (c)," and "202(a)" for "207(a)."	Omitted.	Omitted.	(e) Same as S. 1242. (See special note.)
(h) Provides for interest rate computation.	(h) Same.	Sec. 5 contains the same interest determining provision as sec. 403(h), S. 1242, with minor wording changes.	Sec. 5 is the same as sec. 5 of S. 1004.	(h) Same as S. 1242.
(i) Business-type budgets are to be submitted annually to Congress on basin operation.	(i) Same.	Omitted.	Omitted.	(i) Same as S. 1242.
SEC. 404				
(a) Provides for irrigation repayment contracts.	(a) Same.	Sec. 2(d)(2) is comparable to sec. 404(a) of S. 1242.	Sec. 2(d)(2) is the same as sec. 2(d)(2) of S. 1004 with a proviso that the United States is not committed to contract for more than the basic 50-year period.	(a) Same as S. 1242.
(b) Provides for municipal and industrial water supply contracts.	(b) Same.	Sec. 2(d)(3) is substantially the same as sec. 404(b), S. 1242.	Sec. 2(d)(3) is the same as sec. 2(d)(3), S. 1004.	(b) Same as S. 1242.

SEC. 405

Secretary shall annually report the status of revenues and cost of construction and operation on each project or unit beginning June 30, 1968. Report due Jan. 1 of each year.

TITLE V

Upper Colorado River Basin authorization and reimbursements.

SEC. 501

(a) Authorizes Animas-La Plata, Dolores, Dallas Creek, West Divide, and San Miguel projects and increases Colorado River storage project authorized appropriations by \$360,000,000 for these projects.

(b) Animas-La Plata project to be constructed and operated according to H. Doc. 436, 80th Cong., provided project construction is not to be started until the set-forth compact between Colorado and New Mexico has been properly ratified.

(c) Provides for secretarial determination of nonexcess acreage on authorized projects and the Seedskadee project.

(d) Requires the Secretary to comply with Colorado constitutional and legal provision on Colorado projects with respect to water priorities.

(e) Interprets provisions of S. Doc. 80, 75th Cong., 1st sess., entitled "Manner of Operation of Project Facilities and Auxiliary Features."

SEC. 502

Provides the method for the repayment to the Upper Colorado River Basin fund on account of deficiencies in Hoover generation during the filling period.

Same.....	Omitted.....	Omitted.....	Same as S. 1242.
do.....	do.....	do.....	Do.
(a) Same.....	do.....	do.....	(a) Same as S. 1242, with the addition of a proviso at the end of the 2d sentence, reading: "That the planning report for the Ute Indian unit of the Central Utah participating project shall be completed on or before Dec. 31, 1971."
(b) Same.....	do.....	do.....	(b) Same as S. 1242.
(c) Same.....	do.....	do.....	(c) Same as S. 1242.
(d) Same.....	do.....	do.....	(d) Same as S. 1242.
(e) Same.....	do.....	do.....	(e) Same as S. 1242.
Same.....	Sec. 7 provides for reimbursement of the upper basin fund and is the same except deficiencies remaining as of June 1, 1967, are to be paid from sale of Hoover energy.	Sec. 8 is the same as sec. 7 of S. 1004.	Same as S. 1242.

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
TITLE VI General provisions: Definitions: Conditions	do.	Omitted.	Omitted.	Do.
SEC. 601 (a) This act not to be construed to alter, amend, repeal, or be in conflict with Colorado River compact, Upper Colorado River Basin compact, Mexican Water Treaty, <i>Arizona v. California</i> decree, or, except as herein provided, the Boulder Canyon Project Act, Boulder Canyon Project Adjustment Act, or the Colorado River Storage Project Act. (b) Secretary is to (1) administer his responsibility so as to comply with Colorado River compact apportionment; (2) make reports on consumptive uses and losses after successive 5-year periods, beginning Oct. 1, 1963; and (3) subject all contracts to availability of water under Colorado River compact. (c) All Federal officers must comply with this act and the laws, compacts, treaty, and decree referred to in subsec. (a) in the authorization of authorized works. The right to sue is granted the States for failure to so comply. (d) This act shall not expand or diminish Federal or State jurisdiction, responsibility, or rights in the water resource field; displace interstate compact, or joint agency jurisdiction or responsibility; nor limit Congress authority to authorize or fund projects.	(a) Same. (b) Same with the elimination of (b)(1); and (b)(2) and (3) become (b)(1) and (2). (c) Same. (d) Same.	Sec. 8 is the same as sec. 601(a), S. 1242. Sec. 9 is the same as sec. 601(b), (2) and (3) of S. 1242; sec. 601(b)(1) is omitted. Omitted.	Sec. 9(a) is the same as sec. 8 of S. 1004. Sec. 9(b) is the same as sec. 9 of S. 1004. Omitted.	(a) Same as S. 1242. The contract to be performed by the Colorado River Compact, the Mexican Water Treaty, the <i>Arizona v. California</i> decree, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and the Colorado River Storage Project Act. (b) Same as sec. 601(b), S. 1242. (c) Same as S. 1242. (d) Same as S. 1242.

SEC. 602	<p>(a) In order to comply with the 2 compacts and Mexican Treaty the Secretary is to propose criteria to operate the reservoirs authorized by this act—Boulder Canyon Project Act, Boulder Canyon Project Adjustment Act, and the Colorado River Storage Project Act. Upper basin storage and Lake Powell releases are to be on the following priority: (1) 1/2 the III(c) deficiencies if any exist before the 306(b) proclamation; (2) III(d) releases, less imported water credited to the upper division; and (3) storage of water not required for (1) and (2) as the Secretary, after consultation, finds necessary to comply with (1) and (2) with a proviso that water not so required is to be released (i) to extent that lower division States can put it to use specified in III(e), but no releases if Lake Powell has less active storage than Lake Mead; (ii) to maintain equal active storage in Lake Powell and Lake Mead; and (iii) to avoid anticipated spills from Lake Powell.</p> <p>(b) Provides for method of adoption of the operating procedure and for its subsequent modification.</p> <p>(c) Sec. 7 of Colorado River Storage Project Act is to be administered according to criteria.</p>	<p>(a) Same.....</p> <p>(b) Same.....</p> <p>(c) Same.....</p>	<p>Sec. 10(a) seeks to accomplish in revised form the operating criteria for Federal dams constructed on the Colorado River. The priority of water in the Colorado River storage project units and the releases from Lake Powell are the same except no benefit is given the upper basin in the 2d priority as a result of importation of water.</p> <p>Sec. 10(b) is the same as sec. 602(b), S. 1242.</p> <p>Sec. 10(c) is the same as sec. 602(c), S. 1242.</p>	<p>(a) Same as S. 1242.</p> <p>(c) Same as S. 1242.</p>	<p>(a) Same as S. 1242.</p> <p>(b) Same as S. 1242.</p>
SEC. 603	<p>(a) Right of upper basin to the use of its allocated water shall not be reduced by use in the lower basin of such water.</p> <p>(b) Nothing in this act shall conflict with duties and power of Upper Colorado River Commission.</p>	<p>(a) Same.....</p> <p>(b) Same.....</p>	<p>Sec. 11(a) is the same as sec. 603(a) of S. 1242.</p> <p>Sec. 11(b) is the same as sec. 603(b) of S. 1242.</p>	<p>(a) Same as S. 1242.</p> <p>(b) Same as S. 1242.</p>	<p>(a) Same as S. 1242.</p> <p>(b) Same as S. 1242.</p>
SEC. 604	<p>In the construction, operation, and maintenance of units of this project, the Secretary shall be governed by Federal reclamation laws except as otherwise provided herein and this act is supplemental thereto.</p>	<p>Same.....</p>	<p>Sec. 12 is the same as sec. 604, S. 1242, with minor wording changes.</p>	<p>Same as S. 1242.</p>	<p>Same as S. 1242.</p>

S. 1242 (Allott)	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (Jackson by request)	S. 1409 (Moss)
<p style="text-align: center;">TITLE VI—Continued</p> <p style="text-align: center;">SEC. 605</p> <p>(a) Terms herein used which are defined in the Colorado River compact shall have compact meaning.</p> <p>(b) "Main stream" means Colorado River main stream below Lee Ferry in the United States, including reservoirs.</p> <p>(c) "User" or "water user" means United States or any person or legal entity entitled under decree in <i>Arizona v. California</i> to use main stream water.</p> <p>(d) "Active storage" means storage water capable of release through outlet works excluding bank storage.</p> <p>(e) "Colorado River Basin States" means Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.</p>	<p>(a) Same.....</p> <p>(b) Same.....</p> <p>(c) Same.....</p> <p>(d) Same.....</p> <p>(e) Same.....</p>	<p>Sec. 13(a) is the same as sec. 605(a), S. 1242.</p> <p>Sec. 13(b) is the same as sec. 605(b), S. 1242.</p> <p>Sec. 13(c) is the same as sec. 605(c), S. 1242.</p> <p>Sec. 13(d) is the same as sec. 605(d), S. 1242.</p> <p>Sec. 13(e) is the same as sec. 605(e), S. 1242.</p> <p>Sec. 2(b) provides for the Secretary entering into an agreement with non-Federal interests for the construction of a thermal generating powerplant and for the method of sharing the costs.</p> <p>Sec. 2(d)(1) provides master contracts with agencies having authority to levy tax on all taxable real property if such is determined to be necessary to effect repayment. Indian tribes are exempt.</p> <p>Sec. 14 is a general authorization for an appropriation.</p>	<p>Same as 1242.</p> <p>Sec. 13(a) is the same as sec. 13(a), S. 1004.</p> <p>Sec. 13(b) is the same as sec. 13(b), S. 1004.</p> <p>Sec. 13(c) is the same as sec. 13(c), S. 1004.</p> <p>Sec. 13(d) is the same as sec. 13(d), S. 1004.</p> <p>Sec. 13(e) is the same as sec. 13(e), S. 1004.</p> <p>Sec. 2(b) has a provision like the S. 1004 on the thermal powerplant.</p> <p>Sec. 2(d)(1) is the same as S. 1004.</p> <p>Omitted.....</p>	<p>Do.</p> <p>(b) Same as S. 1242.</p> <p>(c) Same as S. 1242.</p> <p>(d) Same as S. 1242.</p> <p>(e) Same as S. 1242.</p>

STAFF ANALYSIS OF BILLS
Major components of Colorado River Basin-Central Arizona project bills

	S. 861 (Kuchel)	S. 1004 (Hayden)	S. 1013 (administration) (Jackson)	S. 1242 (Allott)	S. 1409 (Moss)
National Water Commission.....	No.....	No.....	No.....	No.....	No.....
Importation study.....	Feasibility study.....	No.....	None.....	Feasibility study.....	Feasibility study.....
Marble Canyon Dam.....	No.....	Steam generating plant substituted.....	Steam generating plant substituted.....	No.....	No.....
Bridge Canyon Dam.....	Yes.....	do.....	do.....	Yes.....	Yes.....
Central Arizona project size.....	1,800 c.f.s. (1,300,000 acre-feet).....	3,000 c.f.s. (2,100,000 acre-feet).....	2,500 c.f.s. (1,800,000 acre-feet).....	2,501 c.f.s. (1,890,000 acre-feet).....	2,509 c.f.s. (1,800,000 acre-feet).....
4.4 protection for California.....	Yes.....	No.....	No.....	Yes.....	Yes.....
Development fund.....	do.....	do.....	do.....	do.....	Do.....
Upper basin projects.....	do.....	do.....	do.....	do.....	Do.....
Construction cost.....	\$1,167,000,000.....	\$719,000,000.....	\$719,000,000.....	\$1,167,000,000.....	\$1,167,000,000.....

Senator ANDERSON. All right, Mr. Secretary, we are glad to have you. I hope you realize this may be a long session. There are very strong points of interest.

STATEMENT OF HON. STEWART L. UDALL, SECRETARY OF THE INTERIOR, ACCOMPANIED BY KENNETH HOLUM, ASSISTANT SECRETARY FOR WATER AND POWER DEVELOPMENT; FLOYD E. DOMINY, COMMISSIONER, BUREAU OF RECLAMATION; AND EDWARD WEINBERG, DEPUTY SOLICITOR, DEPARTMENT OF THE INTERIOR

Secretary UDALL. I am prepared, Mr. Chairman. I have my back-field with me and my line backing up them. Mr. Chairman, I have a prepared statement and I shall read most of it. I may intersperse a few comments that I should like to make.

The issues that we are here to discuss today has consumed more of my time as Secretary and that of many of my top aides than any other matter that has come before the Department in the 6 years and 3 months that I have been Secretary.

In the last 4 years since the Supreme Court decision, there has been a lot of creative thought, many proposals have been presented, and of course there have been many hearings held. It does seem to me, Mr. Chairman, that after shaking the sieve as much as we have, that it should be plain what the essentials are at this point. This is the reason that I believe the administration proposal embodied in Senator Hayden's bill represents the proper vehicle for action, because it is the least costly and least controversial alternatives.

I want to if I may, if the committee will indulge me, to strike a rather personal note at the outset here today, because there are some things that I think should be said at this time that one member of this committee, because of his modesty cannot say, I think I can say them, because Senator Hayden's position and the President's position coincide on this issue today.

There is no one, as members of this committee know better than I, who has served longer in the Congress, in the history of the Republic, than the senior Senator from Arizona. There is no one alive, no Member of Congress who has done more for the development of the resources of this country than the Senator from Arizona.

Yet this gentleman is of such a modest personality, that there is no one in the Congress, and I know because I served in that body, who has ever been giving his support for special appropriations for his State, who has been asked by him as a quid pro quo that he would give him a vote at the time his State needed it for a water project for his State. That is not the way he has operated.

The 90th birthday of this gentleman will occur before this year is out, and I can't think of any greater tribute to him for his service to the country than for his bill, which represents the administration position on this issue, to be enacted by the Senate and by the Congress, and for us to get on down the road toward the solution of the water problems of this region.

As I shall get to in a moment, I think the administration approach embodied in Senator Hayden's bill, as well as in the national water

commission bill, represents the best way if not the only way to really begin a regional approach. I don't think that we have about faced or back tracked in any way, and I will get to that in a moment.

This hearing on the Colorado River legislation comes after passage by the Senate of the national water commission bill, S. 20, a measure which embraces an issue interrelated with Colorado River development. This interrelationship was noted by President Johnson in his January 30 message on conservation—"Protecting Our Natural Heritage"—for in renewing his recommendations for the establishment of the commission, the President spoke specifically of the need to thoroughly explore every means for assuring an adequate supply of pure water to areas like the Southwest.

It was in April of 1964 that I appeared before this committee at the initial hearings on what was then known as the Pacific Southwest water plan. Hopes were high that a program to alleviate the most urgent water deficiencies and to initiate a long-range, comprehensive solution to the Basin's water would be enacted. Unfortunately, the issues involved proved so complex that they have not yet been resolved.

Although certain issues still remain in question, a great deal of progress has been made in the last 3 years. Widespread agreement has been reached on the proper disposition of a number of key issues. On the foundation of agreement already achieved, I am optimistic that, in this session, the Congress can mold and enact legislation that will be an acceptable as well as an adequate, basis for meeting both the short- and long-term water needs of the Colorado River Basin.

S. 861, S. 1242 and S. 1409 follow, to a considerable degree, though with some differences, H.R. 4671 as reported by the House Interior and Insular Affairs Committee last August, following extensive discussion among groups from the Colorado River Basin States. S. 1013, introduced by Chairman Jackson at our request, and S. 1004, introduced by Senator Hayden, for himself, Senator Fannin, Senator Cannon, and Senator Jackson, reflect the administration's recommendation. These bills take an approach that differ in some particulars from the bills passed on H.R. 4671. It is, however, an approach which shares the basic objectives of those other measures. These objectives are:

(1) The establishment of a basis on which a comprehensive long-range solution to the many, varied and complex water problems of the basin can be developed and carried forward, and (2) the authorization of water supply works to alleviate the most pressing and immediate water supply deficiency of the basin; namely, that of central Arizona. While the Administration's original proposals have been modified in the light of further study and the developments over the past several years, these two principal objectives have remained and still remain paramount.

S. 1013 is the bill we transmitted to the Vice President on February 15. Senator Hayden's bill, S. 1004, also follows the administration's recommendations very closely. The differences between them are minor and are discussed in our report to the committee on that bill. Later in this statement, I shall refer to two of these differences—one relating to the capacity of the Granite Reef aqueduct and the other to the specific costs to be borne by the Government under the thermal power arrangements for the central Arizona project.

Consistent with our recommendations, neither S. 1004 nor S. 1013 deal with investigations of Colorado River augmentation possibilities.

As we reported to you in May of 1965 in connection with S. 75 and S. 1019 in the 89th Congress, the administration proposes that certain broad issues of policy essential to development of a comprehensive solution to the water problems of the Colorado River Basin should be reviewed by a national water commission. I believe it highly important that such a commission be established now so that an early start can be made on the necessary studies. The Senate has responded by twice acting favorably on that recommendation which is now covered by S. 20, pending before the House Interior Committee. I am hopeful that this year will see favorable action not only on S. 20 but on legislation dealing with the central Arizona project, on the authorization of the Dolores and Animas-La Plata projects, and on other associated Colorado River Basin matters.

Since S. 20 has already passed the Senate, there is no need to further discuss the National Water Commission here. Suffice it to say, Mr. Chairman, I am confident that, once established, the National Water Commission will of necessity give early attention to the urgent problems of the Colorado River Basin.

Another aspect of regional development involves the creation of a lower Colorado River development fund. Establishment of such a fund was recommended in our report on S. 75 and S. 1019 in August 1965. It was essential, under previous proposals, to the financial integrity of the central Arizona project. Our present proposal for the central Arizona project, which is incorporated both in S. 1004 and S. 1013, and which I shall discuss later, eliminates its dependence on a development fund for financial assistance. It is not needed under this plan. However, should the Congress desire to establish such a development fund to provide financial assistance for future water projects for the lower basin, the administration offers no objection. Legislative language designed to accomplish this objective was included with our February 15 letter to the Vice President transmitting the administration's Colorado River recommendations, and the Hoover system which is already paid out offers the way to do that.

Substantial questions related to the comprehensive development of the Colorado River, both as to propriety and necessity, are involved in determining whether main stream dams should be built at either the Marble Canyon or Hualapai sites. This has been one of the most controversial issues involved in Colorado River Basin project legislation, in fact the most controversial. Our report on S. 75 and S. 1019, 89th Congress, supported authorization of the Marble Canyon Dam while recommending that decision on Hualapai Dam be deferred pending review by the National Water Commission.

Our present proposal for the central Arizona project provides a substitute for the low cost pumping power and financial assistance that would have been furnished by the Marble Canyon development. In view of this, and after further consideration of all aspects of the matter, we have concluded that the highest and best use of the Marble Canyon site is to retain it in its natural state as an addition to the existing Grand Canyon National Park.

Many Members of Congress have introduced legislation to do just that.

On March 9 we transmitted to the Congress a draft bill to accomplish this addition. The bill was introduced as S. 1300 on March 15 by Chairman Jackson. Should it be the committee's desire, Mr. Chair-

man, to include the park extension in the legislation authorizing the central Arizona project, we would have no objection.

As shown on the map referred to in S. 1300, the Marble Canyon addition to the park would extend up the river about 55 miles, following generally the westerly rim of the Canyon to the section line above Lee Ferry, where it would join the Glen Canyon recreation area.

The addition includes 28,300 acres of which 14,336 acres are national forest lands, 11,264 acres are public lands administered by the Department, and 2,700 acres previously withdrawn for the Glen Canyon project which is also, of course, administered by this Department. By agreement with the Secretary of Agriculture, some small additional amount of national forest land would also be included in the Marble Canyon addition to areas for scenic overlooks. The proposed addition does not include the easterly side of the canyon within the Navajo Indian Reservation.

We also propose, with the concurrence of Secretary Freeman and the Forest Service, to round out Grand Canyon National Park by adding two other areas now adjacent to the park within the Kaibab National Forest. One is a very small area of 640 acres contiguous to the present south boundary to protect the South Rim drive; the other—the Kanab Creek area of some 38,500 acres—contains the north side of the Grand Canyon itself and the lower 7 miles of the spectacular Kanab Creek Canyon. Of this area, a small portion, 1,170 acres, is public land under the jurisdiction of this Department. In addition to straightening a portion of the boundary to the east of the Kanab Creek area, we propose to delete about 200 acres of park land and add 400 acres of national forest land.

In respect of the Hualapai Dam, the position of the administration remains unchanged.

I should like to clarify the record here, because there is confusion on this point, Mr. Chairman. The administration has never in 1963, 1964, 1965, or 1966 endorsed the Hualapai Dam. The seven-State plan of last year was not the administration's plan. We did not endorse that plan. This was the plan that had so many controversial provisions in it, that it not only did not get through the door in the House, but the Senate didn't even consider it.

We believe that consideration of it should be deferred pending evaluation of the issues by the National Water Commission.

In the meantime, this site, as well as the Marble site, if the park addition proposal is not included in this bill, should be removed from the operation of part I of the Federal Power Act as is provided by section 7 of S. 1013. In view of our recommendations respecting the central Arizona project, deferment of decision of Hualapai need not affect authorization of the central Arizona project, nor will deferment of decision for a period of a few years be critical to long-range plans for the Colorado River Basin.

The water shortage is not so critical that we cannot wait 5 years for a National Water Commission study.

Once the National Water Commission has completed its studies of the subject, decisions concerning the long-term water future of the Colorado Basin can be made. This is the appropriate time.

Neither S. 1013 nor S. 1004 include the so-called 4.4-million-acre-foot priority to California. This is another of the controversial issues.

This priority is contained in the Kuchel bill (S. 861), in the Allott-Dominick bill (S. 1242), and in the Moss bill (S. 1409). Similar provisions were included in S. 1019, 89th Congress, by agreement among the States. In reporting on that measure in May 1965, we stated the belief that such a priority would not have to be invoked but we regarded it as appropriate since it represented what was then an agreed upon compromise between Arizona and California.

It is our view that this is a matter between the States, and however they want to work this out is satisfactory so far as the administration is concerned.

The year before, in reporting out S. 1658 in the 88th Congress, this committee had also included a "4.4 priority" but with a 25-year time limit.

Recent studies of the central Arizona project by the Bureau of Reclamation have assumed a "4.4 priority" to be in effect. This was basic in our study. As a planning assumption, the "4.4 priority" is conservative in that, of the various probable methods of apportioning shortages, it assumes the economic and financial conditions most adverse to the central Arizona project. Nevertheless, the project has a benefit-cost ratio of 2.5 to 1.0 on both a 50- and a 100-year basis, considering total benefits, and a 1.5 to 1.0 benefit-cost ratio on both a 100-year and a 50-year basis if only the direct benefits are considered. If the "4.4 priority" were omitted from the assumptions, the benefit-cost ratio and repayment of the project would be improved.

The administration continues to believe that the question of an interstate priority is one for resolution primarily by the States involved and by the Congress. If agreement is reached on an interstate priority, it will I am sure be satisfactory to us.

In respect of the second principal objective of our proposed program for the Colorado River Basin, that of alleviating the most immediately urgent water supply deficiencies, the required action at this time in the Lower Basin remains the authorization and construction of the central Arizona project.

The rapidly lowering ground water levels, the agricultural lands going out of production, the expanding population, the mounting needs for municipal and industrial water, and the prospects of economic stagnation if relief is not provided, all urge strongly for the need to go ahead with the central Arizona project.

I think this needs no further argument, to establish that it is the great and pressing need in the basin at the moment.

Our studies, which show that the benefits from the project will exceed costs by a wide margin and that repayment of all reimbursable costs is in prospect, amply demonstrate the economic and financial soundness of the project. I know of no serious opposition to the central Arizona project nor of any valid question as to its justification.

Thus, we continue to urge that the central Arizona project be authorized. This year, as I have already indicated, we have developed a plan that eliminates the need for a Colorado River hydroproject and for reliance on a development fund.

Following the close of the last session of the Congress, the Department of the Interior, in concert with the Bureau of the Budget, made an exhaustive study of alternative plans to serve the central Arizona area involving both old and new concepts.

We studied some 34 alternatives. The one ultimately selected is the one involving Federal prepayment power arrangements embodied in both S. 1004 and S. 1013. A summary report on this plan was transmitted to the committee as a supplement to our letter of February 15 to the Vice President.

The proposed plan of development for the central Arizona project remains the same in all major physical features as previously proposed except for the source of pumping energy required for project pumping needs. I would like to discuss briefly how the Federal prepayment arrangements for project pumping power and energy would work.

This is nothing new. It has been tried before and it works very efficiently.

Current studies indicate that 400,000 kilowatts of capacity would be required in connection with the central Arizona project, with the Granite Reef adequate sized at 2,500 c.f.s., as we propose and as is provided in S. 1013. For a 3,000 c.f.s. capacity adequate, as called for under S. 1004, 470,000 kilowatts of capacity would be required.

I would like to digress a moment, Mr. Chairman, to say a few words about the sizing of the aqueduct.

The central Arizona project originally was formulated on the basis of an 1,800 c.f.s. aqueduct having a diversion capacity of 1.2 million acre-feet per year. With the 4.4 million acre-foot priority to California in effect and we assume this an aqueduct capacity of 2,500 c.f.s. would be required to divert an average annual quantity of 1.2 million acre-feet over the 50-year payout period.

Senator KUCHEL. I don't want to interrupt you now, Mr. Secretary, and I shall not, except to say would you develop that point a little bit please, if you can?

Secretary UDALL. I think it is developed in my statement.

Additionally, a 2,500 c.f.s. aqueduct would have a maximum diversion capacity of 1.6 million acre-feet in any 1 year which, together with other uses of Colorado River water by Arizona, would permit Arizona to use its full entitlement of 2.8 million acre-feet in those years when 7.5 million acre-feet of Colorado River water are available for consumptive use in the lower basin.

Under our proposal the Secretary of the Interior would make arrangements with non-Federal interests to acquire the right to a portion of capacity and associated energy from the output of a large thermal generating powerplant as necessary to serve project pumping purposes. The right would also include delivery of the power over jointly shared transmission facilities.

Payment for the capacity entitlement would be made to the plant owners from time to time during the construction period by advancing a portion of construction costs in a ratio not to exceed the ratio of the capacity entitlement acquired to the total plant capacity. Transmission of power and energy to points of project use would be provided both by Federal construction of transmission lines and by payment for capacity in lines jointly used by the plant owners and the Government, through the Government advancing a portion of the costs of such dual-use lines, again in a ratio not exceeding the ratio of the capacity requirement of the Government to the total capacity of such facilities.

This is a little bit tricky but it can be done. It has been done several times in the utility industry already.

In addition to the payments associated with construction, the Government would also meet currently a commensurate portion of the annual operation and maintenance requirements, including such items as advances for working capital, and replacement costs as they occur. The United States should not participate in such costs as interest, financing charges, taxes, or other similar items. Express provisions to this effect is contained in section 2(b) (3) of S. 1013, in the form we recommended. S. 1004 omits a comparable express prohibition, thus leaving these matters to negotiation. It may be that the language we have proposed is unduly restrictive in respect of items such as sales taxes on equipment and supplies if purchased outside the State in which the plant would be constructed. I invite the committee's particular attention to that problem.

The agreement between the Government and the non-Federal interests would be so drawn as to provide adequate security for the Government's investment. Moreover, there will need to be arrangements for exchanges of power, under contract, to assure backup and continuation of essential pumping during periods of equipment outages.

In this way, the project would obtain assured power for pumping at a low cost reflecting the economy of large thermal electric powerplants; shared economical, high-capacity, extra-high-voltage transmission facilities; and the benefits of Federal financing.

The Federal costs would become costs of the central Arizona project to be repaid by the project beneficiaries as are other reimbursable costs, following long-established reclamation policies.

For purposes of estimating power prepayment cost, we have assumed that a coal-fired powerplant would be located near Page, Ariz., adjacent to Lake Powell. It is contemplated that such a plant would burn coal obtained from the Black Mesa fields of the Navajo-Hopi Indian Reservations in northeastern Arizona.

This is the same field from which we are going to get the coal for the big Nevada Mojave plant and which will be carried through by the largest pipeline in the world.

The actual plant which would be involved would, of course, depend upon the plans of the utilities as well as upon negotiations.

An outstanding example of a large-scale prepayment arrangement for future power is the purchase by a group of Pacific Northwest public and private utilities for a 30-year period of Canada's share of increased power generation under the Columbia River Treaty. Another example is the prepaid purchase by the Salt River Project Agricultural Improvement and Power District of a portion of the output of the steam plant at Hayden, Colo., constructed by Colorado-Ute Electric Association, Inc. This has already been done before.

While the prepaid purchase of pumping power from a non-Federal thermal electric plant is new in reclamation history, the provision of pumping power for project use is, itself, customary.

On the basis of discussions we have had with them, I anticipate no difficulty in negotiating arrangements, consistent with the principles I have discussed, with the members of the west planning group that have expressed an interest and willingness to participate in the project. On March 10 I was formally advised by Mr. Walter Lucking, president of the Arizona Public Service Co., on behalf of that company, Southern California Edison Co., and the Salt River project that they

considered the plan we have proposed to be feasible and that they would be willing to cooperate in working out satisfactory arrangements in connection with a plant at Page. A copy of Mr. Lucking's letter is appended to my statement.

Through such arrangements we estimate that project pumping energy would be available at a cost to the central Arizona project of 3 mills per kilowatt-hour for irrigation water pumping and 5 mills per kilowatt-hour for municipal and industrial water pumping. Power and energy surplus to project pumping requirements (which will not be available in significant quantities until after 1990, and then only if Colorado River water deficiencies have not been overcome) is assumed to have an average value of 5 mills per kilowatt-hour. The disposition of this surplus power will benefit the project in amortizing the prepayment investment and in assisting in repayment of project costs allocated to irrigation.

With the availability of such low-cost power, central Arizona project revenues could repay all reimbursable project costs within 50 years without the necessity for outside financial assistance. Irrigation water would be sold at an average canal side rate of \$10 per acre-foot. No new lands would be developed and the water made available for irrigation would be restricted to replacing ground water now being pumped. Municipal and industrial water could be sold at a rate of \$50 per acre-foot in combination with an ad valorem tax of six-tenths of a mill per dollar of assessed valuation on the taxable real property of the central Arizona service area. Alternatively, municipal and industrial water could be sold for \$56 per acre-foot with no ad valorem tax, or some combination which would produce the same financial results might be adopted. These decisions as to municipal water rates and ad valorem taxes will involve close consultation with the local people. Indeed the legislation can be permissive on that point. They should make those decisions. The legislation we propose will provide the necessary flexibility.

I have included as an attachment to this statement a table summarizing the economic and financial analysis of the central Arizona project as we propose it.

S. 861, S. 124, and S. 1409, like H.R. 3300, contain provisions authorizing certain Upper Basin projects as additions to the Colorado River storage project. They also contain a number of provisions affecting Upper and Lower Colorado River Basin relationships. On these matters our position is essentially as it was last year in testimony before the House Committee on Interior and Insular Affairs on H.R. 4671, 89th Congress. Authorization now of the Animas-La Plata and Dolores projects is recommended.

I think this would be a very wise step to take at this time, particularly in light of the oil shale policy developments which are underway at this time.

We do not object to the inclusion of the substance of the provisions dealing with upper and lower basin matters of common concern. Both S. 1004 and S. 1013 include them.

The major features of legislation which the administration supports, and which I have just outlined, would, I believe, solve the most immediately urgent water deficiencies in the Colorado River Basin and provide a significant start in the right way toward a comprehensive

long-range solution to the overall water problems of the Basin, which we have been stressing for 4 years now.

The decisions which we recommend be deferred are not critical, nor essential to moving ahead at this time. If made in light of the guidance and advice of a distinguished National Water Commission, as embodied in the Senate bill, they will merit widespread confidence and support. Under such a climate the prospects of moving swiftly and harmoniously toward a full solution to the many complex and varied water problems of the Colorado River Basin will be immeasurably enhanced. I urge that the Congress follow this path.

Specifically, Mr. Chairman, we recommend enactment of either S. 1013 or S. 1004, the latter with relatively minor modifications to conform it to our proposal. We recommend also that the boundaries of Grand Canyon National Park be adjusted as proposed in S. 1300 and that the Congress authorize the Animas-La Plata and Dolores projects.

Mr. Chairman this completes my statement, and I should like to end as I began by stressing the hope that we now know where the pitfalls are. I think we know what the realm of the possible is. I think we are much wiser than we were 2 or 3 years ago in terms of knowing how to begin.

In my view, and maybe this was necessary, we have already lost a year or two by failing to go forward quickly with a National Water Commission as an accredited action to make the basin whole, but I am hopeful that this can be the year that Congress faces and decides this very vital issue. I thank you.

(The attachments referred to follow :)

ARIZONA PUBLIC SERVICE CO.,
March 10, 1967.

HON. STEWART L. UDALL,
Secretary of the Interior, Department of the Interior,
Interior Building, Washington, D.C.

DEAR MR. SECRETARY: AS you know, WEST Associates is now made up of some 22 public and private electric utilities in the West. This group has made great strides in cooperative planning of electric resources, and this planning has and will continue to provide benefits to the electric power consumers of the Western United States. The Department of Interior's cooperation in connection with the plants at Four Corners and Mohave have contributed to these efforts.

As you recall, on November 22, 1966, Salt River Project of Arizona, Southern California Edison Company and Arizona Public Service—all of whom are members of WEST—wrote to you and stated we were considering building a large coal-fired steam electric generating station in the vicinity of Page, Arizona, in which we contemplated the use of coal located on Indian Reservations and the use of Arizona Upper Basin water which has not been put to beneficial use. We indicated we would like to negotiate for the use of this water for the proposed Page plant and further, if appropriate assurance for the use of the water could be worked out, we would proceed with our investigation and studies necessary to determine this feasibility of the project. We also stated we would negotiate arrangements with appropriate entities, including Indian Tribal Councils and the State of Arizona, as well as your Department.

Following this letter, discussions were held among representatives of our three utilities and you in which we repeated our interest in a proposed plant near Page. At that time you stated the Administration was studying a number of different combinations of hydro and/or thermal power as sources for the Central Arizona Project pumping requirements. Further, you said that the Administration would be making its recommendation on the Lower Colorado legislation, following completion of these studies. You asked for an indication of our willingness to cooperate in helping work out power arrangements, whether the power source be thermal or hydro. We stated at that time it was impossible to give anything more than a general assurance of cooperation until a specific plan is presented on the basis of which details could be worked out. At that meeting we outlined to you the factors involved in marketing large blocks of low load

factor hydro power, transmission distance between point of production and load centers, integration of large units into resource schedules and the economics involved in large scale thermal plants.

Since that time, the Administration's proposal on the Lower Colorado River Legislation has been announced and involves a prepayment purchase of power and transmission service from a thermal plant as a source of pumping power for the Central Arizona Project. You have asked for our opinion as to whether such a prepayment and allocation of power for pumping from a large thermal plant would be feasible and whether we would cooperate in connection with our proposed construction of the Page plant. We think that such a plan is feasible and we will cooperate in attempting to work out a satisfactory solution. As we stated to you in our earlier discussions, we are not in a position to advocate what power features will be the best solution for the water considerations involved in the Lower Colorado legislation, which involves many different water agencies and states with diverse interests. We are merely stating we think the power solution proposed by the Administration is feasible and is capable of being worked out to the mutual satisfaction of the entities involved.

So there will be no misunderstanding, if we are asked to comment on other proposals on the Lower Colorado which involve hydro development, and therefore other factors, we would also state our intention to cooperate, as we did in our earlier meeting with you referred to above. I would expect the utilities would be pleased to undertake joint studies concerning the marketing of power produced from any hydro development power features that may be adopted in any Lower Colorado River legislation.

Sincerely yours,

WALTER LUCKING.

Central Arizona project economic and financial analysis

Project costs:

Main aqueduct system-----	\$416, 860, 000
Reservoir system-----	132, 237, 000
Drainage system-----	10, 500, 000
Power generation and transmission arrangements-----	91, 950, 000
Indian distribution system-----	19, 970, 000
Water salvage and recovery programs-----	42, 450, 000
Fish hatcheries and wildlife refuge-----	5, 250, 000
Total -----	719, 217, 000

Cost allocation:

Reimbursable:

Irrigation-----	322, 301, 000
Municipal and industrial-----	194, 029, 000
Power-----	91, 950, 000
Irrigation-----	(48, 366, 000)
M. & I. and commercial-----	(48, 584, 000)
Recreation-----	1, 525, 000
Fish and wildlife-----	294, 000
Total reimbursable-----	610, 099, 000

Nonreimbursable:

Flood control-----	11, 164, 000
Recreation-----	4, 818, 000
Fish and wildlife-----	23, 835, 000
Indian distribution system-----	19, 970, 000
Water salvage and recovery-----	42, 450, 000
Fish hatcheries and wildlife refuge-----	5, 250, 000

Total nonreimbursable-----	107, 487, 000
Prepaid investigation costs-----	1, 631, 000
Total -----	719, 217, 000

Benefit-cost ratios:

Total benefits (both 100 and 50 years)-----	2.5 to 1.5
Direct benefits (both 100 and 50 years)-----	1.5 to 1.0

REPAYMENT

All reimbursable costs would be repaid within a 50-year period from project revenues. Estimated average rates for project services are as follows: irrigation water—\$10 per acre-foot at canalside; municipal and industrial water—\$50 per acre-foot at canalside in conjunction with an ad valorem tax of 0.6 mills per dollar of assessed valuation on taxable real property in the central service area or \$56 per acre-foot without an ad valorem tax; commercial power—5 mills per kilowatt-hour. Reimbursable recreation and fish and wildlife costs would be returned from local contributions.

Senator ANDERSON. Before the general questioning starts, I don't think you answered Senator Kuchel's question.

Secretary UDALL. This is a technical matter, and I would like the Commissioner or Secretary Holum, either one, to sketch in quickly on the sizes of the aqueducts. I thought maybe my statement answered it.

Senator ANDERSON. What was your question?

Senator KUCHEL. Mr. Secretary, I did want you, prior to any examination by members of this committee, to elaborate the statement on page 11, that the central Arizona project originally was formulated on the basis of an 800-cubic-foot-per-second aqueduct, having a diversion capacity of 1.2 million acre-feet per year, and that with a 4.4 million acre-foot priority to California. In effect, an aqueduct capacity of 2,500 cubic-feet-per-second would be required to divert an average annual quantity of 1.2 million acre-feet over the 50-year payout period.

I wanted you to add in your statement to the committee what provisions were made for payment of the original 1,800-cubic-feet-per-second aqueduct, and if there were any changes in your recommendations subsequently when the 2,500-cubic-feet-per-second aqueduct was recommended.

Mr. DOMINY. Actually, Senator Kuchel, the repayment plan for the project demonstrates that the sales of water for municipal industrial purposes and irrigation plus some financial assistance from power will pay the cost of the aqueduct. The average diversion of a 1,800-cubic-foot-per-second canal, with a 4.4 guarantee to California would only be about 927,000 acre-feet a year over the payout period. With the 2,500-second-foot capacity aqueduct, and the 4.4 guarantee, the average annual diversion would increase to 1,104,000 acre-feet a year. The increased diversion would provide the increased revenue to offset the increase in cost.

Senator KUCHEL. I would like to pursue that a little bit later on when it is my turn to question.

Senator ANDERSON. I hope you will have some tables as to the cost of water for desalinization which we now will have, and also what the cost might be if the California area were to be selected for improvement of water in that area.

Secretary UDALL. Senator, we would be very happy to give you a table showing the current figures on this. Obviously this also, when one looks down the road to the future, is one of the major questions that a National Water Commission would address itself to. I personally think economics are going to, and should, dictate the order of action. We need to know all the answers before we make decisions when we start considering augmentation.

Senator ANDERSON. Senator Jackson.

Senator JACKSON. I shall defer my questions for the time being. I want to compliment the Secretary on a very fine statement.

Senator ANDERSON. Senator Kuchel.

Senator KUCHEL. Mr. Secretary, in your prepared statement on page 8 you said:

Recent studies of the central Arizona project by the Bureau of Reclamation have assumed a "4.4 priority" to be in effect. As a planning assumption, the "4.4 priority" is conservative in that, of the various probable methods of apportioning shortages, it assumes the economic and financial conditions most adverse to the Central Arizona project.

It is fair therefore to say, Mr. Secretary, that the position of the Department is not one of opposition to a 4.4 priority?

Secretary UDALL. That is essentially our position. We don't oppose it. We don't object to it. We think this is something the States should work out themselves, and the reason that we took no objection on this earlier is that at one point the Arizona and California people, or some of them, were in agreement on some kind of priority. There are various priority proposals, but this is essentially a matter between the States, and for the Congress itself to resolve.

Senator KUCHEL. You are a friend of mine and I am a friend of yours, I have respect for you, and all I am going to try to do is to make this record as full and complete as possible. Surely you recall the meeting that you chaired and I participated in, with the Governors of our two States and your senatorial delegation, in which there was a unanimity of agreement with respect to the corrections of the 4.4 priority.

Secretary UDALL. I don't want to misstate Senator Hayden's position because he has consistently been not for what I would call the full-fledged 4.4 priority. He has favored limitations, and I should probably let him speak for himself on that, but at one point I think it is fair to say that there was complete agreement that there should be some kind of 4.4 priority.

Senator KUCHEL. In which you participated.

Secretary UDALL. I participated in that; yes.

Senator KUCHEL. I will supply my version of that for the record a little later on. You have suggested in your proposal, Mr. Secretary, a so-called prepurchase of electricity in the amount of some \$92 million, and stated to the committee that there is ample precedent I think for this. Actually is this not a new concept that you bring to this committee, in an attempt to justify the removal of the dam controversy on the river?

Secretary UDALL. There is nothing exactly like this that has been proposed, and, quite frankly, I think it is a very creative approach to the problem. It is one of the alternatives we developed last fall working with the Bureau of the Budget, and I was glad they went along with it, Senator.

I hate to see the Bureau of Reclamation, with the work I see ahead of it, get tied to one formula or locked into one set way of doing business. In many areas of the West we do not have major hydro-electric sites remaining. I think the Bureau of Reclamation ought not to be tied to one way of doing business. This is the reason I think we are setting a new policy, a new pattern.

It will work. It is not controversial. It does not stir up the public-private power fight. The Federal Government would not own a single

portion of a steamplant. It would not operate a steamplant. It would be a purchaser of power—I think when we look 50 years down the road, this may be one of the most valuable tools the Bureau of Reclamation would have, in some instances.

Senator KUCHEL. Does the prepurchase recommendation, in your opinion, do any violence to the traditional theory of reclamation law multipurpose water and power projects, including the production by the Government of hydroelectric energy for sale to preference customers?

Secretary UDALL. I come right back to my answer. I don't think the Bureau of Reclamation ought to be stuck with the traditional way of doing business. I think that we ought to be creative enough to develop new methods of solving problems which is one of the reasons for our proposal. We tailored it carefully, and I personally made two or three trips to the west coast to talk to the public and private utilities together. If the proposal stirred up the public-private power argument, I think that it might be a step backward. It does not, and therefore I think it is a great gain for the future, for the Bureau of Reclamation to have a different method other than the traditional method.

Senator KUCHEL. Maybe I don't understand it. Is your recommendation that the Congress first authorize, and then appropriate, \$92 million by which the Government will purchase, in advance, electricity over a long period of time? Is that your recommendation?

Secretary UDALL. This is precisely the approach that we would make payments. There is a very interesting precedent for this related to the Canadian treaty. We will contribute our share of financing and we will realize tremendous advantages. The truth of the matter is we will get power for Arizona's pumping requirements out of this plan almost as cheaply as we would get it from the dam.

Senator KUCHEL. How long a period of time is it contemplated by the \$92 million amount?

Secretary UDALL. In terms of the——

Senator KUCHEL. The purchase of power.

Secretary UDALL. For at least 50 years; the payment period of the project.

Senator KUCHEL. Is it not at all novel that you now recommend that the Federal Government purchase electricity and pay for it 50 years in advance? Is that not an unprecedented plan?

Secretary UDALL. It is novel, but I am not afraid of doing novel things. I am for a novel, flexible, growing dynamic reclamation program, not one that is stuck with one traditional method of doing business.

Senator KUCHEL. I suggest to the members of the committee that when we authorize the purchase of electricity 50 years in advance, with a cash payment to a group of utilities, both public and private, that it may or may not be entirely in the public interest. It surely requires a most careful consideration by the members of the committee as a policy in connection with this or any other project which comes before us.

Mr. Secretary, I think that we need, in as simple, lay language as possible, some of the statistics with respect to water in the Colorado

River under the Colorado River compact, what is the Upper Basin entitled to?

Secretary UDALL. The Deputy Solicitor.

Mr. WEINBERG. Seven and a half million acre-feet annually, Senator Kuchel, provided the Upper Basin meets the 75-million-acre-foot requirement at Lee Ferry every 10 years, plus its share of the Mexican Treaty deficiency, if there is a deficiency, and if indeed it has a share to bear, though there is a dispute as to that point.

Senator KUCHEL. And what constitutes the maximum potential deficiency for the Upper Basin under the Mexican Treaty?

Mr. WEINBERG. If the Upper Basin has an obligation, it would have an obligation to meet one-half the deficiency. There is also an issue on associated carriage losses that would be involved.

Senator KUCHEL. We are talking about generally, sir, is it not true, it is one-half of the Mexican Treaty burden?

Mr. WEINBERG. Yes.

Senator KUCHEL. Which is 1,500,000 acres a year.

Mr. WEINBERG. One-half of which is 750,000 acre-feet plus carriage losses.

Senator KUCHEL. How much does the Upper Basin today deplete the Colorado River water use through reclamation projects?

Mr. DOMINY. There are projects, of course, that are not yet depleting their full amount. I can't give you the exact figure. I will supply it for the record.

Senator KUCHEL. I have been told that the Upper Basin depletion is less than 4 million acre-feet per annum, but if you will, supply that.

Mr. DOMINY. Yes, I will supply the figure for the record.

(The information requested is as follows:)

Studies made in 1965 and submitted to the House Subcommittee on Irrigation and Reclamation show present (1964) depletions by both Federal and non-Federal projects in the Upper Colorado River Basin of 2,787,000 acre-feet. This is exclusive of water impounded in the reservoirs in this year.

Upon completion of existing and presently authorized projects (both Federal and non-Federal), it is estimated that the Upper Basin depletions at Lee Ferry will average 4,602,000 acre-feet annually.

Senator KUCHEL. Mr. Secretary, we passed the National Water Commission legislation here in the Senate. Does that legislation direct the Commission to make any studies with respect to water shortages in the Pacific Southwest?

Secretary UDALL. The Senator is probably as familiar as I am with the bill. My impression is that it is very broad gaged and is directed toward the national solutions to problems looking at all alternatives. Therefore if the studies are done properly, they would cover almost any alternative that is presently being considered or put forward.

Senator KUCHEL. I would interpret the wording of the bill as it passed the Senate to be completely free of any such congressional direction, and I would point to the fact that when an amendment was offered in this committee to supply such direction for study, it was defeated. So would you not be able to agree with me that if the present wording of the National Water Commission legislation were signed into law by the President, there would be no mandatory directive for any study of the water problems of the Pacific Southwest?

Secretary UDALL. My people point out to me that on the bottom of page 3 of H.R. 3300, such direction is included but I want to make my own view clear on this.

I think the Congress, once it sets up a National Water Commission and gives it the task of looking at the Nation's needs, gives it all the direction it needs if it has any sense at all.

It is comparable to setting up a commission to study the national health needs. Obviously such a commission would give attention to cancer, stroke, and heart disease. So I think a broad charge to the Commission is the only sensible direction needed. Otherwise, if you start getting specific, then you have got to get specific on all the details, and everything you don't mention then either takes on or loses significance.

Senator JACKSON. Will the Senator yield at this point?

Senator KUCHEL. Just 2 seconds and I will yield to my chairman, because I want to try to be as explicit as I can. What I am thinking about, Mr. Secretary, is the statement you gave to the Commission some time ago, that in your frank opinion, the most serious water shortage faced in the United States is the water shortage which is present today in the Pacific Southwest. Do I not quote you correctly?

Secretary UDALL. I still hold that view, yes. I think this is accurate.

Senator KUCHEL. The point I wanted to make was that when we passed the Water Commission legislation here, we were unable to amend it so as to carry into specific effect the apprehension which we shared, some of us shared with you, that here was a problem of urgency which should be studied, and we failed. Now I yield to my colleague, the chairman of the full committee.

Senator JACKSON. I think it would be helpful here so that there is no misunderstanding as to what we are talking about, to read into the record section 3(a) of the National Water Commission bill as passed by the Senate.

SEC. 3. (a) The Commission shall (1) review present and anticipated national water resource problems, making such projections of water requirements as may be necessary and identifying alternative ways of meeting these requirements—giving consideration, among other things, to conservation and more efficient use of existing supplies, increased usability by reduction of pollution, innovations to encourage the highest economic use of water, interbasin transfers, and technological advances including, but not limited to, desalting, weather modification, and waste water purification and reuse; (2) consider economic and social consequences of water resource development, including, for example, the impact of water resource development on regional economic growth, on institutional arrangements, and on esthetic values affecting the quality of life of the American people; and (3) advise on such specific water resource matters as may be referred to it by the President and the Water Resources Council.

I think this provision speaks for itself. That is all.

Senator KUCHEL. I want to say to my able friend from Washington that under the direction of the Department of Interior and the Bureau of Reclamation, this Congress has proceeded to build superb multipurpose projects in the public interest, many of which are located in his State and in the Far West, and I have a fear that with the Water Resources Council, and now a Water Commission about to be created, that it is possible, unless direction is given, to have the most serious water shortage problem in the country shunted aside, and that years will pass before this Congress can ever come to grips with

the question which faces the Secretary's State of Arizona, and my State of California, and the States represented by most of the Senators who are on this rostrum now.

This is a fear which I cannot help but express in this hearing, for I have been one of those who has favored legislation to help the people of Arizona solve their problems without damaging any of their neighbors. I continue to hope that we will be able to go forward together under, as my able friend from Colorado recalled earlier, Mr. Secretary, your own first developed proposal for a regional plan of action.

I would feel far more happy as a western American, if this committee had accepted your own assessment of where the greatest urgency lies, and had it written into the National Water Commission legislation.

Secretary UDALL. Senator, my own worry is that we have lost 2 years. The National Water Commission study was proposed 2 years ago. We have just sat and argued about it.

In my view, the key to getting the long term program going, to make the Colorado River Basin whole, is linked to having such a study made, and therefore I think each month that we delay, we have lost a month, and we are failing to come to grips with the problem.

I don't want to labor the point, but I think that if a committee of doctors were appointed to study the health of everyone in this room, that they would concentrate their earliest attention on the people who had the most serious ailments. Therefore I don't think you need any specific direction in this legislation.

Senator KUCHEL. Well, isn't it quite possible that there would be some people on a commission that would disagree with you and me and hold that there were several other matters of urgency in some other part of the country, and shunt this one aside? Isn't that possible?

Secretary UDALL. I can't conceive, Senator, of people being appointed by the President—big, broad-gage people which is the kind that the Congress envisions—that would take parochial views. Almost by definition they would be failing to carry out their proper functions if they did so.

Senator KUCHEL. We have got some big, broad-gage people not very far away from where I sit, that would have the honor to disagree with you.

On page 96 of the House hearings of March 1967 is a table, Mr. Secretary, which you have submitted, entitled "A Summary of Bureau of Reclamation Reservoir Operation and Water Supply Studies," and it is also on page 21 of this booklet you have supplied to the committee. (The table referred to appears on p. 29.)

There you set forth your estimates of available waters in the Colorado River for the years 1975, 1990, 2000 and 2030. You estimate the virgin flow at Lees Ferry of a constant 15 million-plus. You suggest the Upper Basin depletion increasing from 4.2 million to 5.1 million to 5.4 million to 5.8 million in the year 2030. You set forth your estimates of storage, of spills, of gains, of net gains, Lee Ferry to Hoover. You suggest the problems of inflow, of operation spills, and then the regulated release.

What does the regulated release mean, Mr. Secretary, where you set forth that for the 4 years estimated, the regulated release will be 10,000-plus, 9,500, 9,300, and 8,900, respectively?

Mr. DOMINY. These figures, of course, Senator Kuchel and members of the committee, are based upon past hydrology of the river, with extreme variations from year to year. Of course, we don't get that average every year, but we hope to attain that average over any 20-year or 30-year hydrologic cycle.

If we do, and by 1975 the Upper Basin States not having the ability to put their compacted waters to work, there would actually be more water than the Lower Basin allotment available in the Lower Basin. This would continue to hold true until at least 1990, and by that time, we estimate the Upper Basin projects will have developed to the point where about 7,500,000 acre-feet annually would be available from the Colorado River for consumptive use by the Lower Basin.

So that somewhere between 1990 and the year 2000, the only waters that are going to be available in the Lower Basin are those which are released under the provisions of the compact, plus Upper Basin spills plus the inflows below Glen Canyon.

Senator ANDERSON. Senator Kuchel said I could ask one question about this table.

Mr. DOMINY. Certainly, sir.

Senator ANDERSON. Does this show a constantly declining supply?

Mr. DOMINY. Only by reason of the increased Upper Basin diversion. It shows a constant declining supply available to the Lower Basin, because until the Upper Basin, as the Senator from New Mexico well recognizes, has the capability of using all of its compacted waters, the unused water do go down and are available to the Lower Basin over and above the Lower Basin compacted rights.

Senator ANDERSON. But you show a constant flow in the river, and you talk about having this flow for a long period of time. Hasn't the Department of Reclamation been carefully studying this river for at least 45 years, since the compact, and hasn't the flow decreased every 10-year period?

Mr. DOMINY. That is the general trend.

Senator ANDERSON. Why do you calculate you are going to have a full flow?

Mr. DOMINY. It is true that recent hydrologic cycles have been less than long-term average. We believe, however, that the Colorado River, over the long term, will yield as much water as the long-term hydrologic average would indicate.

Senator ANDERSON. But what is the reason for the hope, when you see every year a declining flow?

Mr. DOMINY. We are certainly in a dry cycle, and we are again this year going to be below average.

Senator ANDERSON. This has been going on for a long time, hasn't it?

Mr. DOMINY. That is correct, but our studies go back to about 1896. The vagaries of this river are well recognized by all of us. Since 1896 there have been wet cycles for periods of several years, and then there have been dry cycles for periods of several years.

Senator ANDERSON. The compact was signed in 1922 wasn't it?

Mr. DOMINY. That is correct, sir.

Senator ANDERSON. What evidence from that time on makes you think you have a 15 million acre-feet flow in the river? Do you have any figures to prove this?

Mr. DOMINY. The hydrology which we have available to us now so indicates. We did not have as long a period of time in 1922.

Senator ANDERSON. How many years of drought do you forecast?

Mr. DOMINY. Nobody really knows what the future cyclical hydrologic picture will be on the Colorado River. I only submit that the best man can do is take the measurements for as long a period as he has available to him, and assume that they will repeat themselves, and that is what we have done.

In 1922 we did not have as many years of record as we have now. Were we to compact the Colorado waters today, we would do it a little differently, because we do have a longer period of record, and the recent record has been a declining one.

Senator ANDERSON. I am only objecting to the fact that year after year and table after table you show an equal flow of the river, and you know from long studies and experience that that is not so.

Mr. DOMINY. This is the long-term average available to us on the years of record that are solid enough to be relied upon, Senator. It is less than the long-term average that the States used in 1922 when the compact was negotiated.

Senator KUCHEL. I invite your attention to the line which reads "available for use in United States." That is after delivery of the waters to the Republic of Mexico, in which it is estimated for the 4 years seriatim, 8 million acre-feet, 7.5 million-plus acre-feet, 7.3-plus million acre-feet, and in 2030, 6.9 million acre-feet. Are those the figures which the Bureau and the Department estimate to be available in those particular years for the Lower Basin?

Mr. DOMINY. Yes, that is based on average conditions as of those years.

Senator KUCHEL. Yes.

Mr. DOMINY. That is correct.

Senator KUCHEL. Then dropping down several lines, for the central Arizona project, you have a line "available," 2 million acre-feet in 1975, 1,500,000 acre-feet in 1990, 1,200,000 acre-feet in the year 2000, and 800,000-plus acre-feet to the central Arizona project in the year 2030. Do I state that correctly?

Mr. DOMINY. Yes, sir.

Senator KUCHEL. Limited, however, by the next line, 2,500 cubic feet per second in the following manner: 1,600,000—let me be precise, 1,650,000 acre-feet available to the central Arizona project in 1975, 1,255,000 acre-feet in 1990, 1,026,000 acre-feet in the year 2000, and 676,000 acre-feet in the year 2030.

Is that another way of saying that the water in the aqueduct, on the basis of 2,500 cubic feet per second, would have a maximum in the year 1975, that is 8 years from now, were it to be built, of 1,650,000 acre-feet, declining until in the year 2030 it would only amount to 676,000 acre-feet?

Mr. DOMINY. That is correct on the average. In the early years, even though there might be more water available in the river, as we predict there would be, the limit on the capacity of the aqueduct to 2,500 cubic feet per second would preclude the diversion of more than 1,650,000 acre-feet per year. Then as the availability of water declines with the Upper Basin depletions increasing, the capacity would be

sufficient to carry the water available on an average basis, but not necessarily during certain periods, if there was a spill out of Hoover, for example.

The water available might be greater than the capacity of the canal over a period of time, so we indicate that over the long term, we could actually divert less than would be available in the river, because of the pattern of when that water might be available in the river.

Senator KUCHEL. One of the estimates which you make which seems to me to be reasonable, that it would be on the order of 25 years or more before this Congress would authorize construction of additional projects in the Upper Basin, by which a greater amount of the Upper Basin's entitlement would be used.

Mr. DOMINY. Of course, it is impossible to get complete unanimity of agreement among all of us as to how fast the Upper Basin depletions will increase. We do know that the Colorado River storage project has been constructed at a reasonably fast rate. We got off to a real good start after the project was authorized in 1956, and we have since made real substantial progress. There are other projects, however, awaiting authorization and construction, and we have to the best of our ability estimated the rate at which these would come into being.

Senator KUCHEL. And particularly the Bureau and the Department estimated that in approximately 50 years from the year 1975, the waters available to the central Arizona project would be in the neighborhood of 676,000 acre-feet.

Mr. DOMINY. That is correct, and all of our repayment studies are based on a declining supply of water.

Senator KUCHEL. And to repeat, that during all that time California would maintain a constant level somewhat above 4.4 million acre-feet, according to the line in the table referring to California.

Mr. DOMINY. That would be true.

Senator KUCHEL. Why is it incidentally that you estimate more than 4.4 million acre-feet for California in all four of these, well, particularly in the last two columns, when you assume that the total water available is less than the compact authorizes?

Mr. DOMINY. Well, the figures represent California and Arizona's entitlements under the decree *Arizona v. California* including surplus in excess of 7.5 million acre-feet when available, and the 4.4 priority for California.

California could use more due to Arizona's inability through physical limitations to use its full share. As a minimum California would divert 4.4 million acre-feet in any year. In periods of good runoff it would divert more. That is why we show that California, on the average, would actually be diverting more than 4.4.

Senator KUCHEL. I still don't understand how California would receive 4,564,000 at a time when you would show the water in the central Arizona project declining from 1.26 million to 676,000.

Mr. DOMINY. Of course, if average runoff occurred each year, it would not work that way, but we expect there will be years when there are surpluses that have to be divided under the compact.

Senator KUCHEL. I want to make this point so that my colleagues will understand that when, as and if the Congress were to approve a central Arizona project, even with this priority, there would be an im-

mediate diminution of water available to the people of southern California from that which they have enjoyed for over 25 years, whereas there would be no concomitant diminution of the waters available to Arizona for another 50 years. I want to make that point in pleading that we adopt procedures in our bill that will attempt to eliminate the hazards from all States. That is what I am trying to do in asking these questions.

Mr. Secretary, the comments which you made on May 17, 1965, to the chairman of the Committee on Interior and Insular Affairs of the House of Representatives spelled out in detail your own recommendation of H.R. 4671, which was a regional plan. I ask consent that the Secretary's comments involved in that letter be placed in the record at this point.

Senator ANDERSON. Without objection it will be done.

(The letter referred to follows:)

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., May 17, 1965.

HON. WAYNE N. ASPINALL,
*Chairman, Committee on Interior and Insular Affairs,
House of Representatives, Washington, D.C.*

DEAR MR. ASPINALL: This responds to your request for a report on H.R. 4671 to H.R. 4706, 36 identical bills to authorize the construction, operation, and maintenance of the Lower Colorado River Basin project, and for other purposes. These 36 bills share a common purpose of resolving the old stalemates blocking further Lower Colorado River development. They combine features of the Pacific Southwest water plan draft bill we transmitted to the Senate Interior and Insular Affairs Committee on April 9, 1964, with the January 1964 Pacific Southwest water plan, bills now pending before your committee (H.R. 313, H.R. 1740, H.R. 2264, H.R. 2618, H.R. 2663, and H.R. 3176), and S. 75, of this Congress. A copy of our letter of April 9, 1964, is enclosed with this letter for your committee's information. Also enclosed is a copy of the letter of May 10, 1965, from Deputy Director Staats to Chairman Jackson of the Senate Committee on Interior and Insular Affairs setting forth the views of the Bureau of the Budget.

I am most pleased to endorse the goal of all of these bills, and I strongly recommend the enactment of H.R. 4671 or one of its counterparts subject to the following comments and recommendations.

The Lower Colorado project bills have the same major objectives as were outlined in our Pacific Southwest water plan. They would provide the means to meet the immediate water needs of the Southwestern United States and lay the basis for developing a comprehensive program to solve the water supply problems of the Western United States which are related to the Colorado River by providing adequate water supplies in the Upper and Lower Colorado River Basins.

These bills would—

1. Authorize and direct the Secretary of the Interior to investigate sources and methods of providing water to meet current and long-range needs in the Colorado River Basin and to prepare and submit reports to the Congress on comprehensive plans and projects to accomplish this objective.
2. Set forth standards to protect the interests of States and areas of origin of any water exported to the Colorado River Basin.
3. Establish a Lower Colorado River Basin development fund as the financial and accounting vehicle for the works required.
4. Authorize projects to meet immediate needs for water, power, and other purposes in the lower basin, and to initiate the "bank account" of the development fund.
5. Provide a priority to existing California Colorado River consumptive uses in the amount of 4,400,000 acre-feet annually and to existing main stream Colorado River consumptive uses and entitlements in Arizona and Nevada by limiting diversions from the main stream for the central Arizona unit in any year in which the Secretary of the Interior determines that there is insufficient main stream Colorado River water available for release to

satisfy annual consumptive use of 7,500,000 acre-feet in California, Arizona, and Nevada. This priority is to last until the President determines that works are in operation capable of delivering 2,500,000 acre-feet per year of water originating outside the Colorado River Basin into the main stream of the Colorado River below Lee Ferry.

6. Provide that water, imported or salvaged under this bill which augments the supply otherwise available in the Colorado River to satisfy annual consumptive uses from the main stream of the Colorado of 2,800,000 acre-feet in Arizona, 4,400,000 acre-feet in California, and 300,000 acre-feet in Nevada, would be made available to users of main stream water at the same cost and on the same terms as prevail for main stream water naturally available.

7. Accommodate developments for recreation and fish and wildlife.

8. Establish a regional commission to assist and advise in the development of comprehensive resource plans.

One of the key features of the bill is in section 304. This section requires the Secretary of the Interior to limit diversions from the mainstream of the Colorado River for the purposes of the central Arizona unit of the Lower Colorado River project (authorized by this bill) in any year in which he determines that there is insufficient mainstream Colorado River water available for release to satisfy annual consumptive use of 7,500,000 acre-feet in Arizona, California, and Nevada, to amounts which will assure the availability of water in quantities sufficient to provide for (1) the aggregate annual consumptive use in California by holders of present perfected rights, by other users therein served under existing contracts with the United States by diversion works heretofore constructed, and by other existing Federal reservations therein, of 4,400,000 acre-feet of mainstream water, and (2) annual consumptive use by users of the same character in Arizona and Nevada.

The foregoing protective provisions are to be operative until works are proclaimed by the President to be in operation capable in his judgment of delivering annually not less than 2,500,000 acre-feet of water into the mainstream of the Colorado River below Lee Ferry from sources outside the natural drainage of the Colorado River System. It should be clear that this is a statement of the condition which terminates the priority; it is not a commitment to the construction of import projects. The latter would be studied by the National Water Commission discussed *infra*.

These provisions in section 304 have evolved from the efforts of Arizona and California to accommodate their differences.

Other priority proposals have been suggested. The Senate Committee on Interior and Insular Affairs in reporting S. 1653 in the 88th Congress provided a flat 25-year priority for 4,400,000 acre-feet of annual consumptive use in California as against the central Arizona unit. Twenty-five years, considering the hydrology of the Colorado River, is about the time remaining before the assured flows of the Colorado River available to the lower basin will diminish to the point where diversions for the central Arizona unit would have an impact on existing uses within the basic allocation of 7,500,000 acre-feet, assuming that salvage works authorized by section 305 are accomplished.

This bill formulates the priority provisions in connection with an affirmative program for insuring that the statutory priority will not have to be invoked, rather than as a mere prohibition. The National Water Commission studies discussed, *infra*, would look toward the same goal. Because of this constructive approach, all interested parties will be working toward obtaining the needed supplemental water for the Colorado River, and not merely defending the status quo.

We are confident that the means of augmenting the Colorado's flows can be accomplished within the approximately 25 years remaining before diversions for the central Arizona project will have an impact on existing uses within the basic allocation of 7,500,000 acre-feet. Therefore, we believe the statutory priority provided by the bill will not have to be invoked. We commend the willingness of both Arizona and California to moderate their previously held positions in order to resolve the impasse which has blocked consideration of lower Colorado River development for so many years.

I am most gratified to note that the bill states as its objective the provision of adequate water supplies for the use of the Upper as well as the Lower Colorado River Basin. Given the history of the Colorado River and the pattern of its development, it is far better to treat the upper and lower basins together when planning long-range water resource developments.

The Bureau of the Budget believes that in lieu of the authorization for investigations provided for in title II of the bills and the Regional Commission authorized by title VI, the long-range water problems of the Pacific Southwest, together with the long-range problems of other areas of the country—the Great Lakes area and the Northeast, as examples, should be studied within a period of not more than 5 years, by a National Water Commission which it recommends be established.

Specifically, with respect to the Colorado, the Bureau proposes that the Commission study the proposals to guarantee areas of origin of imported water against increased costs arising from exports, and the desirability as well as the feasibility of import projects. It is proposed, however, that the Commission should develop, using the full resources available to it by the Federal Government and State and local governments, specific plans for review by the President and the Congress to resolve the water supply problems of the Colorado Basin. The Commission's Colorado studies should, the Bureau recommends, cover the proposal for Bridge Canyon Dam, allocation of an additional 84,000 acre-feet of main stream water for fish and wildlife purposes, and any additional steps required to develop an effective program for the use and control of ground and surface water.

The Commission would not be intended to eliminate the planning and investigative authority of existing Federal resource agencies in the geographic areas it undertakes to study. Indeed, it is proposed by the Bureau of the Budget that the Commission should utilize to the maximum possible extent the resources of the Federal water resources agencies.

I am advised that the Bureau of the Budget intends shortly to submit a draft of legislation embracing the administration's recommendations regarding the National Water Commission. If this proposal is adopted, in addition to elimination of titles II and VI, it is suggested that the statement of policy in section 102 be revised by striking the language commencing with the last word in line 12, page 2, and continuing through the word "agencies" in lines 15 and 16 and by inserting the words "be developed" after "authorization," in line 17. The words "additional and" in line 10, page 1, might also be stricken as redundant.

The 2,500,000 acre-feet of augmenting water which is the amount that terminates the priority provided in section 304, is the equivalent of the Colorado River supply this Government is bound to deliver to Mexico under the Water Treaty of 1944, plus all river losses in the Colorado River from Hoover Dam to the international border. Satisfaction of the Mexican Water Treaty can quite reasonably be treated as a national and not a regional or sectional obligation. When the Mexican Treaty was entered into, it was considered that 1,500,000 acre-feet could be delivered to Mexico annually without impairing the availability for use in the upper and lower basin of the quantities allocated by article III(a) and III(b) of the Colorado River compact. The reason for this optimism is apparent from the report of the Senate Foreign Relations Committee on the treaty. The committee stated that "according to all the testimony, the average annual virgin runoff from the Colorado River Basin is approximately 18 million acre-feet a year" (Senate Ex. Rep. No. 2, 79th Cong., 1st sess., p. 4). Based on runoff records to date, however, the Bureau of Reclamation has determined that the long-term average annual virgin runoff of Colorado River is approximately 16 million acre-feet, or 2 million acre-feet less than that upon which the treaty was predicated.

Although the Department's Pacific Southwest water plan contemplates the construction of Bridge Canyon Dam, we concur in the recommendation of the Bureau of the Budget that authorization should be deferred pending a reevaluation. Deferral of the Bridge Canyon project will affect only the magnitude of surplus revenues in the development fund, and will not adversely affect the financial feasibility of the other units of the Colorado River project authorized at this time. Meanwhile, a moratorium should be imposed on the issuance of a license to any non-Federal entity for the construction of a dam at this site.

Section 302(4) avoids any implication that authorization of Marble Canyon Dam under the bill is a congressional sanction of the Kanab project.

The amounts of water specified in section 304(c) are those adjudicated by the Supreme Court in *Arizona v. California, et al.* to have been apportioned for use in the three States respectively out of the first 7,500,000 acre-feet of mainstream water available for consumptive use in the Lower Colorado River Basin. The section does not constitute the United States an insurer of the availability of

the augmenting water. The United States traditionally has not, as a matter of law, warranted the achievement of the purposes of water resource projects.

Section 304(c) does include, however, a price guarantee with respect to water imported into the Colorado River system. The Bureau of the Budget in its May 10 letter recommended against any Federal commitment to Colorado River imports at this time. With respect to a price guarantee to lower basin users in the event of import, the Bureau of the Budget believes that if the Congress undertakes this commitment it should be only after most careful consideration. The Bureau recognizes that the Mexican Treaty imposes an important demand on the Colorado River and it suggests that if the Congress decides that the situation in the Lower Colorado River Basin is unique, the price guarantee in the pending legislation should be limited to the importation of not more than 1,500,000 acre-feet of water per annum, with the costs being met from the development fund. A cost guarantee of up to 1,500,000 acre-feet per annum would, as the Bureau of the Budget points out, make minimal the chances that any imported water would carry a price higher than mainstream water, at least through the year 2030. To accomplish the limitations proposed by the Bureau of the Budget would require the following modifications in the legislation:

(1) On page 9, line 17, change the period at the end of subsection 304(c) to a colon and add "Provided, That the amount of additional water from outside the Colorado River system made available at such cost shall not exceed one million five hundred thousand acre-feet in any given year".

(2) On page 17, line 9, insert after the word "power" the phrase ", the replenishment of Colorado River flows available for use in the United States occasioned by performance of the Water Treaty of 1944 with the United Mexican States (Treaty Series 944),".

(3) On page 18, line 7, insert after the word "deficiencies" the phrase "up to a maximum of one million five hundred thousand acre-feet from outside the Colorado River system in any given year".

(4) On page 19, lines 13-14 and 24, change the word "depletion" to "replenishment".

(5) On page 19, line 15, strike the phrase ", including river and reservoir losses".

(6) On page 19, line 23—page 20, line 1, strike the phrase commencing with the word "the" through the word "other".

An alternative approach, of course, to assure the maintenance of mainstream prices for not to exceed 1,500,000 acre-feet of imported water per annum would be to retain the nonreimbursable allocation, now provided for in section 402, to replenishment of deficiencies in mainstream water occasioned by Mexican Treaty deliveries, with the limitation that the nonreimbursable costs be limited to those associated with the importation of not to exceed 1,500,000 acre-feet for replenishment purposes. In the Bureau of the Budget's view this alternative, too, would be applicable if the Congress considered the Lower Colorado River situation unique. This alternative would call for the following modifications in the bill:

(1) On page 9, line 13, after the word "water" insert the phrase ", including not to exceed one million five hundred thousand acre-feet from outside the Colorado River Basin,".

(2) On pages 17-18, omit subsection 401(e) (3).

(3) On page 19, line 15, strike the phrase ", including river and reservoir losses,".

(4) On page 19, line 24, after the word "of" insert the phrase "up to a maximum of one million five hundred thousand acre-feet in any one year of,".

(5) On page 19, lines 13-14 and 24 change the word "depletion" to "replenishment,".

With respect to fish and wildlife, two points in particular should be noted. One is the incorporation in section 305 of an affirmative requirement that mainstream water salvage programs shall be consistent with maintenance of a reasonable degree of undisturbed habitat for fish and wildlife. Second, is the reservation of 84,000 acre-feet annually of Colorado River water (sec. 208(b)) for non-Federal fish and wildlife installations. This 84,000 acre-feet is in addition to the reservations for fish and wildlife purposes made in the Supreme Court decision. The Bureau of the Budget has recommended that the reservation of 84,000 acre-feet be deferred for further study, and we have no objection to that procedure.

The following other amendments to the bill are recommended:

(1) On page 5, line 16, delete "Bridge Canyon and", and change "projects" to "project".

On line 17, change "dams, reservoirs, powerplants" to "dam, reservoir, powerplant".

On line 18, delete "Coconino and" and make the word "reservoirs" singular.

On lines 19 to 24, delete all of clauses (1) and (2) and renumber clause (3) as clause (1).

On page 6, line 4, renumber clause (4) as clause (2).

On line 5, delete "either Bridge Canyon or".

On line 6, change "Reservoirs" to "Reservoir".

On lines 7 to 10, delete the entire sentence and substitute "The Federal Power Commission shall not entertain or consider any application for the construction, operation or maintenance of a dam or other project work under the Federal Power Act (41 Stat. 1063), as amended (16 U.S.C. 791), at the site on the Colorado River between the Marble Canyon project and Lake Mead except as specifically authorized by the Congress."

The purpose of all of these changes is to delete the authorization for the Bridge Canyon project, and to impose a moratorium on Federal Power Commission licenses at that site.

(2) On pages 10-11, delete section 306 and renumber present sections 307, 308, and 309 as sections 306, 307, and 308.

As the southern Nevada water supply project is being handled by separate legislation, it may be omitted from this bill.

(3) On page 12, line 23, delete all of subsection (b).

The purpose is to defer the reservation of 84,000 acre-feet of water for fish and wildlife purposes for further study.

(4) On page 20, line 7, change the period to a colon and add: "Provided, however, That all of the separable and joint costs allocated to recreation and fish and wildlife enhancement at the Dixie project and the main stream reservoir unit shall be borne by the United States and shall be nonreimbursable."

Section 402 of H.R. 4671 contemplates that the administration's policy for allocating recreation and fish and wildlife enhancement costs at Federal water resource projects, as set forth in the proposed Federal Water Project Recreation Act (H.R. 5269 and S. 1229) will apply to the Lower Colorado River Basin project. Under this policy, non-Federal public bodies are encouraged to share the separable costs allocated to recreation and fish and wildlife enhancement and to take over the administration of such facilities, except in those areas where Federal management is determined to be appropriate.

The proposed Federal Water Project Recreation Act does not specifically designate any such areas but contemplates that special provisions for nonreimbursability of recreation and fish and wildlife enhancement costs will be made in project legislation where it is determined that Federal administration should be retained. The Marble Canyon unit of the Lower Colorado Basin project is, in our view, such an area.

The Marble Canyon Dam site would be 12.5 miles above the Grand Canyon National Park boundary, and the reservoir would extend upstream to Glen Canyon Dam. The upper 20 miles of the Marble Canyon Reservoir would be within the area surrounding Glen Canyon Dam now administered for recreation and fish and wildlife enhancement by the National Park Service. Logically, Marble Canyon should be similarly administered.

Thus, by providing for Federal administration of the facilities for recreation and fish and wildlife enhancement at the Marble Canyon unit, a fully developed recreation area, extending from below Davis Dam to above Lake Powell, consolidated under National Park Service administration, will be possible in this otherwise arid and recreation limited region. We do not believe that this unique potential should be wasted.

The Dixie project was authorized by the 88th Congress (78 Stat. 848) and is, by section 309 of H.R. 4671, expressly integrated into the Lower Colorado River Basin project. Section 6 of the Dixie project legislation authorizes the Secretary to provide basic recreation facilities and to acquire such lands as are necessary for this purpose. The foregoing proviso would dispel any doubt as to whether this authority continues and would make clear that the Dixie project would not be subject to the proposed Federal Water Project Recreation Act.

(5) On page 12, line 8, delete "basic."

To so restrict outdoor recreation facilities at these projects is not consistent with the proposed Federal Water Project Recreation Act. The latter bill will establish its own criteria with respect to separable costs for recreation and fish and wildlife enhancement.

(6) On page 22, after line 3, add a new section 406 as follows:

"Sec. 406. Notwithstanding any other provisions of law no contract relating to an irrigation water supply from the mainstream of the Colorado River shall commit the United States to deliver such supply for a basic period or irrigation block exclusive of any development period authorized by this Act, nor shall such a contract carry renewal or conversion rights or entitle the contractor to water beyond expiration of the delivery periods specified therein. In negotiating new contracts for delivery of such mainstream water, the Secretary shall consult with representatives of the State in which the use of such water is apportioned by any decree of the Supreme Court of the United States entered in *Arizona v. California, et al.*, 373 U.S. 546, and the Secretary shall take into consideration the overall water supply and needs of the project involved. The provisions of this section shall not apply to any user who on the effective date of this Act has in force a contract with the United States for mainstream water, or to mainstream water decreed for Indian lands in *Arizona v. California, et al., supra.*"

Until such time as sufficient water is available to meet all demands, it is important that legislation authorizing new projects using lower basin Colorado River water include the mechanisms whereby the availability of water as between irrigation and municipal and industrial uses can be further considered from time to time. Irrigation water contracts should be of a definite term—long enough to justify investments and development to put the water to use, but nevertheless with a finite time limit—to provide the opportunity for reappraisal of the water situation at the end of the contract period looking to the dedication of water to its highest use at that time. We recognize that this is a departure from the permanent service requirement of the Boulder Canyon Project Act and the provisions of the act of July 2, 1956 (70 Stat. 415) providing for renewal of irrigation water delivery contracts. It is, however, in our view justified by the conditions now prevailing in the Southwest.

(7) On page 23, lines 9 to 11, delete the parenthetical phrase "(which may in its discretion remand any such action to the United States District Court for the District of Columbia)".

It is believed that if such a waiver of immunity is to be retained, it should be limited to suits in the Supreme Court as is the case under the similar provision in section 14 of the Colorado River Storage Project Act (70 Stat. 110, 43 U.S.C. 620m). In addition, article IX of the Supreme Court's decree in *Arizona v. California* provides for retention of jurisdiction by the Supreme Court. While we believe such waivers of immunity are undesirable, no objection is offered in view of the inclusion of a similar provision in the Colorado River Storage Project Act and other Colorado River legislation.

(8) Renumber section 503 as 504 and add new section 503. New section 503 should read as follows:

"Sec. 503. Notwithstanding any other provision of this Act, water made available by or to units of the project herein or hereafter authorized shall not be made available directly or indirectly for the irrigation of lands not having a recent irrigation history as determined by the Secretary, except in the case of Indian lands, national wildlife refuges, State-administered wildlife management areas with the approval of the Secretary, and the Dixie project, Utah (not to exceed 11,615 acres), unless and until otherwise provided by the Congress."

This new section is designed to limit the expansion of irrigated acreage using water made available under the bill. It is justified by the concept of protecting existing economies that underlies the provision of water at Colorado River costs to maintain the Lower Basin supply of 7,500,000 acre-feet of water for annual consumptive use from the mainstream of the Colorado River. See January 1964 Report, Pacific Southwest Water Plan, page 30.

(9) Earlier presentations to the Senate committee by this Department recommended that legislation such as this include language authorizing the Secretary to "continue construction of irrigation distribution and drainage facilities on the Colorado River Indian irrigation project, Colorado River Indian Reservation, and construct diversion and distribution facilities to develop approximately 3,200 acres of new land on the White River project, Fort Apache Indian Reservation." The facilities referred to in the foregoing language are presently authorized under existing legislation pertaining to Indian projects and the foregoing language was included as part of our legislative drafting in the interest of presenting a complete projection of the Department's proposed water resource

activities in the Pacific Southwest. Because these facilities are authorized, it is not necessary that this provision be included in this legislation.

(10) On page 25, line 11, the reference to title III should be to title II.

Although as noted earlier in this report, it is proposed that titles II and VI be eliminated in favor of a "National Water Commission," we call this evident typographical error to the committee's attention.

In my report of April 9, 1964, reporting on S. 1658 and transmitting the Department's Pacific Southwest water plan report of January 1964, I stated:

"As spokesman for the administration, I can state that we have bent every effort to develop the framework of a regional plan which would be eminently sound in its conception and which would serve as a vehicle for common cooperation. This comprehensive plan represents the largest and most complex planning job ever undertaken in a single river basin by this Department or any other administration.

"I am not prepared today on behalf of the administration to present a final and conclusive report and set of recommendations to your committee for two reasons, and for two reasons only. First, there are several major issues which are still under study by the administration and which need further analysis. The second reason relates to our uncertainty whether the people of the Pacific Southwest and their representatives in the Congress are prepared to support and work for a specific regional plan. Many voices have been heard in the region during recent months. A general consensus has developed in favor of a regional approach but no broad agreement has been evident as to a specific type of regional plan.

"Obviously, our extensive planning efforts will have been wasted unless sufficient unity can be attained by the water leaders of the respective States and their representatives in the Congress.

"If such unity is forthcoming, I can say with confidence that the final decisions will be made and the administration will give its full support to a sound regional plan that will achieve the objective of water sufficiency for the Pacific Southwest."

That unity has been largely achieved. The administration has concluded its study. The program recommended in this report is a sound approach to the water problems of the Colorado Basin. It poses no threat to the interests of any other region. It is responsive to the call made in your letter to me of November 27, 1962, and in your address of September 28, 1963, to the Arizona Reclamation Association.

The Bureau of the Budget has advised that there is no objection to the submission of this report from the standpoint of the administration's program.

Sincerely yours,

STEWART L. UDALL,
Secretary of the Interior.

Senator KUCHEL. Mr. Secretary, if you say that you offer here what is in Senator Hayden's bill and Senator Jackson's bill today as a first step toward a regional development, I most respectfully suggest that the step you outlined in detail in 1965 would be far more preferable, because that was the step concurred in, Mr. Secretary, by representatives of every State in the basin, upper and lower.

Secretary UDALL. Senator, let me address myself to this, because I do not think the current administration bill abandons in any way the regional approach which we supported 4 years ago at the time of the Supreme Court decision. We pointed out then, and it took us 2 years to persuade some people that this was the true situation, that the whole basin was in trouble, that the river was short, and that the runoff estimates of 1922 in Santa Fe were too optimistic.

There are two things in this legislation, or that can be put into it, that assure the regional approach. One is the type of language that we suggested that the committee could include to establish a basin account. This could be done with the Hoover-Parker-Davis system power revenues. It is curious to me that some people don't want to talk about that.

The second thing is a National Water Commission study that I now see as a predicate, as the first step necessary before there be action. I want to be brutally candid on this.

I participated in discussions 2 and 3 years ago when the Columbia River was discussed as an alternative source of water for the Colorado River. The Bureau of Reclamation people pointed out, and I think they were probably right, that if you are going to have a large importation program, to get economies you had to go to a project of large size.

I did not realize at that point, but I learned rather quickly, how seriously the people in the Northwest objected to an immediated march toward the Columbia River. This is the reason it seems to me at this point, and I think this ought to be excruciatingly clear to everyone, that the people in the Northwest, and I think quite rightly, regard the authorization of Hualapai Dam as a gun pointed at the Columbia River.

I would predict if it is authorized—I can't promise you the President would sign such a bill—that there are Members of Congress who will cite it as a decision by the Congress aimed at some time in the future, that the Congress at that point made a decision to import water from the Columbia River.

Therefore I came to the conclusion, after painful experience, which I think this is the course of wisdom, that the way to get a regional plan started is to begin with a National Water Commission study. When the Deputy Director of the Budget, Elmer Staats—this was his idea 2 years ago, it as not mine, I was skeptical about it—proposed this originally I had reservations about it. I no longer have reservations. I think this is the right way to begin, so that we can get a bona fide look at alternatives and not prejudice it by saying that the way to make the Colorado River whole is to go to the Columbia River.

The more that I have learned, as I have looked at weather modification, as I look at advance waste treatment and the reuse of sewage effluent, as I look at the big bold steps we are taking in water desalination, I think it would be foolish to be making a decision at this time by saying we must authorize Hualapai Dam, because that is the only way that we can get the money that we need to go to the Columbia River.

Senator KUCHEL. You do, however, do you not, recommend further, and state to this committee, that if the committee saw fit to authorize the construction of a dam on the river, which by the production of hydroelectric power would feed a fund, you would have no objection to that; is that not a true statement?

Secretary UDALL. We would have a very big objection to authorization of a dam. We don't think a dam is needed. If the committee wants to set up a basin account, and I think it should, the way to do it is to base it on a project that is half paid out, one of the best on the river, the Hoover-Parker-Davis complex. Go ahead and establish a basin account with that as the initial base.

Why do we have to inject controversy? The reason that I support Senator Hayden's bill is that it tries to eliminate controversy. Let's not put controversy back in unless we absolutely need to, and we don't need to. That is the point we are trying to make.

Senator KUCHEL. You took the dam out because you felt that that would avoid a controversy.

Secretary UDALL. I think this is very important. This is the way we achieve an objective. That is the traditional way. A dam isn't necessary. If a dam were absolutely necessary, I think we would have to authorize a dam. It isn't necessary, and therefore why should we? I think the burden is on those who say we need a dam.

Senator ANDERSON. Will you yield for one question?

Senator KUCHEL. Sure.

Senator ANDERSON. Do I understand, Mr. Secretary, that if Hualapai Dam is authorized you are going to oppose it?

Secretary UDALL. We are opposed to a bill with a dam in it.

Senator KUCHEL. Mr. Secretary, do you believe the public interest would be served by studies being made of areas of potential water surplus by which that surplus might be transported to areas of deficiency?

Secretary UDALL. I think what the Nation needs, and I believe this today although I did not see it that way 2 years ago, is the modern approach to conservation of resources. You look at all alternatives, and this enables you to make a series of choices. It enables you to do what is the best thing, which is usually the most economical thing.

Why, as a beginning step would you want to go to the Columbia River and build a tremendous aqueduct, and import \$65-per-acre-foot water when you can produce it through weather modification for \$1? Therefore I think you are going to have to make a series of decisions over a period of years. You begin by doing the thing that is most economical, and ultimately if you must do the things that are more costly and more controversial, well, you do them.

You will probably have a whale of a fight doing it, but I think the prudent way to plan resources is to look at your alternatives and do the least controversial thing that is most economical first, and move on from there.

Senator KUCHEL. You used the word "Columbia." I didn't.

Secretary UDALL. Senator, the word is in the room. It is there. I learned it the hard way, and I think we might as well be honest about it. That is the only way I know how to approach it.

Senator KUCHEL. But I am learning it the hard way too, and in August 1965, Mr. Secretary, when one of the Representatives in the House, Mr. Reinecke, said:

Is the Central Arizona Project an end in itself or is it the long-range plan of the Department to incorporate other features of the original Southwest water plan of the future?

You said—

I think the important answer to that is that the main feature of the bill, to me the heart of the bill, is not the central Arizona project. The heart of the bill is the basin account, and the basinwide approach, which opens the door to whatever the region needs in the future. I think that this is a first phase, and an import program of some kind is the obvious second phase. We now propose a vehicle with the major hydroelectric dams on the river committed to produce revenues for whatever the region needs in the future.

Mr. Secretary, I will say to you in my judgment this committee almost unanimously would agree on a regional bill. This is my view. I think most members on this committee are ready to say, "Let's have studies made. Let's give some consideration to what Secretary Udall

said, that the specific problem of the Southwest has more urgency than any other area in the country." I think this committee would give consideration to the type of financing necessary, which would be different from what you have suggested here, and I think that some legislation similar to what your good brother, who is sitting over there——

Secretary UDALL. Don't do that to me.

Senator KUCHEL (continuing). Sponsored in the House of Representatives last year could go to the President. Would you quarrel, Mr. Secretary, with——

Secretary UDALL. I think he has some very controversial provisions in his bill that I don't think could pass the House much less get a signature on it.

Senator, I am not retreating one inch from my belief that the only wise thing for the people of the Colorado River Basin is to work together on a regional basis to solve their problems. I would like to see a basin account established in this legislation, and I agree precisely with what I said at that time.

The thing that amazes me though is the attitude of some people, particularly the people in your State, concerning the one big dam in the region. Hoover Dam is not producing revenue for water. It never has been. Why not use it to establish a basin account?

Is it because the power users in southern California don't want to pay a little extra the way everybody else is for water? This dam is built. It is half paid out. It is there ready to go to work for the basin, but no, we don't want to put it in the basin account. We want to authorize Hualapai. Why? Because this is the downpayment on the Columbia River. Now that is clear to me.

Senator KUCHEL. You should be ashamed of that statement, because you and I are friends, and I hope that the difficulties that we face in this legislation we can overcome, and I think that the history of Hoover Dam and how it was built and who paid for it might indeed be a subject of discussion, but I would prefer to look forward rather than backwards, and I prefer to try to bind up wounds rather than to stick a knife in people.

As far as I am concerned, I want in good faith to go back to the recommendations which you made to this committee 2 years ago, and use that, Mr. Secretary, as a basis for helping the people of Arizona, without damaging anybody else.

Secretary UDALL. Senator, the sad truth is the 89th Congress did not act, and it did not act because there was too much controversy. Senator Hayden's bill, which is in agreement with the position of the administration and the President, proposes to eliminate controversy and to get started. It, plus the National Water Commission would do just that. Five or six years from now we can all, those of us who are still here, sit down and make some decisions at that time. But the water crisis is not so critical that we can't spend 5 years to have a real searching look at alternatives by a national water commission. I really believe this.

Senator KUCHEL. Your statement to the committee is, however, that the water needs of the Pacific Southwest are going to be satisfied only, to use your word, by augmentation of waters?

Secretary UDALL. I think some kind of augmentation is obviously needed. Clearly it is.

Senator KUCHEL. An augmentation includes among other potentials the possibility of importing water, which is surplus to another area's need, is that not true?

Secretary UDALL. Northern California, or any other river basin. This is the modern approach.

Senator KUCHEL. Alaska.

Secretary UDALL. Look at the alternatives. Here the State of California, with its magnificent big State project in which we are your partners, is rapidly completing a diversion system to southern California. It hasn't delivered water yet. And so we are not in a position of a crisis in California, in the sense that 5 years is crucial, or even 10 as I read the record. It is crucial for Arizona. It has a very crucial problem, much more so than the other States.

Senator KUCHEL. I would like, Mr. Chairman, to have the right to submit some questions in writing to the Department to be included in the record.

Senator ANDERSON. Is there objection? There is none.

Senator KUCHEL. I have no other questions. Thank you very much.

Senator ANDERSON. Senator Hayden.

Senator HAYDEN. No questions.

Senator ANDERSON. Senator Bible.

Senator BIBLE. No questions at this time. I want to ask some questions of some of the departmental people, but I will reserve my time.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Yes. Mr. Chairman, before starting, I wonder if I could inquire of the Chair what the plans of the chairman are with respect to these meetings. We have a lot of people here. I realize that. On the other hand, we have an unresolved question on the Senate floor which may demand our attention, and more than just walking in to participate in the vote. What are the Chairman's ideas about that?

Senator ANDERSON. I have been through two of the hearings on projects some years ago. I assume there are a great many questions on the controversy here today. I think we might recess at 12:30 and resume at 2:00, or we might recess at 1 o'clock and resume at 3:00.

Senator ALLOTT. Mr. Chairman, could I ask this. If the situation on the floor became such that some of us felt we had to be here, would the Chairman entertain a request that we adjourn this meeting temporarily, in order that we could be there at those times?

Senator ANDERSON. I would follow the wishes of the majority of the committee. I would hope to keep these hearings going as long as we can.

Senator ALLOTT. And I would hope we could too.

Senator ANDERSON. Let's proceed until 12:30 and come back at 2. Is that agreeable with the Senator?

Senator ALLOTT. Yes. First of all, Mr. Chairman, I would like to join in the point of view expressed by my ranking member on this committee, Senator Kuchel, as expressed in his statements and in his questions. I want to say that I think he has done a brilliant job of setting out in his cross examination the basic situation in which we find ourselves.

And so I would like to turn first of all to the item on page 96 of the House hearings, which is found on page 21 of the summary report

of the Department of Interior, Bureau of Reclamation. Beginning at the bottom, I would like to ask two or three questions not covered by the Senator from California.

The top item there showing the figures for the years 1975, 1990, 2000, 2030 is indicated as virgin flow at Lee Ferry, which is estimated at 15 million acre-feet. Now I want to be sure that we are talking about the same thing. You are not talking about a discharge at Lee Ferry of 15 million acre-feet?

Mr. DOMINY. No, sir. What we have done there, Senator, is take the longest period of hydrology available to us, which goes back from 1906 through 1965. We update this every year. As we get a new year of record we add to it.

That period equates to an average virgin flow of 15,063,000 acre-feet per year at Lee Ferry. That doesn't mean there is that much water at Lee Ferry, because we have calculated all of the diversions and uses in the Upper Basin.

Senator ALLOTT. So that the next item, which is the Upper Basin depletion, shows 4,220,000 in 1975, increasing to 5,300,000 in 2030.

Mr. DOMINY. That is correct.

Senator ALLOTT. I must say, Mr. Chairman, I do intend to go into these figures in far greater detail with later witnesses. Now based upon the annual hydrology of the last 30 years, and based upon the upper States apportionment of the river, what do you estimate is available for depletion for the upper States at this time?

Senator ANDERSON. Does the Senator from Colorado want to know the actual depletions from the river?

Senator ALLOTT. Not actual depletion but what they figure is available for depletion.

Mr. DOMINY. First of all, Senator Allott, did you intend to limit this to the average available in the last 30 years when our hydrologic studies are based on the last 60 years? We go back to 1906 in our records.

Senator ALLOTT. You are taking advantage of some awfully good years, but then what do you figure is available? Based upon the last 30 or 35 years it would change the figures considerably.

Senator ANDERSON. Senator Allott, you know what the flow for the past 45 years has been.

Senator ALLOTT. Yes.

Senator ANDERSON. If we took the actual measurements over a shorter period of time we would have a shocking picture of the stream flow. But picking up from 1906 it shows a much better picture.

Senator ALLOTT. The chairman is entirely correct, and this is what I was really trying to get at. How much do you figure, based upon the hydrology of the past 30 or 35 years, Mr. Dominy, is available for depletion in the Upper Colorado Basin?

Mr. DOMINY. Of course, I disagree with the assumptions that we ought to take a lesser period of record than is available to us to base the judgment of the future of the Colorado River. Of course, if we took the last 30 years, we wouldn't get 5.8 by the year 2030. We would get something less than that.

Senator ANDERSON. Would not 45 years be a pretty fair sample?

Mr. DOMINY. I think the longest period of record is the best man can use on any river, Senator.

Senator ANDERSON. How are those records to be obtained? Not very carefully, were they?

Mr. DOMINY. I am talking about the ones that were obtained, carefully enough so that they can be relied upon with reasonable judgment. That is what we have used. We went back to 1906—1906 to 1965. We do think that period of record is a realistic one.

Senator ALLOTT. If you take the last 30 or 35 years or 45 years, back to the year of the Colorado River compact, what figures would you come up with?

Mr. DOMINY. I will be glad to supply that for the record. We can calculate it on the last 30 years. We can calculate it on the last 45 years.

Senator ALLOTT. Let's use the last 45 years, since the Upper Colorado River compact. Will you supply this?

Mr. DOMINY. Yes; I will be happy to.

(The information requested is as follows:)

In the 45-year period 1922 to 1966, inclusive, the average annual virgin flow at the Lee Ferry Compact Point is estimated to be 13.81 million acre-feet. Studies show that these flows could be regulated by Upper Basin storage reservoirs without spill in this period. If it is assumed that the Upper Basin obligation to deliver water at Lee Ferry to meet the obligations of III(c) and III(d) of the Colorado River Compact averages 8.25 million acre-feet per year, the water available for depletion in the Upper Colorado River Basin would be 5.56 million acre-feet per year.

Senator ALLOTT. Then, moving down to the figures, on the basis of your present bill, you assume that there will be 2,142,000 acre-feet available for the central Arizona project in 1975?

Mr. DOMINY. That would be available. It would take a larger aqueduct than 2,500 feet to actually move that amount into the central Arizona project. We show 1,650,000 acre-feet.

Senator ALLOTT. That would fall to 822,000 by the year 2030.

Mr. DOMINY. That is correct, as the Upper Basin depletions increase with project completions.

Senator ALLOTT. So that you would have a project in Arizona, then, if you constructed a larger aqueduct, in which the water available for Arizona in 50 years has been depleted by $2\frac{1}{2}$ times.

Mr. DOMINY. Well, not quite that much.

Senator ALLOTT. Approximately.

Mr. DOMINY. Approximately that; yes, sir.

Senator ALLOTT. It is the difference between 8 and 21, and that is about $2\frac{1}{2}$ times.

Mr. DOMINY. Yes.

Senator ALLOTT. In fact, I think that is a little over $2\frac{1}{2}$ times.

Mr. DOMINY. Yes. Our whole projection of the central Arizona project, Senator Allott, is one of preserving the economy and permitting the agricultural economy to continue as long as possible. We recognize that agriculture will gradually diminish, and that eventually what assured water is available from the project will be used for municipal and industrial purposes. Our payout is predicated on that basis.

Now, fortunately, the agricultural operations are based largely on use of ground water. In the good years we will slow down the depletion of this ground water substantially with this project, and thereby prolong the agricultural base potential of Arizona. But, inevitably,

it will decline, unless the Colorado River is augmented with additional supplies of water from some source.

Senator ALLOTT. So that what I am really trying to get at is this: that if, as is proposed in the administration and Hayden-Fannin bill, only the Dolores and the Animas-La Plata projects are authorized in Colorado, and then it would be as it has been for many years, to the advantage of the Lower Basin States to slow down the further authorization in Colorado, because then a difference between the 822,000 in the year 2030 and the 2,142,000 in 1975 would, of necessity, have to come out of the Upper Basin water.

Mr. DOMINY. It is certainly true that until the Upper Basin puts its full compacted water to work, we anticipate there will be a greater quantity available in the Lower Basin.

Secretary UDALL. Senator, I would like to add something that may be helpful to the case you are trying to make here, because there has been a recent development; namely, the implementation of an oil shale development policy, which I think has a considerable bearing on the whole problem of the five Colorado projects.

The West Divide project, for example, is one that I think very clearly we see today in a way that we did not even a few months ago. The highest and best use of water will not be for irrigation, as was planned initially, but will be used in major part for oil shale development which is certain to occur on the western slope. Therefore we already have in view a completely different economic projection in terms of the water.

These projects are probably far more feasible for that reason than the initial study showed.

Senator ALLOTT. I appreciate the Secretary's remarks. I think we may find some other changes of view throughout the entire upper State basin, so that the oil shale application may not be the only one.

The point I do want to make out of this particular matter is that, until these others are authorized, and I will show at a later time by examination of other witnesses, that even on the Dallas and West Divide and San Miguel, when they are authorized and built and in operation, Colorado will not be able to utilize its full share of the water of the upper Colorado River compact, 51.75, even under the 60-year figures of the Commissioner, and certainly not under the 45-year figure which I intend to see is put in the record.

So why, then Mr. Secretary, have you chosen at this time to delete what for Colorado is a very necessary development?

Secretary UDALL. Senator Allott, this was a decision that was made in the usual way, with the Bureau of the Budget playing a primary role in this. We recommended two. We did not recommend against the other three which were included in the House bill reported last year, as you know. But it was felt at the time the studies were made, because these were projected primarily as irrigation projects, that they were so marginal that there should be further study.

I think the thing that has changed the whole picture is the promulgation of an oil shale development policy, and I think the water from some of these particular projects, as I indicated a moment ago, is probably going to be prime water, and its highest and best use will be as part of the total oil shale development on the western slope, rather

than for irrigation. You will probably get 30 to 40, to 50 times more economic benefits from using it for municipal and industrial purposes than for high mountain irrigation.

Senator ALLOTT. This may be true, Mr. Secretary, but for example, in the San Miguel, you can hardly conceive using that water for oil shale.

Secretary UDALL. This is probably true in terms of that particular project.

Senator ALLOTT. Now, I would like to go back temporarily to another matter.

Mr. Secretary, I know we have not seen eye to eye on a lot of matters, but I regard you as a sincere man, who is trying to do the right thing. But in the establishment of the National Water Commission, the passage of that in the Senate, Senator Kuchel in the hearings asked you:

Without in any way attempting to put words in your mouth, is it fair to say, Mr. Secretary, that you feel there is no greater water problem in this nation today than that which faces the States in the Colorado River Basin.

You replied:

Well, I think in terms of the pending serious water shortages that have clearly emerged, that certainly this is the first priority area in terms of crisis.

Do you still feel that way?

Secretary UDALL. Yes, indeed. I think this is the only honest estimate one can make.

Senator ALLOTT. And, as you know, an amendment proposed by me in the Senate was that, "the Commission give first priority to the water resource problems of the Pacific Southwest and the Colorado River Basin."

That was defeated in committee, as you are aware. Now, later on in that same hearing, you stated that the Colorado River was "an obvious candidate for one of the first undertakings of the Commission."

Then later, you said, "Acceleration of the review of the Western water problems, with particular emphasis on the Colorado River Basin," that you were favorably disposed to that.

Now, Senator Fannin asked Mr. Hughes, the Deputy Director of the Bureau of the Budget, some questions, and he answered this way:

As Secretary Udall indicated this morning, we have supplemented our earlier comments on the Commission by indicating that some priorities with respect to Western problems and perhaps the Colorado River Basin in particular, would be acceptable to use and appropriate.

Later, in a colloquy with Senator Kuchel, Mr. Hughes said further:

It seems to me that the Commission bill language, or perhaps the legislative history, could be worded to meet the priority need as we see it, and as the Congress sees it, of the West, and the Colorado River Basin in particular.

I must confess that with these words, Mr. Secretary, I cannot quite understand your optimism in the fact that a Commission sometime in the future is going to be able to solve these problems. This indicates in your own words the matter of prime necessity in the Colorado River Basin.

Secretary UDALL. Senator, let me put this in perspective, because there is no question that the most critical water shortages that are im-

pending appear today in that geographical region which we call the Pacific Southwest and the Colorado River Basin.

However, the problems are not so critical that a 5-year time span creates critical problems in its own right, and I understand the concern that you and Senator Kuchel have expressed.

I would be surprised, as I indicated that in my testimony, that if, of necessity, the Commission did not give early attention to these problems. But I think if you try to put guidance in the legislation, you might very well find there are other people in other parts of the country that think their problems are equally critical, and that you would create confusion, rather than leaving a general choice for the Commission to study the broad problems that the country has.

Senator ALLOTT. This is an added point, it seems to me, why the States involved in the Colorado River Basin should proceed on their own. On page 9 of your statement you indicate:

The Administration continues to believe that the question of an interstate priority is one for resolution primarily by the States involved and by the Congress. If agreement is reached on an interstate priority, we would offer no objection.

It seems to me that although you speak about interstate priorities, that this is essentially what the Congress did, what the seven States did, in presenting to this Congress last year the bill which was offered in the House, which unfortunately did not become law, but that isn't of particular significance.

A lot of things don't become law. But when I consider this with respect to your own statement, I think that this is exactly what we did, and that that concept has been abandoned in favor of a concept which gives immediate relief to one State. And let me say that no one is more concerned than I am about the problems of Arizona and the crisis they face.

I want to help them, but I don't want to do it at the expense of my own great State, which has been too long deferred in its development, or of the other States, either, of the Upper Basin or of the Lower Basin. Therefore, I cannot understand the sudden change in policy which does exactly this, in my opinion.

Secretary UDALL. Senator, the administration bill, I would point out, does favor authorization of these Colorado projects.

Senator ALLOTT. Only two out of five.

Secretary UDALL. Two large ones. I think these are urgent and you have made the case on that. We do favor the establishing of a framework for a regional approach, and of course, this is another matter that is before the committee as well.

Senator ALLOTT. Mr. Chairman, do you want to stop the hearing now? I have quite a few more questions.

Senator ANDERSON. Mr. Secretary, we will recess. All those who are scheduled to testify will please give their statements to the staff as soon as possible. To avoid confusion, we would like to request visitors to refrain from taking material from the podium. I think, Mr. Secretary, we will adjourn and meet again at 2 o'clock.

The meeting is recessed.

(Whereupon, at 12:35 p.m., the committee recessed, to reconvene at 2 p.m. the same day.)

AFTERNOON SESSION

Senator ANDERSON. We will probably have some difficulty today because of interruptions, so we had better start on time.

Senator ALLOTT.

Senator ALLOTT. Yes.

Mr. Chairman, reverting to the questions on water supply this morning, which were answered by Mr. Dominy, is it true, Mr. Dominy, that as of January, this year, the estimated supply of the river was 10 million acre-feet?

STATEMENT OF HON. STEWART L. UDALL, SECRETARY OF THE INTERIOR, ACCOMPANIED BY KENNETH HOLUM, ASSISTANT SECRETARY FOR WATER AND POWER DEVELOPMENT; FLOYD E. DOMINY, COMMISSIONER, BUREAU OF RECLAMATION; AND EDWARD WEINBERG, DEPUTY SOLICITOR, DEPARTMENT OF THE INTERIOR—Resumed

Mr. DOMINY. Yes. December was a real good month this last year, about 140 percent of normal. October–November had been below normal, and December overcame that, and we had a real good runoff prospect had we been able to get normal precipitation in January, February, March, and April. But we did not get normal precipitation during those 4 months, and we now have a projection of only 4.3 million acre-feet runoff at Lee Ferry during April through July. This would be one of the lower runoff years of record, if it should hold at that level.

Senator ALLOTT. At this point, this being the 2d of May, there is no reason to suppose that there is going to be any more precipitation in the mountains by way of snow of any consequence.

Mr. DOMINY. You can still get snow in the high elevations, of course, but even assuming a normal May and June and July, we still anticipate only 4.3 million acre-feet of runoff during April to July.

Senator ALLOTT. And what is your present forecast for the water year ending September 30, 1967?

Mr. DOMINY. We figure 66 percent of the longtime average for our entire water year.

Senator ALLOTT. Sixty-six percent of the longtime average?

Mr. DOMINY. That is right, 66 percent of 15 million.

Senator ALLOTT. Is the longtime average of 60 years what you are using?

Mr. DOMINY. That is correct. That is the 1906–65 period.

Senator ALLOTT. So if you use the 45-year period, it will be substantially less than that.

Mr. DOMINY. No, sir.

Senator ALLOTT. Expressed in terms of percentage.

Mr. DOMINY. No, sir; in terms of percentage it would be more, because the 45-year period is a lesser acre-foot average than the 60-year period.

Senator ALLOTT. What would it be then?

Mr. DOMINY. We are figuring about 7.1 million acre-feet as the actual yield of water for the year ending September 30, 1967.

Senator ALLOTT. 7.1, did you say?

Mr. DOMINY. 7.1, that is right, sir. This compares with the lowest year of record of about 5.5 million acre-feet of virgin flow.

Senator ALLOTT. And this compares with 15?

Mr. DOMINY. The 7.1 is the actual wet water we expect to reach Lee Ferry. Taking into account the Upper Basin uses, the virgin flow will be about 10 million acre-feet. That equates to 66 percent of the long-term average.

Senator ALLOTT. That would, then, leave diversions of approximately 2.9 million acre-feet in the upper river basin?

Mr. DOMINY. That is what you are presently using at the most, yes.

Senator ALLOTT. I would like to go in, with the Secretary, to the matter of the proposed powerplant. Where will this proposed steam-plant be located?

Secretary UDALL. It will be located, Senator, somewhere fairly close to Lake Powell. We refer to it as the Page plant—Page, Ariz., being the nearest city. We haven't located it precisely, but it will probably be the closest point where we can get near enough to the lake, and also be as close as possible to the coalfields to minimize transportation.

Senator ALLOTT. I presume, then, it would be somewhere south and west of the dam itself?

Secretary UDALL. Yes, more south. It would be south of the lake somewhere.

Senator ALLOTT. First of all, how much less is it contemplated would be produced by this powerplant? You estimate 400,000 kilowatts is needed in the central Arizona project.

Secretary UDALL. We don't have anything positive on that. I would assume it would be a plant comparable to the Mohave plant of the west group, which is two 750,000-kilowatt units, with a total of 1,500,000 kilowatts.

Senator ALLOTT. Two 750,000?

Secretary UDALL. They are thermo units; that is right.

Senator ALLOTT. That would be 1,500,000.

Secretary UDALL. That is right.

Senator ALLOTT. Now, what would be the source of water for these operations?

Secretary UDALL. The source of water contemplated would be that part of Arizona's Upper Basin entitlement that is not now being used. We think this makes a very good solution.

Arizona was given 50,000 feet of Upper Basin water in the Upper Basin compact because of the drainage basin in northeastern Arizona, practically all of which incidentally is on Indian reservation. Using this water, which must be used in the Upper Basin, for the development of coal and the generation of power, seems to us to be the most logical use of this water.

Senator ALLOTT. What is your estimate of the total consumptive use of this water?

Secretary UDALL. We have been thinking of up to 40,000 acre-feet. There is some of that water that is already put to use, about 10,000 acre-feet.

Senator ALLOTT. There is a little less than 10,000 acre-feet utilized by the Indians in this area, and it is contemplated that all of this water is subject to the control and request of the Indians, is it not?

Secretary UDALL. I would not anticipate any problem with respect to this water that could not be worked out between the Department, the Indians, and the State.

Senator ALLOTT. I don't recall the exact figures, but that exact figures at the time this matter was settled, discussed, on the Colorado River, House Document 419 of the 80th Congress, First Session, the amount of present depletion at that time which was utilized by the Indians was 10,200, and the potential increase was set at 39,000, making a total ultimate depletion of 49,200; is that correct?

Secretary UDALL. This is essentially the correct figure still.

Senator ALLOTT. I am reading from page 150 of that document. So you are simply rounding figures out above the then present depletion up to the ultimate depletion of the river from Arizona's share of the upstate water?

Secretary UDALL. That is correct, Senator.

Senator ALLOTT. So then, this water would be charged to Arizona?

Secretary UDALL. That is correct.

Senator ALLOTT. Now if the water is to be charged to Arizona, to its Upper Basin allocation, can you tell me how much water is Arizona presently using in the Upper Basin compared with the figures that I just read from the 1947 report?

Secretary UDALL. I would like to give you a precise figure, Senator. It is something in the vicinity of 10,000 acre-feet. I cannot give it to you exactly. It is really a modest amount for irrigation use for the most part.

Senator ALLOTT. The original report contemplated—this was, of course, in 1947—it contemplated the development and use of water for tourists, and otherwise beyond that, do you know whether this has occurred or not?

Secretary UDALL. Whether what has occurred?

Senator ALLOTT. For recreation.

Secretary UDALL. No. I am told the main use of water at the present time other than for irrigation is for Page itself, and of course, there is a recreational aspect to that.

Senator ALLOTT. Outside of Page, what are the locations of the present Arizona Upper Basin uses?

Secretary UDALL. These would be small irrigation projects on the Navajo Indian Reservation.

Senator ALLOTT. That is on the San Juan River?

Secretary UDALL. Yes; this would be part of the San Juan Basin.

Senator ALLOTT. I believe it is the Paria River, isn't it?

Mr. DOMINY. It is Indian irrigation on Chinle Creek, primarily.

Senator ALLOTT. Now, at the time the Upper Colorado River Basin compact was executed, was it not the understanding that Arizona's Upper Basin allocation was to be secured from the San Juan River tributaries in Arizona, and a small amount from the Paria River in Arizona?

Secretary UDALL. I don't know precisely what the record was, Senator. My understanding is that because Arizona had drainage in the

Upper Basin above Lee Ferry, and rather substantial drainage, that it was felt that it should have a modest Upper Basin entitlement. The truth of the matter is, I think there is probably some slight drainage on Paria which, of course, has its main drainage in Utah, but the tributaries of the San Juan are the primary source of Arizona runoff.

Senator ALLOTT. In the event that this plan of yours, Mr. Secretary, should ever come into being, what measures would you take to insure that the steam plants' allocation would be included within Arizona's Upper Basin allocation?

Secretary UDALL. We would tie this down by contract, Senator. There is already precedent for this. New Mexico has committed some of its water in the Four Corners area which involves development of Indian coal resources, to these big thermal plants. Nevada has just committed a substantial fragment of its water to the building of the Mohave plant, and that water has also been earmarked by contract. So we do this by contract.

Senator ALLOTT. I believe this is the Navajo's chiefly, there. What would you do if they brought a suit against the Government to preclude the use of this water by the Federal Government in the construction of this plant?

Secretary UDALL. Senator, the truth of the matter is that the Navajos are most anxious to have Arizona's Upper Basin water used and the Hopis, too, because their reservation is covered for the development of coal. This will bring them a far greater return than any other possible use, so that we have no conflict in that regard.

Senator ALLOTT. Have you negotiated with these tribes with respect to the use of the water and the use of the coal?

Secretary UDALL. We haven't put it all together, but we have been talking with them about it, and of course they are tremendously interested in this big coal development, which would be the first large-scale coal development in Arizona. It will supply the coal, by coal slurry pipeline, to the Nevada plant and to the Arizona plant, as well.

Senator ALLOTT. Of course, you recognize that I am talking about the Winters Doctrine, when I am talking about the Navajo's interest in this water. It seems to me that at this stage of the game, with respect to what has been done with relation to both the water and the coal rights, that we are in a very speculative position, or I should say, rather, that you are.

Secretary UDALL. Senator, I think I can calm your concern on this point, because the Navajos have been rather aggressive in wanting this water used for the development of their coal resources.

Senator ALLOTT. But as I understand it, you have no agreement with them, conditioned upon the building of the plant, either with respect to water or coal.

Secretary UDALL. We haven't put the agreement together. We do not see any obstacles to its consummation, however.

Senator ALLOTT. So you intend to secure such an agreement to preclude Arizona from using water in excess of her Upper Basin apportionment, in the event the steamplant is constructed?

Secretary UDALL. I think that we would have to observe very closely the limitations under the compact so that Arizona under no circumstances could use more than the amount of water allocated to it. We would have to tie that down by contract.

Senator ALLOTT. But, of course, as long as the various projects in Colorado remain undeveloped, it means there will be that much more water available in the Colorado River, both for Arizona and California.

Secretary UDALL. What we envision is, that in an orderly and planned way, all of the States, as their growth demands, are going to fully utilize the water to which they are entitled. This should be the basis of all planning.

Senator ALLOTT. I suppose then, Mr. Secretary, that you would have no objection to an amendment to the bill which would make it doubly sure that the water used in the steamplant would come out of Arizona's Upper Basin allocation?

Secretary UDALL. I think that would be a very good housekeeping detail. I see no reason why it shouldn't be in the legislation, to tie that point down and protect the Upper Basin States.

Senator ALLOTT. I would like to address a question to Mr. Dominy. I assume that you are familiar with the proposal presented by Mr. Goss, chief engineer of the Los Angeles Department of Water and Power, and I assume that you have had some opportunity to study this proposal with respect to some of its technical aspects; is that correct?

Mr. DOMINY. Well, to a limited degree. We certainly, at the suggestion of the House committee, have discussed it with Mr. Goss and a number of his people. An inspection trip up into the canyon section was involved, but there has been no exhaustive study by the Bureau of Reclamation technicians, Senator Allott.

Senator ALLOTT. Have you made a preliminary check as to the cost estimates?

Mr. DOMINY. Based on our preliminary check, we think that the Goss estimates are plus or minus within a very narrow margin of difference, if any.

Senator ALLOTT. A very narrow margin of difference with what?

Mr. DOMINY. Mr. Goss' estimate is within the realm of what we would have estimated for similar engineering works on the same time basis.

Senator ALLOTT. Have you had a preliminary financial analysis of this proposal?

Mr. DOMINY. Yes, to the same degree that I have discussed here. It is certainly not a feasibility grade study that we have made and that we would be prepared to recommend to Congress. We haven't gone into that detail. We haven't had the opportunity.

Senator ALLOTT. Could you possibly place in the record a reasonable summary?

Mr. DOMINY. Yes.

Senator ALLOTT. Of what the financial analysis shows on the repayment on this?

Mr. DOMINY. Secretary Udall sent a letter to Chairman Aspinall on this subject, with some attached material, based on our preliminary review, and I think that you might want to place that letter and the review in the record at this point to answer these questions.

Senator ALLOTT. All right. I don't have it available to me today.

(The letter above referred to follows:)

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., April 29, 1967.

HON. WAYNE N. ASPINALL,
*Chairman, Committee on Interior and Insular Affairs,
House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: Commissioner Dominy has advised me of your request that the Bureau of Reclamation analyze the proposal for a 5,100,000-kw pumped storage project at or near the Hualapai Dam site on the Colorado River. This proposal was first advanced on March 17, 1967, by Mr. Floyd L. Goss, Assistant Manager of the Los Angeles Department of Water and Power at hearings before the House Committee on Interior and Insular Affairs.

To prepare a meaningful analysis of Mr. Goss' proposal presents many difficulties. The proposal itself was obviously lacking the complete engineering and marketing studies which would normally be made by any Federal water planning agency. It is obvious, however, that the proposal as made implies substantial changes in national policy in the marketing of Federal power, including the preference clause, bus-bar sales, and pricing practices. In addition, it raises serious questions of timing in relation to the future marketing of Federally generated peaking power in the Pacific Southwest—including the repayment of the Northwest-Southwest intertie which is already under construction.

Mr. Goss' proposal also raises new conservation issues as it would require a re-regulating dam on the Colorado about 7½ miles below the Hualapai Dam in the Lake Meade National Recreation Area. The pool fluctuations of this working pool would be as much as 140 feet, which would necessitate the closing of this entire section of the river. It would also necessitate that the re-regulating reservoir be dredged, and the spoil placed in the mouth of Separation Canyon, a side canyon which enters the Colorado River within the area of the re-regulating reservoir.

Nonetheless, the Bureau of Reclamation developed a preliminary analysis of the proposal. The Commissioner's summary of that analysis is attached for your information.

Sincerely,

STEWART L. UDALL,
Secretary of the Interior.

ANALYSIS OF LOS ANGELES DEPARTMENT OF WATER AND POWER PROPOSAL FOR HUALAPAI DAM

An analysis has been made of the proposal to construct the Hualapai Dam as a 5,100 megawatt capacity pumped storage installation which was presented to the House Committee on Interior and Insular Affairs in testimony by Mr. Floyd L. Goss, Chief Electrical Engineer and Assistant Manager, Los Angeles Department of Water and Power, on March 17, 1967.

Mr. Goss' presentation to the Committee did not include sufficient descriptive data on the proposed physical plant and financial arrangements to provide a basis for engineering estimates and repayment studies. It was necessary, therefore, to meet with Mr. Goss and members of his staff and review with them the descriptive data and assumptions to be used in the analysis. The plan described below is in conformance with the understanding obtained of Mr. Goss' concept of his proposal.

Physical plan

The basic structure of the high Hualapai Dam would be essentially the same as in earlier Bureau of Reclamation presentations. Certain spillway modifications would be necessary. The major change in plan would involve increasing the installed generation capacity from 1,500 megawatts to 5,100 megawatts through adoption of a pump-back storage arrangement. In order to provide an afterbay reservoir and pumping bay for pump-back operation, an additional (afterbay) dam would be constructed at river mile 244.9, 7½ miles downstream from Hualapai Dam. The afterbay dam would be a concrete gravity structure, rising 215 feet above the riverbed, with a gated spillway.

The afterbay reservoir formed would have a capacity of 40,000 acre-feet. All loose material, silt and gravel deposits, and some rock would be excavated from the afterbay and placed in the mouth of Separation Canyon, a side canyon which enters the Colorado River within the afterbay section from both sides of the River. The resulting spoil would be blanketed with rock excavated from the

afterbay and placed to serve as silt detention structures for natural runoff from Separation Canyon.

Twelve 425-megawatt, reversible pump-generator units are contemplated at this time, with six units in underground vaults on each side of the dam. A switchyard would be provided as a project feature, but the main transmission system would be constructed by the utilities receiving the power and is not included as a project feature. The transmission facilities required to provide service to the Central Arizona Project pumps, however, are retained as project features. The estimated Federal costs of this plan as compared to Mr. Goss' estimate and to the Hualapai Dam plan included in H.R. 3300 (Aspinall) are summarized as follows:

Summary of construction costs

[In millions of dollars]

	H.R. 3300 (October 1963 prices)	Goss ¹ estimate	Goss plan * USBR estimate	
			October 1963 prices	Current prices
Hualapai Dam and Reservoir.....	138	133	142	154
Powerplant and afterbay.....	141	516	413	457
Switchyard and transmission.....	188	-----	93	104
Coconino.....	12	12	12	13
Paria.....	11	11	11	12
Construction camp and other.....	15	21	15	17
Recreation and Fish and Wildlife.....	19	19	19	20
Indian payment.....	16	16	16	16
Total.....	540	728	721	793

¹ Current prices.

* Preliminary estimate.

Project operation

The basic assumed flows of the Colorado River used in all recent Central Arizona Project studies were used in this analysis. The fluctuation in the surface level of Hualapai Reservoir would be limited to 5 feet, but the afterbay reservoir elevation would fluctuate 140 feet which would require closing the 7½ mile section of the river channel downstream from Hualapai Dam to any other use. The releases into Lake Mead from the afterbay dam would be essentially within the same range as those from Hualapai Dam in earlier plans.

As in past studies energy would be generated by natural river discharges through the powerplant. In addition, the utilities would provide offpeak energy from their systems to pump a part of the water back into Hualapai Reservoir at offpeak times and thereby increase the water available in Hualapai Reservoir for onpeak generation. The pumped storage plus natural runoff will provide a total of 55 hours of onpeak operation weekly at an average capacity of about 4,850 megawatts at the bus bar.

The energy and capacity requirement for Central Arizona Project pumping would be accommodated within the output of the plant. The remaining energy and capacity would be sold commercially at the bus bar to the participating utilities on long-term contracts.

The Goss proposal also suggests that as an alternative arrangement, Central Arizona Project pumping energy and capacity could be provided by exchange from thermal power taken out of the utility system.

Economics

In general, the analysis of the plan presented herein is based upon the premises used in prior Bureau of Reclamation analyses of plans for the Central Arizona Project. The portion of the costs of the power generating facilities associated with irrigation pumping were sub-allocated to irrigation and would be repaid without interest. Pumping power rates charged to the Central Arizona Project were the same as those used in previous plans which included Hualapai Dam, and the water rates for Central Arizona Project service were set at \$10 and \$50 for irrigation and municipal and industrial supplies respectively. Surplus revenues from Hoover Dam and the Parker-Davis Project after payout were included in the payout study to assist in project repayment and to contribute to a basin development fund.

The Commercial sales of energy were assumed to be the energy produced by streamflow through the powerplant less the energy required for Central Arizona Unit pumping. This energy was priced at 3 mills/kwh at the bus bar in accordance with the Goss plan. According to Mr. Goss' testimony, the price for commercial capacity remaining for sale after accommodating the Central Arizona Project pumping requirements, would be negotiated. For purposes of analysis, the effect on the development fund balances which would be produced for various capacity charges was determined. Representative examples are listed below for comparison with the Administration plan and the H. R. 3300 plan.

Plan	Total estimated cost (including C A P) (millions of dollars)	Development fund balance (including Hoover, Parker-Davis revenues) (millions of dollars)			
		Year 2025	(Hualapai contribution)	Year 2047	(Hualapai contribution)
Administration plan.....	719	500	(0)	1,191	¹ (110)
H. R. 3300 (Hualapai).....	1,167	768	(370)	1,849	(845)
Goss plan.....	1,348				
With \$4.40 per kilowatt charge.....		768	(370)	2,045	(1,042)
With \$9 per kilowatt charge.....		2,080	(1,630)	3,790	(2,790)

¹ From surplus thermal power generation.

In his testimony, Mr. Goss suggested that, if it were thought to be desirable, the utilities could provide a cash prepayment of capital costs associated with the generating facilities. This proposal would reduce the Federal investment; however, the utilities would then expect to negotiate a lower capacity price commensurate with their investment costs. Because investment costs to the utilities would be higher than those of the Federal government, a net reduction in the development fund prepayment arrangements would be anticipated.

Prospects for marketing Hualapai capacity

It can be seen from the above that under the Goss plan, a charge of \$4.40/kw for Hualapai capacity would net a Development Fund Balance equal to that developed under H. R. 3300 by the year 2025 and nearly \$200 million more by the year 2047. The lowest cost alternative source of peaking available to the Los Angeles area in the foreseeable future is that to be obtained from the Northwest via the Pacific Northwest-Pacific Southeast Intertie. The established Bonneville price of this capacity is \$9/kw at the Oregon border. If the charge for capacity at Hualapai Switchyard is made equal to this competitive price of \$9/kw then the Development Fund Balance would be increased by 1¼ billion dollars at year 2025 and nearly two billion dollars by year 2047 as compared to amounts developed under the H. R. 3300 plan.

Under the Goss plan, it is estimated that the average amount of peaking capacity available from Hualapai for commercial sale (after subtracting project pumping loads) will be over 4800 megawatts by about 1990. The table below shows estimated loads and resources in the Pacific Northwest-Pacific Southwest interconnected systems areas which indicate that there will be an ample demand for additional power resources such as Hualapai.

Estimated loads and resources, Colorado River Basin and Pacific Northwest areas (southern California, Arizona, Utah, New Mexico, southern Nevada, western Colorado, southwestern Wyoming, Oregon, Washington, and Idaho)

	Megawatts at load, year		
	1976	1980	1985
Estimated loads.....	56,400	71,200	92,000
Estimated resources ¹	54,000	60,000	69,000
Deficit to be served by future power sources.....	2,400	11,200	23,000
Probable peaking requirement (at 35 percent).....	840	3,920	8,060

¹ Existing and planned, including Intertie, MWD desalting plant, and Coulee 3d powerplant.

Secretary UDALL. Senator, I should like to comment on this because I think we should make the record clear.

To me, the fact that there has been no opportunity to make a full-scale depth analysis of this causes the Goss proposal, really, to become to my way of thinking a very powerful argument for what is proposed in the administration approach. That is to have a much fuller study made, including a study by the National Water Commission, of the Hualapai site.

The biggest question that it raises in our minds is a question of a market for the power. To authorize it now probably would be premature by several years. It might endanger the repayment of the intertie between Hoover Dam and the Pacific Northwest. We have none of the related intertie power sold at the present time. We are in the process of building, and we have very serious questions about the timing with regard to marketing the power.

Senator ALLOTT. I will ask this of Mr. Dominy. From a physical standpoint, do you believe the Goss plant is practical?

Mr. DOMINY. From an engineering practicality, yes. It will involve an afterbay of major proportions somewhere between that point and the upper part of Lake Mead, because there will need to be very wide fluctuations in the afterbay in order to accommodate the releases that would give the peaking capacities that the Goss proposal envisions.

Senator ALLOTT. It would give a greater opportunity for the development of generating peaks in the Hualapai Dam than considered in the original proposal, would it not?

Mr. DOMINY. Yes. An afterbay is provided which would accommodate the capacities that Mr. Goss has projected, with very little more fluctuation in the Hualapai Reservoir.

We have projected a 4-foot fluctuation in the Hualapai Reservoir under the 1,500-megawatt plant. Under the Goss proposal, with the pump-back storage and the requisite regulatory afterbay, you could probably hold fluctuation in the Hualapai Reservoir to 5 feet.

Senator ALLOTT. Do you see anything in that proposal, the Goss proposal, that would pose any exceptional construction or engineering problems?

Mr. DOMINY. No, nothing out of the ordinary as far as construction would be concerned.

Senator ALLOTT. How does your preliminary estimate—I haven't seen your paper—differ, if at all, compared with the figures presented by Mr. Goss?

Mr. DOMINY. There really isn't any major difference. The Goss estimate that was put into the record in the House, was \$728 million for the total job that he discussed. We estimate just a little less at October 1963 prices, because that was what our studies were based on.

If you index our estimate up to current prices, it would be more. We would have it up to about \$793 million. So I'd say it is just on a plus or minus basis. The difference is too nebulous to discuss in detail.

Senator ALLOTT. It is not really much more nebulous than the powerplant at Page at this point, is it?

Secretary UDALL. I am afraid, Senator, I would have to take serious disagreement with you on that point. The Page plant would un-

doubtedly be very similar to the Mohave plant and the latest plant in New Mexico in the Four Corners area.

We are far along in the negotiations. The Goss plan, to be quite candid about it, was pulled out of a hat a few months ago at the time of the House hearings, and has not been thoroughly studied by anyone. In my judgment it is not the type of study that the Bureau of Reclamation takes pride in presenting when it comes before a committee.

Senator ALLOTT. In conformity with your remarks that we have got to be visionary in this matter, don't you think that it deserves the same study that the Page plant would?

Secretary UDALL. Indeed, I do think it deserves study. This, to me, adds weight to the argument that development of the Hualapai site itself should be deferred at this time and should be studied further, in order to determine at some point in the future, after the National Water Commission's report is in, what the future of that site should be.

Senator ALLOTT. Would this proposal, the so-called Goss proposal—it would develop, as I understand it, 5,100 megawatts as compared with the 1,500-megawatt installation previously considered for Hualapai.

Secretary UDALL. The pump-back feature would add additional peaking power, yes, sir.

Senator ALLOTT. Are those figures approximately correct, Mr. Dominy?

Mr. DOMINY. Yes. The Goss proposal was based on an installed capacity of 5,100 megawatts for peaking purposes.

Secretary UDALL. I might add, Senator, the Goss plan is also noteworthy in that it stirs up a great deal of new controversy, both with regard to conservation issues and with regard to power policy. The Goss plan proposes that the Federal Government build Hualapai and the utilities build the lines in and take the power off at the busbar. It seems more designed to meet, or stir up, controversy than quiet it.

Senator ALLOTT. Mr. Secretary, I am also concerned about controversy, too, and yet having been in the water business for some 37 years now, I have found that you cannot get into the water business without getting into controversy, and so I think we need to ask ourselves, what is the best for the development of this region, not Arizona, but for the region, if we are to consider that.

Now, I would like to go back to another matter. There seems to be some confusion about what has occurred in the past. Mr. Secretary, you did recommend in the hearings in the Senate here in 1964 that the Hualapai Dam be built, did you not?

Secretary UDALL. As I recall, in 1964——

Senator ALLOTT. I don't wish to try and trap you, sir. Let me read from your statement.

Secretary UDALL. I think I can clarify it.

Senator ALLOTT. I want to read it into the record anyway. It is found on page 31 of those hearings, part 1. You said:

I recommend that your consideration of S.1658 be directed to careful consideration of the total needs and problems of the region, so that existing differences within the area may be resolved and a constructive program of action agreed to.

I have submitted with my report on S. 1658 for the use of the committee as it deems appropriate the Department's current draft of legislation designed to authorize the regional development and a plan of development for the region. The draft legislation would authorize in addition to the central Arizona project the Bridge Canyon and Marble Canyon power projects, the Dixie project, S. 26, the southern Nevada water supply project, S. 2388, and certain other needed developments of the Pacific Southwest.

Secretary UDALL. Yes, Senator. The 1964 hearing was exploratory in nature. At that point, the Bureau of Reclamation either had completed or was in the process of completing its studies, and this was the Department's position. It was never the administration position.

The Department's original proposal had not gone through the Bureau of the Budget. When it did and when we came in 2 years ago, in 1965, our position was for the construction of Marble, but for deferring action on the Hualapai site. The administration has never taken a position favoring the Hualapai site. It has taken a position favoring deferring action, and study by the National Water Commission.

Senator ALLOTT. I will ask you if, on page 317 of the hearings, you did not say this:

If there were any other site for a major dam which did not carry with it even the slight impairment of the park values resulting from a high dam at Bridge Canyon, I would not favor high dam. However, the urgency of the need for water in the Pacific Southwest and the requirements for the revenues from the high dam under present applicable feasibility standards, in my opinion, far outweighs the slight impairment of park values which Congress anticipated might result in the water development proposed in the plan.

Secretary UDALL. This was a presentation of the Department's thinking at that point. Of course, a lot of water has gone over the dam and down the river since that point, and we have all had to refine our views on what is appropriate at this point.

Senator ALLOTT. At one point, Mr. Secretary, you used the figure of producing water from weather modification at a cost of \$1 a year.

Secretary UDALL. An acre-foot.

Senator ALLOTT. \$1 an acre-foot. Where did you get that figure?

Secretary UDALL. Senator, that is the same figure I gave you, as I recall it, at the hearings 3 weeks ago, on weather modification. In fact, the figures that our weather modification people, the Bureau of Reclamation people, Dr. Kahan, have been giving us, is between 50 cents and \$1.50 per acre-foot. This is a present estimate, so I take \$1 as a median figure.

Senator ALLOTT. At the present point, I don't want to take your figure on face value, because at the present time we have not proven that we can produce water there at that cost or at any other cost, have we?

Secretary UDALL. I shall say again what I said at the hearing. I think we are not now ready for field applications, but it is anticipated that we might be ready, particularly if we get increased appropriations, by 1975. If your question is, are we ready today, we are not.

Senator ALLOTT. You are talking here to a group of Senators who have supported weather modification about as strongly as any group in the United States except those who would like to put it in another Department of the Government. I submit very respectfully that to base any part of the argument upon the production of water from

weather modification at this point, of \$1 an acre-foot is certainly speculative in the extreme; wouldn't you agree to that?

Secretary UDALL. No, I wouldn't, because I don't think that is what I testified. I want to be consistent.

Our judgment is that if Congress continues to support the program at the levels that we anticipate, we should be ready by 1975 to put in a program on the Colorado watershed that would produce a 10 to 20 percent increase in runoff at a cost of 50 cents to \$1.50 per acre-foot. This was our testimony with no ifs or reservations about it, except the reservation of Congress supporting the research.

Senator ALLOTT. And except the reservation that we can find the technology to make this weather modification meaningful, which we all hope for.

Secretary UDALL. We have the technology. It is a matter of refining it, Senator, of testing it out and being able to carry out weather modification with a precision that a scientific program should require.

Senator ALLOTT. I think some of our scientists would disagree with your position that we have the technology. We are spending millions of dollars every year to try to perfect the technology. I would have to disagree with that.

In your statement, on page 11, the last sentence bothers me a little bit. You ended by saying:

* * * would permit Arizona to use its full entitlement of 2.8 million acre-feet in those years when 7.5 million acre-feet of Colorado River water are available for consumptive use in the Lower Basin.

Can you give me a record of what years 7.5 million acre-feet of water have not been available there, or do I misunderstand your statement?

Mr. DOMINY. Up until the present time you are absolutely correct. We haven't had problems in this regard. But as the Upper Basin States build their projects and complete the river to the extent that they permitted under the interstate compact, then we are facing the years when there might not be 7.5 million acre-feet available to the Lower Basin.

Senator ALLOTT. Is it your position that with the Glen Canyon Dam in place, and Lake Powell, that this is a modification of the Colorado River compact, and we would not have to deliver 7.5 million acre-feet?

Mr. DOMINY. Not at all.

Senator ALLOTT. Over a period of—it isn't 7.5 million, it is 75 million acre-feet.

Mr. DOMINY. This is correct, and it is presumed that you will comply precisely with the commitment of the compact to deliver a moving average of 7.5 million acre-feet, or, in other words, 75 million acre-feet in each 10-year period. However, taking into account deliveries to Mexico, with associated carriage losses, 7.5 million acre-feet at Lee Ferry means only 5.0 to 5.55 million acre-feet for the Lower Basin States.

Senator ALLOTT. On page 16, one other question for clarification. You were talking about municipal and industrial water selling at a rate of \$50 per acre-foot, "in combination with an ad valorem tax of six-tenths of a mill per dollar of assessed valuation on the taxable real property of the central Arizona service area."

I assume that you have compiled figures on that, and what would this mean, then, that would be paid for municipal water in that area?

Secretary UDALL. The charge under our plan for municipal and industrial water without an ad valorem tax would be \$56 per acre-foot. As an alternative method, you could have an ad valorem tax in lieu of any or all of the \$6 above the basic \$50 per acre-foot rate. You could have an ad valorem tax in lieu of a \$3 increment, for instance, and sell the water for \$53. There are alternatives here.

The ad valorem idea is not new. It has been used in many projects. For the Dixie project in Utah, for example, there was to be a relatively high ad valorem tax there to help make the project financially feasible.

Senator ALLOTT. I think, Mr. Chairman, those are all my questions.

Senator ANDERSON. Senator Church.

Senator CHURCH. Mr. Secretary, first of all, I want to commend you for your testimony today, for this morning and this afternoon. It has been a long session.

I want you to know that I fully favor the comprehensive development of the Colorado River for the maximum use and benefit of the States of the Southwest. By the same token, I favor the full use and development of the Columbia-Snake River drainage for the maximum development of the States that that natural basin drains in the Northwest.

The only problems that we have come when efforts are made or designs are laid to funnel water from the Northwest out of the Northwest and into an entirely different river basin, to serve the needs of another part of the country. This can only be done at the expense of my part of the country.

We presently have studies underway—we have a fine State Water Resource Board commencing studies of its own—to determine future use we have of lands that are still to be developed in my State. These studies will measure this potential for future growth against our present water resources.

We think that these studies, once completed, will show that, as measured against optimum development, we will be faced in the future with a water deficiency rather than with a water surplus. As a result, we have cause to be concerned about proposals that have been made to divert water out of the Northwest and into another river basin.

We have five bills before us, one by Senator Allott, one by Senator Kuchel, one by Senator Hayden, one that the chairman has introduced by request for the administration, and one by Senator Moss. Three of these bills contain similar language having to do with studies that are to be undertaken by the Water Resources Council and the Secretary of the Interior. The language is as follows (reading from an analysis of the bills under consideration):

The Secretary, under Commission direction and conforming to the established procedures, is authorized and directed to (1) estimate Colorado River Basin long-range water supply available for consumptive, use, current water requirements and growth rate of water requirements in the year 2030.

With that we have no quarrel.

(2) To investigate sources and means of supplying Colorado River system water requirements, including loss reduction, importation from outside sources...

That is just about as far as we get in this bill before serious problems arise, because "outside sources" obviously means the Northwest. Then, reading down, we have no trouble with the other provisions of the study responsibilities laid out in the language of these three bills until we reach subsection (6) which reads:

Investigate available water supply from outside sources for import, including the ultimate needs of these areas of origin for all purposes, and estimate availability of supply for import into the Colorado River system;

Here again, we not only have very serious problems, but it is clear that we cannot fully and adequately represent our own people in the Northwest without taking serious objections to this language. Now, I understand that the administration's proposal contains no language of this kind that would authorize and direct either you as the Secretary, or the Council, or any other agency, to undertake this sort of study. Is that the case?

Secretary UDALL. That is correct. Both Senator Hayden's bill and Senator Jackson's bill have no such provisions. If I may, Senator, I would like to add something to this, because I think this is the course of wisdom.

It just happens that the National Water Commission and its responsibilities over a 5-year period would dovetail very nicely with the new Columbia-North Pacific Planning Commission that has just been created, which will be studying the Pacific Northwest needs during the same period. Some of the States, such as your own, I know Oregon is doing the same, are studying their future needs.

I just think it is premature, it is very clearly premature, to be talking about, or studying, or putting anything in this legislation that attempts to prejudice a big issue that must be confronted somewhere down the road. I think we ought to know much more about what modern engineering can do, what technology can do, and what the options are, rather than setting out in any specific direction at this point.

Senator CHURCH. Mr. Secretary, I certainly do concur in that. I think it is very important that it is stated clearly and forcefully for the record at this time. You remember that our alarm in the Northwest dates back to 1963, when the Los Angeles Department of Water and Power indicated that they had plans that would tap the Snake River in Idaho, and divert water out of Idaho into southern California. Naturally, when those plans came to light, we in Idaho were very much concerned as to what this would mean for our own future. We were also aware of the fact that no such plans could come to fruition without the active cooperation and assistance and, indeed, the financing of the Federal Government.

I wrote to you at that time—in 1963—a letter which I think perhaps you will recall. The last paragraph of that letter reads as follows:

It is inevitable that the sponsors of this most recent California scheme will seek to involve the Federal Government in their plans. For this reason, I make the request that you issue a definitive statement of the Administration's position respecting this Los Angeles proposal to divert Idaho water to Southern California.

Under date of December 9, 1963, you replied to my letter, and the last paragraph—well, your reply was rather short—so let me read it all into the record:

DEAR SENATOR CHURCH: This is in reply to your letter of November 21 concerning the Los Angeles proposal to divert Snake River water to the south.

As you know, the suggestion that the Snake River in Idaho could provide a source of water for Southern California was advanced by an official of the Los Angeles Department of Water and Power. The water needs of the Southwestern United States are critical, and it is in the national interest that they should be satisfied.

However, I fully agree that it would be the height of folly to create a water shortage in Idaho in order to relieve one anywhere in the Pacific Southwest. I can assure you categorically that the Administration of President Johnson has no intention to divert Idaho water to other regions or river basins. You can assure the people of your State that their water resources will receive full protection and move toward full development for Idaho uses while this Administration is in office.

That ends the letter. Since that was 1963, I would like to ask you, Mr. Secretary, if your letter still represents the position of the Johnson administration on the question of possible diversion of water from Idaho or any other State in the Northwest?

Secretary UDALL. I think, Senator, I can say again categorically that that was our position, that still is our position, and I am pleased to be able to reassure you on that point at this time.

Senator KUCHEL. May we understand that answer to be responsive to your question so there is no question at all about it, Senator? May the reporter read your question so that the Secretary understands exactly what he said "yes" to.

Senator CHURCH. Yes.

Senator KUCHEL. You did not confine that to Idaho. You confined that to every State of the Northwest.

Senator CHURCH. If the reporter will read the question please, and the Secretary may readdress the question, and if he has any changes in his answer, let the record show what they are.

Senator ANDERSON. Read the question and the answer as it there appears.

(The reporter at this point read back the question and answer above referred to.)

Senator KUCHEL. That is the Secretary's answer to that question, and the record is clear on the point. I just wanted to be sure that there is no misunderstanding.

Senator CHURCH. Do you want to modify your answer in any way?

Secretary UDALL. The Senator's question in the letter that I responded to was related to the State of Idaho. I was not aware that he broadened it.

I have been one who in the period when there has been discussion about the Columbia River have said that I did not ever expect to see a headwater diversion at anytime. I thought it was foolish to plan and contemplate taking any water from the Columbia River that was not water taken out below Bonneville Dam after the Northwest was through with it; in other words, waste water that would go into the ocean.

Now, my position on this has been clear throughout—

Senator CHURCH. Yes.

Secretary UDALL (continuing). And I want to make it clear again today.

Senator CHURCH. So there is no misunderstanding, Mr. Secretary, I meant, of course, to confine my question to the content of the original

letter, and I will now do it. Is it still the decision of the administration that you are categorically opposed to the diversion of water out of the State of Idaho, into the Southwest?

Secretary UDALL. I can say, categorically, that is our position. It has not changed.

Senator KUCHEL. You have to have a couple of policemen around this committee.

Senator CHURCH. Mr. Secretary, I appreciate getting that testimony. It means a great deal to me, because we are unable in my State to justify the enormous costs that would be involved in diverting water from Idaho into southern California, or any other part of the Southwest, and there applied to the land for irrigation, when there is so much unirrigated land still to be placed under water right at the point of diversion, where, of course, the cost would be a great deal less.

On that same point, it seems utterly and uneconomically indefensible to propose diversions into the Southwest while Idaho still remains so largely undeveloped, and while there are hundreds of thousands of arid acres close to the source of water supply that can and will in the future be placed under irrigation.

Secretary UDALL. Senator, the thinking that is expressed by you and what I was responding to is that if the course of the growth of the country continues, we will need just as many more potatoes as we will grapes and grapefruits, let's put it that way.

Senator CHURCH. Thank you very much, Mr. Secretary, for your testimony.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Mr. Chairman.

Mr. Secretary, as I understand your statement, there is no doubt in your own mind as to the present need for the central Arizona project, nor as to its justification; is that correct?

Secretary UDALL. I think this is the third time that I have made a presentation to this committee on Arizona's needs, Senator, and I haven't stressed it today because I think it is accepted by everyone as a fact. If the need was critical 2 years ago, or 3 years ago, it is even more so today.

Senator FANNIN. The question I ask you, then, is correct?

Secretary UDALL. Yes.

Senator FANNIN. Do I understand you to say also that there is no real opposition to the central Arizona project?

Secretary UDALL. There is none that I know of in the State of Arizona, Senator. There is more unity today than there ever has been. I know of no differences of view with regard to that, and of course, I haven't heard any expression of opposition today to the central Arizona project itself.

Senator FANNIN. Thank you.

Now, although you have assumed a California 4.4 million acre-feet priority for purposes of a study of the central Arizona project, for instance, your summary report, it is true, is it not, shows that there is no such 4.4 priority in existence?

Secretary UDALL. That is true. Presently, unless Congress writes one into law, there is none.

Senator FANNIN. During the testimony today we have discussed the size of the aqueduct. We have a summary that is on page 21 of the "Summary Report" and on page 96 of the "House hearings." I would just like to cover that subject momentarily.

Isn't it economically sound to have flexibility in the aqueduct capacity? I would also want you to state the cost to have the aqueduct size increased. As you know, we all hope to have additional water in the Colorado River, or additional water available to Arizona, through weather modification, importation, desalination, water exchanges, or from some source. So wouldn't it be better to build a larger aqueduct originally? I am speaking of 3,000-cubic-feet-a-second flow.

Mr. DOMINY. Senator Fannin, on a purely cost/benefit basis, you can justify an aqueduct larger than 2,500 c.f.s. capacity, and still come within a favorable benefit/cost ratio. This is true.

Senator FANNIN. I notice in the summary of the Bureau of Reclamation's observation on water and supply studies that—and of course, this would be taking into consideration a 4.4 guarantee to California which, as I stated, does not exist—we have 1,650,000 in the year 1975, with a 2,500 c.f.s. aqueduct, whereas it would be a possibility with a larger aqueduct to take 2,142,000. Now, would the 3,000 c.f.s. aqueduct carry that additional amount?

Mr. DOMINY. It would carry considerably more especially in the early years when the water was available. You could divert a greater quantity of water available in the river.

Senator FANNIN. It would be up to the amount of 2,142,000 available in the year 1975.

Mr. DOMINY. It would be nearly that.

Senator FANNIN. Then, too, would it have this disastrous effect under this 4.4 guarantee? Going to the year 2030, we go from 822,000 down to 676,000 by the lack of capacity in the aqueduct. That, of course, would be corrected, as I understand it, if the aqueduct carried 3,000 c.f.s.

Mr. DOMINY. Yes, you could divert, as an average, a little larger amount, because you could get a higher proportion of that which was available in good years that would be beyond the capacity of a smaller canal.

Senator FANNIN. And, of course, we have the demand for a much larger amount of water in the State of Arizona than is involved in any circumstances we have discussed.

Mr. DOMINY. That is correct, and you would have the capability of using it by just not pumping from the groundwater reservoir.

Senator FANNIN. There has been some discussion about the allocation of shortages, and I would like to ask the Secretary to answer this question: The Congress, in the Boulder Canyon Project Act, has already determined who should allocate shortages, isn't that true?

Secretary UDALL. I would like the Deputy Solicitor to answer that.

Senator FANNIN. Could we have read into the record the Supreme Court's confirmation of that statement?

Mr. WEINBERG. Yes, I think I have it here.

Senator ANDERSON. Without objection, it will be included in the record.

(The confirmation, above-referred to, follows:)

EXCERPT FROM OPINION OF THE SUPREME COURT IN *ARIZONA v. CALIFORNIA*,
373 U.S. 546, pp. 592-594

III. APPORTIONMENT AND CONTRACTS IN TIME OF SHORTAGE

We have agreed with the Master that the Secretary's contracts with Arizona for 2,800,000 acre-feet of water and with Nevada for 300,000, together with the limitation of California to 4,400,000 acre-feet, effect a valid apportionment of the first 7,500,000 acre-feet of main stream water in the Lower Basin. There remains the question of what shall be done in time of shortage. The Master, while declining to make any findings as to what future supply might be expected, nevertheless decided that the Project Act and the Secretary's contracts require the Secretary in case of shortage to divide the burden among the three States in this proportion: California 4.4/7.5; Arizona 2.8/7.5; Nevada 0.3/7.5. While pro rata sharing of water shortages seems equitable on its face,³⁰ more considered judgment may demonstrate quite the contrary. Certainly we should not bind the Secretary to this formula. We have held that the Secretary is vested with considerable control over the apportionment of Colorado River waters. And neither the Project Act nor the water contracts require the use of any particular formula for apportioning shortages. While the Secretary must follow the standards set out in the Act, he nevertheless is free to choose among the recognized methods of apportionment or to devise reasonable methods of his own. This choice, as we see it, is primarily his, not the Master's or even ours. And the Secretary may or may not conclude that a pro rata division is the best solution.

It must be remembered that the Secretary's decision may have an effect not only on irrigation uses but also on other important functions for which Congress brought this great project into being—flood control, improvement of navigation, regulation of flow, and generation and distribution of electric power. Requiring the Secretary to prorata shortages would strip him of the very power of choice which we think Congress, for reasons satisfactory to it, vested in him and which we should not impair or take away from him. For the same reasons we cannot accept California's contention that in case of shortage each State's share of water should be determined by the judicial doctrine of equitable apportionment or by the law of prior appropriation. These principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress, with full power to do so, has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency under a statutory scheme.

None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation. It will be time enough for the courts to intervene when and if the Secretary, in making apportionments or contracts, deviates from the standards Congress has set for him to follow, including his obligation to respect "present perfected rights" as of the date the Act was passed. At this time the Secretary has made no decision at all based on an actual or anticipated shortage of water, and so there is no action of his in this respect for us to review. Finally, as the Master pointed out, Congress still has broad powers over this navigable international stream. Congress can undoubtedly reduce or enlarge the Secretary's power if it wishes. Unless and until it does, we leave in the hands of the Secretary, where Congress placed it, full power to control, manage, and operate the Government's Colorado River works and to make contracts for the sale and delivery of water on such terms as are not prohibited by the Project Act.

Senator FANNIN. Thank you. I have no further questions.

Senator ANDERSON. This morning Senator Jackson reserved his right to question the Secretary. We will go back to him now for questions.

³⁰ Proportion of shortage is the method agreed upon by the United States and Mexico to adjust Mexico's share of Colorado River water should there be insufficient water to supply each country's apportionment.

Senator JACKSON. I have just a few questions, Mr. Secretary, with reference to the so-called Goss plan.

First of all, I want to commend you for your testimony here. I think it has been extremely helpful, and you have been most patient in going into all the details of the administration's proposal, as well as the other proposals that are now pending before the committee.

Am I correct, Mr. Secretary, in understanding that the so-called Goss plan will require two dams on the Colorado River?

Secretary UDALL. Yes, this is correct. It would require an afterbay.

Senator JACKSON. Do you recall how far below the Hualapai site the second dam would be located?

Secretary UDALL. According to the Goss plan, it would be about $7\frac{1}{2}$ miles below.

Senator JACKSON. The purpose of the second dam, I take it, is for reregulation?

Mr. DOMINY. That is correct, Mr. Chairman. In order to get the kind of peaking capacity that the Goss plan is based on, you would have to fluctuate the river very widely immediately below Hualapai Dam, and you also would have to have the afterbay capacity to store water to pump back during the off-peak time.

Senator JACKSON. Would it be necessary to excavate the reservoir area between Hualapai Dam site and the dam below?

Mr. DOMINY. Yes. There are a number of possible sites. The one that the Secretary mentioned, about $7\frac{1}{2}$ miles below Hualapai Dam site, would require the least amount of additional river commitment, but in order to get the capacity that would be needed in the afterbay, you would have to excavate the loose material that has accumulated there over the years, and move it into Separation Canyon on each side of the river.

Senator JACKSON. What will you do with this spoil? This is going to be a real problem, isn't it?

Mr. DOMINY. If that site were the one selected, and there are a number that would need to be considered, the spoil would be placed in Separation Canyon.

Senator JACKSON. Aren't you getting into some real esthetic problems in the area?

Mr. DOMINY. Yes. The Secretary mentioned that very fact. One proposal would be to move the spoil into Separation Canyon on each side of the river, and create a debris and silt dam. Then, when you excavated for the underground powerplants, you would use the rock as the surfacing for the silt detention dams in Separation Canyon.

Senator JACKSON. What would be the fluctuations of the reservoir below the Hualapai site?

Mr. DOMINY. If the site that we are talking about now, the one that is $7\frac{1}{2}$ miles below Hualapai, were to be utilized, it would require a fluctuation of about 140 feet.

Senator JACKSON. That is quite a fluctuation, is it not?

Mr. DOMINY. I would consider that a major fluctuation.

Senator JACKSON. Obviously, under those circumstances, this area would be closed to boaters and other visitors, wouldn't it?

Mr. DOMINY. Definitely. It would have to be used exclusively for the purpose of afterbay performance for power production.

Senator JACKSON. What would be the appearance of the canyon walls when the reservoir below Hualapai is drawn down?

Mr. DOMINY. There would be a discoloration, obviously. The Colorado River water carries about 700 parts per million of dissolved solids, and there would be a white discoloration of the walls.

Senator JACKSON. Stated another way, it would be pretty muddy, wouldn't it?

Mr. DOMINY. It would be sheer canyon wall, with a white water mark on it.

Senator JACKSON. It wouldn't have the greatest appeal as compared with its natural state, would it?

Mr. DOMINY. I wouldn't consider it—

Senator JACKSON. From an esthetic point of view.

Mr. DOMINY. I think that is a correct statement, sir.

Senator JACKSON. What percentage of the time would the reservoir be kept at levels below the maximum level?

Mr. DOMINY. The Hualapai Reservoir would not be affected adversely, compared with the 1,500-megawatt proposal. We expect about a 4-foot variation in the Hualapai Reservoir with a 1,500-megawatt installation. We would anticipate only 5 feet under the Goss plan. But the afterbay would fluctuate greatly.

Senator JACKSON. Would it be below the maximum level most of the time?

Mr. DOMINY. Whenever you had releases for peaking purposes, you would bring it up to its maximum operating level, and then, during offpeak, you would pump it back down in order to get the water back in Hualapai Reservoir to make peak energy during the next part of the cycle. The level would fluctuate as much as 140 feet.

Senator JACKSON. One of the things that really concerns me, of course, is that, as you know, the Bureau of Reclamation and the Bonneville Power Administration are building a 1,300,000-kilowatt direct current line from Hoover Dam to the Columbia River power system at The Dalles at a cost of somewhere, I think, between \$120 and \$140 million. This line is scheduled for completion in 1972. As we all know, its purpose is to provide peaking capacity in the Southwest in the summer and to the Northwest in the winter.

It is my understanding that thus far the Bureau of Reclamation and Bonneville have not signed any contracts for the use of the 1,300,000-kilowatt capacity in the Hoover-Dalles line, and I am informed that they do not believe this line will be fully loaded until sometime after 1980.

Doesn't this suggest that it might be difficult to find an assured market for the 5,100,000 kilowatts of Hualapai Dam peaking capacity?

Secretary UDALL. Senator, I mentioned this point during your absence a little while ago. In terms of the repayment capability for the intertie line to Hoover, we have some problems, and I would think that in terms of order of priority that we ought to sell all of that power, and be certain that we have a repayment program that is sound, rather than rushing on ahead prematurely and authorizing a huge pump storage project that would compete with it.

Senator JACKSON. It seems to me, too, Mr. Secretary, at least it is my recollection, that the Bureau was asked by Secretary Holum last

fall to study the best alternative power projects in connection with the lower Colorado, including pump storage projects. With all the various alternatives, and the Bureau went into these alternate possibilities in great detail, the Bureau did not include the Hualapai pump storage site and studied instead some 30 or 40 alternatives. Is that not correct?

Secretary UDALL. The Gross proposal was not studied by the Bureau in its look at pump-back storage project possibilities.

Senator JACKSON. There is one other matter that I want to call to your attention. There is a story out of Salt Lake, in the Idaho State Journal, dated April 21, by Tom Hume of the Associated Press, which reads:

On the Utah-Arizona border, where water is precious, the Bureau of Reclamation disclosed Thursday it has lost 3 million acre-feet of water. The water, enough to fill a major reservoir, was lost into the porous banks of manmade Lake Powell.

Although some bank storage was forecast, this is more than we anticipated, says Charles S. Rippon, Associate Regional Director. He admits that excessive bank storage at the huge reservoir will probably extend the period needed to fill the 27-million acre-feet reservoir behind Glen Canyon Dam.

Geologists say a 20-percent void in the sandstone comprising Lake Powell's shore will probably absorb another two to three million acre-feet of water during the next ten years. The lost water weighed in dollars means ungenerated hydro-electric power and unirrigated fields in the Upper Colorado River Basin.

To keep track of how much water is filtrating into the Lake's banks, the Interior Department has sunk wells from one to twenty miles' distance from the reservoir. Close to the dam, the Bureau said water is creeping upward four feet per week in some wells. Rippon said water lost at Lake Powell equals a Lake one mile square and three feet deep, which is somewhat more than that recorded at Lake Mead and Hoover Dam. He described the reservoir as a geological trough when it fills solely Lake Powell.

The point is that while this is a one-time loss, there are some serious water seepage problems in this area, are there not?

Mr. DOMINY. We would not want to characterize it as seepage, because it is a one-time loss, as you say. It is not just getting away and lost for all time. It merely means that the reservoir has a greater capacity than was contemplated, and it takes longer to fill it.

But once filled, that bank storage does not have to be refilled, and as you draw it down, a portion of it comes back and is available. But that which doesn't come back out, of course, is still in the bank and doesn't have to be refurnished from the next supply of water coming down the River.

Senator JACKSON. What happens if they keep taking it out of the wells? How long will it last?

Mr. DOMINY. These wells are nothing but observation wells to help us calculate what the bank storage amounts to. These are not irrigation wells.

Senator JACKSON. But this is a substantial amount of water.

Mr. DOMINY. Yes. Any large reservoir is characterized by bank storage during the initial filling period. At Hoover, in the early years, we had not as much as this, and when we finally filled it, it averaged out to about 12½ percent of additional capacity as a result of bank storage.

We don't know yet where Lake Powell bank storage will stabilize, but it appears that it will stabilize considerably higher than at Lake

Mead. It might run as much as 20 percent of reservoir storage as compared to the original capacity.

Senator JACKSON. I suppose one could add on the other side of the ledger the fact that it won't evaporate so fast.

Mr. DOMINY. This is correct. It is really the best storage you have in one sense, but it does take longer to fill, particularly when we are having dry years in the early years of filling.

Senator ANDERSON. Senator Hansen.

Senator HANSEN. Thank you, Mr. Chairman. I do have some questions.

If I may, Mr. Secretary, I would like to ask you: Do you endorse the idea of a National Water Commission?

Secretary UDALL. Yes, indeed; very enthusiastically, of the type that the Senate has already passed.

Senator HANSEN. Do you think such a Commission should be able to study the problem of water free of administrative directives?

Secretary UDALL. Yes; I think it is very important for the Commission to have a broad charter and to be independent.

Senator HANSEN. You would not wish, then, if such a Commission were to become a reality, to inhibit it in any way in its findings or in the recommendations that it might make?

Secretary UDALL. I would think, as I said, it should be independent. I would think at the same time, if the Commission were wise, it would want to pump all the information and data and opinions it could from the main water agencies of the Federal Government, such as the Corps of Engineers, the Bureau of Reclamation, and so on.

In other words, it would use all the resources at its disposal, including Federal.

Senator HANSEN. You spoke this morning about the broad gage character of the membership of such a commission, and I inferred from that statement that you probably would impose a rather considerable trust in them, being appointed as they would be; is that not right?

Secretary UDALL. These would be Presidential appointees. I personally think this would be one of the most important Presidential commissions appointed during the 1960's, and that, therefore, I am sure the President would want to have the very best people that he could get from the country at large.

Senator HANSEN. What would be your opinion if this commission were indeed to become a reality, and after having studied the entire western part of the United States, after surveying the water needs of the Southwest it were to make a recommendation that water be taken from the State of Idaho?

Secretary UDALL. Well, Senator, that is the type of "iffy" discussion that I don't think I should get into at this point because I can't really assume. I think we should all remain openminded as to what types of recommendations or policy decisions such a commission might make.

Senator HANSEN. I share that last expression from you, Mr. Secretary, and for that precise reason I was quite surprised to hear you say, I think a little bit ago in response to a question by the Senator from Idaho, Mr. Church, that this administration would oppose cate-

gorically—if I did not misunderstand you—the exportation of any water from Idaho. Did you not say that?

Secretary UDALL. Yes, and if I may explain, Senator because you are new on the committee, we have discussed this in the past. I think my position has been quite consistent. I have said many times, and I said it again here a few moments ago, that I think it would be politically impossible, and from a planning standpoint rather foolish, to contemplate—I would apply this even broader than the Columbia River—that any region would want water or expect to get an importation of water from another region, except water that has already been fully used by a State or States, or a basin and that is going to otherwise be wasted.

This is the reason that when we had our dialog about the Columbia River, I have been one who has talked about the mouth of the Columbia River. I will be very surprised in my lifetime, if there is a project of importation from one region to another, if this principle is not adhered to, because I don't see how politically you could get it done otherwise.

Senator HANSEN. It may be that you can't contemplate it at all, and yet I must point out to you that the State of Wyoming is very vitally concerned, and we are very much interested.

We have opposed some of the bills before the Congress in the past and may at this time have to, not because we don't want to do all we can to see the development of all of the Southwest, but that, in so doing, we don't write our own death warrant in the State of Wyoming.

Now, if you are precluded or if you attempt to preclude the consideration of areas from which water may be taken—if in the judgment of the commission, there may be an excess—if you say or if you imply that only from certain places can water be taken, then I think what you are telling the State of Wyoming, in effect, is that we may not have as many options open to us to have water put into the Colorado River Basin system at some place and at some time so as to make available to us in Wyoming that portion which has been guaranteed us by the terms of the Upper Colorado River Compact, ratified in 1948.

Now, we have never said that we would point to Idaho or any other State, and by the same token, it seems somewhat improper to me that you would assure the State of Idaho, our good friends and good neighbors on the west, that no matter what else happened, they could be assured of your undying opposition and the opposition of this administration to a plan which would contemplate the exportation of water from that State.

I am perfectly willing to have water taken from the mouth of the Columbia, after it is just ready to drop into the salty brine of the Pacific, and we would welcome any such step, but frankly, I am surprised that you would give the endorsement that I thought you gave this morning to a national water commission, and then turn around and say, "But don't look here." Isn't that what you are doing now?

Secretary UDALL. The commitment that I made in writing to Senator Church three and a half years ago was made prior to the time that the National Water Commission study was conceived. But I don't see any reason to change our basic position in that regard.

I think a national water commission should look at all alternatives. I think also, if it is wise, it will try to identify the politics of different alternatives.

It seems to me that when you start moving waters from one basin to another, even within a State, you have to begin with the assumption that that water is surplus and will not be needed. The only way that States have been able to have transmountain projects within their own borders is to operate on such an assumption.

Until a State makes a finding, or there is some finding that is clear cut, that there are surplus waters, it seems to me you are then in a politically impossible position of saying we are going to take from one river basin or from one State and give to another, and you have to have a rationale for that.

Senator HANSEN. How would you feel about taking water from one river basin in Wyoming, and transporting it to another river basin in Wyoming, Wyoming's water in both cases?

Secretary UDALL. I think that would be up to Wyoming, Utah, and Colorado, your neighbor States, which are doing just that, if you could get together. The trick there is to get the politics within the State meshed together so that you don't involve great controversy.

Senator HANSEN. You are aware, I assume, that we have water that has been reserved for use in Wyoming on the Snake River that is presently not being used which now flows into Idaho. You would have no objection, then, if I understand you correctly, if it suited the people in Wyoming, to transport that water from the Snake into the Colorado. Is that what you are saying?

Secretary UDALL. Senator, the matters of States rights of the waters within a basin, I think, is for the States to wrestle with, and I don't think we should set ourselves up at this point to say what a State should do with water that it has a right to.

Senator HANSEN. Isn't that exactly what you are saying about Idaho, though?

Secretary UDALL. No. I am simply saying that as far as Idaho's water is concerned—

Senator HANSEN. You are not going to take any of it.

Secretary UDALL. Until there is a demonstration which I have not seen, or the facts would indicate that there are surplus waters, I don't see any reason for any study of any kind to be made. This is the reasoning behind the letter that I sent the Senator.

Senator HANSEN. Then what you have just said now is that you don't really think that, if the National Water Commission were organized, there would be any reason for it to study the water situation within the State of Idaho? Do I understand you correctly?

Secretary UDALL. No. I think it it should be able to study any water situation anywhere.

Senator HANSEN. What do you mean by your last statement?

Secretary UDALL. I think it should have the widest latitude in making any study, irrespective of what any of us in the Federal Government or any of the State people have said. It may come up with some answers based on economics and technology that none of us have thought of. I don't think we should attempt to limit or prejudice its work in any way.

Senator ANDERSON. We will have to recess for at least a half hour.

(Whereupon, there was a short recess.)

Senator ANDERSON. Senator Hansen was asking questions. However, he isn't here at just this moment.

In these five bills, I have some interest in the Hooker Dam. Is it included in these bills, Mr. Secretary?

Secretary UDALL. Yes, it is.

Senator ANDERSON. The Wilderness Society has made an adverse recommendation on the basis of a small segment that these dams would affect. Do you know how many acres it would be?

Secretary UDALL. As I understand it, 130-odd acres, Senator, on the very edge of the wilderness area.

Senator ANDERSON. There could be a reservoir of some 265,000 acre-feet. What would it involve, 400 or 500 acres?

Mr. DOMINY. The maximum water surface on the large reservoir, if you built a high dam would involve at maximum water elevation for the flood control pool only 164 acres in the primitive areas, and 540 acres in the wilderness area.

Senator ANDERSON. There are 2,700,000 acres in the primitive national forest; is that correct?

Mr. DOMINY. The figures I have, Senator, are 132,788 acres in the primitive area, and 438,626 acres in the wilderness area.

Senator ANDERSON. Mr. Secretary, you have been a very fine friend of conservationists. Would you feel that we ought to take this out of the wilderness area or leave it in?

Secretary UDALL. Senator, I want to go on the record on this point. I think this can very accurately be described as a very peripheral wilderness involvement. I think that we have to be flexible enough concerning the wilderness system, because we are going to see, from time to time, problems like this arise, to be able to modify boundaries, and to exclude small areas, particularly where a minimum peripheral invasion is involved. We should be flexible and maybe compensate by putting little more land in the wilderness area elsewhere.

I like the policy that we are developing now. I hope we are developing it in such terms that any time a road or highway system takes land in a park, it gives back 1 or 2 acres for every acre that is taken.

I think this is sound from a conservation point of view. I must say I disagree with those who oppose Hooker Dam because I think it is a de minimis thing with those of my friends in the wilderness movement who want to make every acre that once goes into it sacred.

I think we need people, and I am delighted we have such a large body of them, that will fight for every acre of wilderness, but I think they ought to have a little flexibility in realizing that there are going to be peripheral problems. I would rather see them take the view that will permit changing the boundaries a little bit but adding to the wilderness somewhere else.

Senator ANDERSON. I thank you for that, because as you know, I have had a little interest in the wilderness societies and the wilderness bills, and hope that we won't have to get involved in this situation.

Secretary UDALL. Senator, may I add one other thing for the record here, because those who know the history of the wilderness bill, and

your leadership in it, ought to know, too, that your own personal ties with the wilderness, with this particular piece of wilderness, that this is where your convictions arise from. I think again, I would be very disappointed in the preservation people, in the conservation movement, if they don't look with a little bit of flexibility on your own views with regard to a problem of this kind, because no one has had a deeper commitment nor has done more for the Wilderness Society than you.

Senator ANDERSON. I hope we won't have to take that land out of the area of the wilderness. I have some pictures here that show it is just an ordinary gravel bank, and maybe it doesn't measure up to quite some other things, perhaps, but I have tried my best to preserve the wilderness, as I have done once or twice in the same area.

I appreciate your testimony that it is not the greatest or most scenic country in the world.

Secretary UDALL. We are talking here, too, Senator, about what, one-tenth of 1 percent encroachment on the wildness area. There ought to be a di minimis rule that would apply in cases like this.

Senator ANDERSON. I will ask permission to put in the record the material from the House of Representatives which covers this point.

(The material referred to follows:)

STATE OF NEW MEXICO,
Santa Fe, April 6, 1967.

Mr. HAROLD T. JOHNSON,
Chairman, Subcommittee on Irrigation and Reclamation, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR MR. JOHNSON: At the March 13-17, 1967 hearings of your subcommittee on the Central Arizona Project you received a statement from Mr. Stewart M. Brandborg, Executive Director, The Wilderness Society. Mr. Brandborg recommends that there be a full study and exploration of alternative sites downstream from the proposed Hooker unit of Central Arizona Project, because the reservoir created by Hooker Dam would back water into a small segment of the Gila Wilderness and Gila Primitive areas.

Hooker Dam would be located in Sections 19 and 30, Township 14 South, Range 16 West. The dam site and all but a small part of the reservoir area would be outside both the Gila Wilderness and Gila Primitive areas. A table showing pertinent information for reservoir capacities of 98,000 acre feet and 265,000 acre feet follows:

Capacity acre-feet	Reservoir area-acres at spillway			Reservoir length-miles at spillway		
	Total	Primitive	Wilderness	Total	Primitive	Wilderness
98,000.....	1, 130	77	110	9.7	0.6	3.0
265,000.....	2, 250	141	480	13.7	.6	7.0

These small areas are near the southwest corner of the Gila Wilderness area. The Gila Wilderness area consisting of about 438,000 acres and Gila Primitive area consisting of about 130,000 acres are within the 2,700,000 acre Gila National Forest in New Mexico.

The Hooker site has long been considered in planning for development of the land and water resources of the Gila River as evidenced by its withdrawal under Water Power Designation No. 1, dated August 7, 1916. The Gila Wilderness area was not established until 1924.

During the consideration of the Wilderness Act of 1964, the Hooker Project along with others was brought to the attention of the Congress and was in part

responsible for the language in the Act which permits the construction of water resources works within wilderness areas where such works in a specific area would better serve the interests of the people of the United States than will the denial of such works.

Several investigations to determine feasible dam and reservoir sites on the Gila River in New Mexico have been made. The three sites specifically mentioned by Mr. Brandborg and other sites have been investigated by the Bureau of Reclamation and the Hooker site has been found to be the most efficient for the development of the water resources of the area.

The Lower Cliff site in Section 33, Township 17 South, Range 17 West, below Mangas Creek and about 25 river miles downstream from the Hooker site was investigated by the Bureau of Reclamation during their 1930 investigation of the Upper Gila River. A dam at this location would flood a part of the Cliff-Gila Valley, a highly developed farming community and the largest single area of irrigated land on the Gila River in New Mexico. The Connor site in Section 13, Township 18 South, Range 18 West, and about 6 miles downstream from the Cliff site, was also investigated. A dam at this site would inundate less of the developed area in the Cliff-Gila Valley. The Bureau's report found that the cost of dams at the Connor site and the lower Cliff site were comparable; the right of ways costs at the Cliff site would be larger because of the greater amount of developed area inundated; and that water loss by evaporation at the average operating level of the Cliff site would be slightly larger than at the Connor site. Thus, the Connor site is clearly preferable to the Cliff site.

The Bureau's 1930 report also investigated the "Canador" site in Section 19, Township 19 South, Range 19 West, 17 miles downstream from the Connor site, just below the mouth of Blue Creek and about 15 miles upstream from the State line. The Bureau found that for equal storage a reservoir at the Connor site would be cheaper and concluded that the Canador site is materially inferior to the Connor site and not worthy of further consideration. Construction of a reservoir at the Canador site, suggested by Mr. Brandborg, would inundate about 1,400 acres of presently irrigated land in the Red Rock area.

Thus, the Bureau has found the Connor site preferred over both the lower Cliff and Canador sites.

The Bureau of Reclamation in their 1963 investigation of the Upper Gila, in cooperation with the State of New Mexico, investigated the Hooker and Connor sites. The report found Hooker to be the most favorable storage site in terms of cost per acre foot of firm yield. A reservoir at the Connor site would require about twice the reservoir storage capacity for sediment control because of the intervening high-yield sediment area.

The total evaporation loss from the Connor reservoir was estimated by the Bureau to be about twice as large as the evaporation loss from the reservoir at the Hooker site for about the same yield.

A dam at the Hooker site would provide flood and sediment protection to the developed area of the Cliff-Gila Valley which would not be provided by a dam at the Connor site downstream from the Valley.

Since the Hooker site is at a higher elevation than the Connor site, pumping costs for M & I water supplied to Silver City and Tyrone would be less if the Hooker site is developed.

Thus, the Bureau investigations have shown that the Hooker site is better than any of the downstream alternatives, including the Connor site.

A reservoir at the Hooker site will create a clear lake and provide seasonal water temperatures cooler than present stream water temperatures in the area. Thus, fishery in the reservoir area, as well as stream fishery downstream from the Hooker dam site for a considerable distance, would be improved over present conditions.

The recreation and fishing benefits that Hooker reservoir would create in southwestern New Mexico would more than offset the small infringement on the Gila Wilderness and Gila Primitive areas. The small portions of the Gila Wilderness and Gila Primitive areas in this project involve a narrow canyon on the Gila River. The lake created within this narrow canyon section would offer attractive fishing and canoeing water not now available in the area.

In summary, the investigation of alternative sites recommended by Mr. Brandborg already has been made with the result that the Hooker site has been found

the most feasible. Development at the Hooker site would provide substantial benefits, including increased opportunity for recreation, with little effect on wilderness values. The Wilderness Society seems concerned principally with the possible precedent setting implications of development at the Hooker site. This concern seems ill-founded when it is borne in mind that the site was withdrawn for water resources development about eight years prior to the administrative designation of the Gila Wilderness area in 1924 and that the Wilderness Act of 1964 permits water resources works within wilderness areas under circumstances such as those as those surrounding the proposed development at the Hooker site.

I respectfully request that this letter be made a part of the record of the March, 1967 hearing on legislation to authorize the Central Arizona Project.

Yours truly,

S. E. REYNOLDS, *State Engineer.*

Senator ANDERSON. Senator Hansen.

Senator HANSEN. Thank you, Mr. Chairman.

Mr. Secretary, and Mr. Dominy, there is some information which I think this committee should have to assist it in its deliberations on the central Arizona project. I realize that you may not have all the information with you, since it is rather detailed.

A copy of these questions was submitted to you, and to Mr. Dominy. I would like, if I may, to reread them :

1. Would you please furnish this committee a detailed breakdown of Department estimates of the amount of beneficial consumptive use of water presently being made and also proposed as the ultimate future requirements in each of the States; Arizona, California, Nevada, New Mexico, Utah, from the surface water supply in the following streams: Little Colorado River, Kanab River, Virgin River, Bill Williams River, Muddy River, Gila River, and any other tributaries of the Colorado River Basin.

Differentiate in this breakdown between the tributaries, State-by-State, and include the amount of beneficial consumptive use of groundwater, but also differentiate between surface water and groundwater.

2. Present a detailed breakdown of the amount of estimated present and future losses on the main stream of the Colorado River from Lee Ferry to Mexico before any offset is taken for river accretions or precipitation, including losses on an average annual basis, (a) from Lee Ferry to Lake Mead, (b) within Lake Mead, (c) from Hoover Dam to Mexico, with a much detail as possible to break down the losses into various reasons for the loss, such as channel loss, evaporation, illegal uses, in Arizona and California, or others.

3. A detailed breakdown on an average annual basis of the amount of estimated present and future uses of water from the mainstream of the Colorado River in each of the States of the Lower Basin.

4. A detailed breakdown on an average annual basis of the amount of estimated virgin flow of the following streams: Little Colorado, Kanab Creek, Virgin River, Bill Williams River, Muddy River, Gila River, and other tributaries above Hoover Dam and below Hoover, each to be listed separately.

Finally, a detailed breakdown of the estimated present and future accretions to the mainstream of the Colorado River on an average annual basis from the Little Colorado River, Kanab Creek, Virgin Creek, Bill Williams River, Muddy River, Gila River, and any other tributaries, listing each separately, and also any other present and future expected accretions from other sources such as precipitation on Lake Mead, reduction of channel losses, or others.

I would hope that if you do not have the information with you, that it can be supplied later in a complete, accurate, and concise manner, so that we can assure ourselves that all facets of this matter have been thoroughly evaluated.

These tributaries are an important asset of the Colorado River System. They are included in the apportionment of water covered by the Colorado River Compact of 1922, and the inclusion of this information will be invaluable in making a complete assessment of the Central Arizona Project.

Thank you, sir.

Mr. DOMINY. Senator, I want to thank my old classmate from Wyoming University for giving me the courtesy of sending down these very involved questions in advance.

Mr. Chairman, we have looked into these things to the extent that we could in the time that we have had. We have some of the information.

Senator ANDERSON. Senator Hansen, would you rather have them communicate all the information and supply it later?

Senator HANSEN. Yes, in the interest of time, that would be satisfactory.

Mr. DOMINY. That is what I was going to suggest, sir. We will have to work with the information we have and with that available from the States, Senator, and develop what we can. We will be glad to supply for the record as much of the information as is available.

Senator ANDERSON. Mr. Dominy, when you furnish these copies, furnish it to Senator Hansen in advance so that he can see if it is complete.

Mr. DOMINY. We will be happy to do that.

Senator HANSEN. Thank you very much.

(The information requested is as follows:)

Much of the information requested is not presently available and would require much field work and additional study and analysis to obtain. The bills under consideration contemplate that such studies would be made in the future. For example, Section 601 (b) (2) of S. 1242 directs the Secretary to "make reports as to the annual consumptive uses and losses of water from the Colorado River system after each successive five-year period, beginning with the five-year period starting on October 1, 1965. Such reports shall be prepared in consultation with the States of the lower basin individually and with the Upper Colorado River Commission, and shall be transmitted to the President, the Congress, and the Governors of each State signatory to the Colorado River compact."

Some years ago the Bureau of Reclamation compiled a "Report on Water Supply of the Lower Colorado River Basin" dated November 1952. That report analyzed the available streamflows, uses, etc., for the period 1914 to 1945, inclusive. Subsequent supplements extended the analysis through the year 1958. The following information has been abstracted from the Second Supplement (October 1963) to the 1952 report. It is all that is currently available to the Bureau of Reclamation and is in response to the numbered requests.

1. *Information on uses by tributaries.*—The 1952 report and its two supplements presented estimates of the "stream depletion" for four of the tributaries—Little Colorado River above Grand Falls, Virgin River above Littlefield, Bill Williams River above Planet, and Gila River above Gillespie Dam and also above Dome. Estimates were also made of the stream depletion for the entire lower basin between the Lee Ferry Compact Point and the International Boundary.

The procedure used was to first determine the areas irrigated within the natural drainage of the Colorado River; then apply to such areas appropriate unit rates of consumptive use of irrigation water to determine the consumptive use of cropped lands. Estimates were also made of use from adjacent noncropped areas, and from cities, towns, and farmsteads. Information was compiled on the water diverted to serve areas outside of the natural drainage basin of the Colorado River. Study was made also of the evaporation losses from reservoirs and the change in contents of the reservoirs. In the case of the Gila River, the changes in ground-water storage were also studied.

In determining the "depletion" of the various tributaries and of the entire lower basin above the International Boundary, estimates were made of the amount of channel loss that was salvaged by various means. Three sources of channel salvage were recognized in the study:

(1) Reduction in evaporation losses from the channels by reason of control of floods and by channelization which together reduce the water area of the channels;

(2) Replacement of natural vegetation along the river channels—this usually occurs by clearing areas of phreatophytes and planting such areas to crops. In some cases the cleared areas are used for cities, highways, railroads, etc.;

(3) Changes in areas and intensity of natural vegetation—in some cases the growth factor was found to decrease. In other cases it was found to increase.

Attached is a copy of Table A-2 of the Second Supplement which shows by years the acreage irrigated within the natural drainage area of the Lower Colorado River Basin for the 45-year period 1914 to 1958, inclusive. The acreages are segregated by States.

Table 1, attached, summarizes information abstracted from the Second Supplement to show average conditions for the seven-year period 1952 to 1958, inclusive, setting forth the estimates of stream depletion by the various items and by geographic areas and States.

Attached are copies of three tables from the 1963 Supplement which show by years, for the 45-year period 1914 to 1958, inclusive, depletions above Lees Ferry (Table A), depletions above the International Boundary (Table H), and depletions, by States, above the International Boundary (Table N).

2. *Detailed estimate of various components of channel loss.*—Information in the detail requested is not available. In operation studies for the Central Arizona Project, "net" river gains or losses for the two reaches of river (i.e., Lees Ferry to Hoover Dam and Hoover Dam to the Mexican Boundary) were determined by comparing the recorded discharges at the two ends of each reach and making allowances for changes in storage and measured uses or losses in the reaches of the river.

Table 2 shows estimates of average annual net gains for the reach between Lees Ferry and Hoover Dam for the 52-year period 1914 to 1965, inclusive.

TABLE 2.—*Estimate of historic net gains between Lees Ferry compact point and Hoover Dam—Average for 52-year period, 1914-65, inclusive*

	1,000 acre-feet
Colorado River below Hoover Dam ¹	12, 409
Average storage change in Lake Mead:	
Surface storage.....	+358
Estimated bank storage ²	+45
Evaporation losses from Lake Mead ³	486
Diversions from Lake Mead.....	7
Average annual inflow to Lake Mead.....	13, 305
Colorado River at Lees Ferry ⁴	12, 426
Estimated net gain, Lees Ferry to Hoover Dam.....	879

¹ Records started in 1934. Discharges estimated from records at downstream stations 1914-33, inclusive.

² Estimated to equal 12 1/2 percent of surface storage.

³ Gross evaporation losses.

⁴ Lees Ferry compact point. Records started in 1922. Discharges estimated from records at upstream tributaries 1914-21, inclusive.

In the 1963 report on Pacific Southwest Water Plan, the then current net losses between Hoover Dam and the Mexican Boundary were estimated to be 1,270,000 acre-feet as follows:

	1,000 acre-feet
Net reservoir evaporation.....	370
Regulatory losses.....	230
Other net unmeasured beneficial and nonbeneficial uses.....	670
Total	1, 270

The future salvage of these losses was estimated (in 1963) to be as follows:

	1,000 acre-feet
Channelization and phreatophyte control.....	290
Ground water recovery.....	220
Reduction in regulatory losses.....	170
Total	680
Estimated future net losses, Hoover Dam to boundary	590

It is contemplated that these estimates of net river losses will be reviewed in consultation with the States, as part of the future work to be undertaken pursuant to Section 601 (b) (2) of S. 1242 and similar bills.

3. *A determination of the present and future consumptive uses from the main stream of the Colorado River.*—Information has been compiled pursuant to Article V (B) of the Supreme Court Decree of March 9, 1964, for the three calendar years of 1964, 1965 and 1966. Consumptive uses in these years by the three States are summarized as follows (values rounded) :

TABLE 3
[In thousands of acre-feet]

Calendar year	State	Diversions	Return flows	Beneficial consumptive use
1964	Arizona	1,816.2	689.0	1,127.2
	California	5,621.2	556.5	5,064.7
	Nevada	25.3		25.3
	Total	7,462.7	1,245.5	6,217.2
1965	Arizona	1,687.5	679.0	1,008.5
	California	5,345.8	445.8	4,900.0
	Nevada	22.7		22.7
	Total	7,056.0	1,124.8	5,931.2
1966	Arizona	1,766.9	693.8	1,073.1
	California	5,554.5	457.6	5,096.9
	Nevada	26.7		26.7
	Total	7,348.1	1,151.4	6,916.7

The Summary Report—Central Arizona Project with Federal Prepayment Power Arrangements, February 1967, shows (on page 21) the estimates of future annual water supply available for use along the Colorado River at and below Hoover Dam. These are based on studies of the 60-year runoff cycle 1906 to 1965, inclusive, and on the assumption that California would be granted a priority to use 4,400,000 acre-feet. The actual future uses in individual States will depend on several items such as the authorization of the Central Arizona Project, the size of the Central Arizona Aqueduct constructed, and the nature of a priority for California, if any.

TABLE 4
[In thousands of acre-feet]

Level of development	Year 1975	Year 1990	Year 2000	Year 2030
California.....	4,762	4,687	4,654	4,564
Arizona.....	3,162	2,698	2,488	2,052
Nevada.....	100	150	200	300
Total	8,024	7,535	7,342	6,916

4. *Estimated virgin flow of the tributaries.*—Estimates of "virgin" flow for four of the tributaries for the 45-year period 1914 to 1958, inclusive, are as follows:

Estimated average annual virgin flow in acre-feet

	Thousands
Little Colorado at Grand Falls.....	281.1
Virgin at Littlefield.....	244.8
Bill Williams at Planet.....	110.2
Gila at Gillespie Dam.....	1,508.1
Gila near Dome.....	1,125.5

Attached are copies of tables from the October 1963 Second Supplement to the November 1952 report which present the calculations year by year for these streams—Tables B (Little Colorado River), C (Virgin River), E (Bill Williams River), and F and G (Gila River).

5. *Accretions to the Colorado River from lower basin tributaries.*—All of the tributaries named have not been measured. Available discharge records at the gaging station located nearest to the Colorado River show average annual discharges for various available periods of record as follows:

Stream	Place of measurement	Period of record	Years of record	Average annual discharge (thousand acre-feet)
Little Colorado River.....	Cameron, Ariz.....	1947-65	18	143.3
Bright Angel Creek.....	Grand Canyon, Ariz.....	1924-65	42	25.6
Virgin River.....	Littlefield, Ariz.....	1930-65	36	162.2
Muddy River.....	Moapa, Nev.....	1913-15		
		1916-18		
		1928-31		
		1944-65	28	33.5
Las Vegas Wash.....	Henderson, Nev.....	1957-65	8	15.0
Bill Williams River.....	Alamo, Ariz.....	1940-65	26	62.3
Gila River.....	Dome, Ariz.....	1903-65	63	(¹)

¹ At the present time the flow at this station is negligible. For all practical purposes, the waters of the Gila River are fully utilized.

TABLE 1.—*Analysis of depletions in Lower Basin—Averages for 7 years, 1952 to 1958, inclusive*
[1,000 acre-feet]

Item	Little Colorado River, above Grand Falls	Virgin River, above Littlefield	Other areas, above Hoover Dam	Subtotal, above Hoover Dam	Bill Williams River, above Planet	Gila River, above Dome	Other areas between Hoover Dam and boundary	Total, above international boundary
Depletion by cropped lands.....	30.7	29.3	42.5	102.5	14.3	2,574.1	811.1	3,502.0
Depletion by adjacent noncropped lands.....	3.5	3.0	3.2	9.7	1.5	131.2	27.7	170.1
Depletion by cities, towns, and farmsteads.....	13.5	5.4	3.7	22.6	1.2	242.0	25.8	291.6
Transbasin diversions.....	1.2	1.6	0	2.8	---	1 -208.2	4,214.4	4,009.0
Subtotal, depletions at sites of use.....	48.9	39.3	49.4	137.6	17.0	2,738.1	5,079.0	7,972.7
Net evaporation from reservoirs.....	30.1	3.1	723.5	756.7	---	70.2	219.6	1,046.5
Storage change in surface reservoirs.....	+3.0	---	+676.4	+679.4	---	+104.5	26.4	+810.3
Change in ground water storage.....	---	---	---	---	---	-1,921.3	0	-1,921.3
Subtotal, storage.....	33.1	3.1	1,399.9	1,436.1	0	-1,746.6	246.0	-64.5
Channel salvage—reduction in evaporation.....	0.5	---	6.7	7.2	---	40.5	207.4	264.1
Channel salvage—replacement of vegetation.....	8.6	5.4	18.9	32.9	13.6	349.2	343.8	789.5
Channel salvage—change in growth.....	-4.0	---	-5.3	-9.3	---	61.1	-18.5	23.3
Subtotal, channel salvage.....	5.1	5.4	20.3	30.8	13.6	449.8	532.7	1,026.9
Estimated net depletion in lower basin.....	76.9	37.0	1,429.0	1,542.9	3.4	542.7	4,792.3	6,881.3
Estimate of net depletion by States:								
Arizona.....	67.3	-0.1	5.9	73.1	3.4	531.6	513.3	1,121.4
California.....	---	---	---	---	---	---	4,226.5	4,226.5
Nevada.....	---	---	24.5	24.5	---	---	1.6	22.9
New Mexico.....	9.6	---	9.6	0	---	8.0	-0.5	17.1
Utah.....	---	37.1	5.7	42.8	---	---	-2.3	40.5
Mexico.....	---	---	---	---	---	3.1	-0.1	3.0
Subtotal.....	76.9	37.0	36.1	150.0	3.4	542.7	4,735.3	5,431.4
Undistributed ¹	0	0	1,392.9	1,392.9	0	0	57.0	1,449.9
Total, net depletion in lower basin.....	76.9	37.0	1,429.0	1,542.9	3.4	542.7	4,792.3	6,881.3

¹ Imports of water from other parts of Colorado River Basin.

² Salvage of channel losses on tributaries exceeds consumptive uses.

³ Includes net effect of evaporation and storage changes in surface reservoirs and salvage of channel losses on main stream.

TABLE A-2.—Acreages irrigated within the natural drainage area of the Lower Colorado River Basin, tabulated at selected points

Water year	Little Colorado River Basin				Virgin River Basin				Kanab Creek Basin and miscellaneous areas			Total, Lee Ferry to Hoover Dam				
	Upstream from Grand Falls			Grand Falls to mouth, Arizona	Total	Upstream from Littlefield			Littlefield to mouth		Total		Arizona	Utah	Total	
	Arizona	New Mexico	Total			Arizona	Utah	Total	Arizona	Nevada						Total
1914-----	17,042	4,685	21,727	380	22,107	425	15,118	15,543	381	7,354	7,735	23,278	2,415	3,550	5,965	51,350
1915-----	16,762	4,685	21,447	418	21,865	425	15,118	15,543	381	7,354	7,735	23,278	2,415	3,550	5,965	51,108
1916-----	16,587	4,685	21,272	428	21,700	425	15,118	15,543	381	7,354	7,735	23,278	2,410	3,550	5,960	50,938
1917-----	16,725	4,685	21,410	428	21,838	425	15,118	15,543	381	7,354	7,735	23,278	2,410	3,550	5,960	51,076
1918-----	16,749	4,680	21,429	428	21,857	425	15,118	15,543	381	7,449	7,830	23,373	2,410	3,550	5,960	51,190
1919-----	17,159	4,700	21,859	428	22,287	425	17,068	17,493	381	7,544	7,925	23,418	2,410	3,550	5,960	53,665
1920-----	17,180	4,825	22,065	428	22,493	425	17,068	17,493	381	9,941	10,322	27,815	2,410	3,550	5,960	56,288
1921-----	17,415	5,142	22,557	428	22,985	425	17,068	17,493	381	9,989	10,370	27,863	2,410	3,550	5,960	56,808
1922-----	17,523	4,217	21,746	428	22,174	425	14,598	15,023	381	9,979	10,360	25,853	2,410	3,550	5,960	53,517
1923-----	17,828	5,155	22,983	428	23,411	425	14,598	15,023	381	9,946	10,327	25,350	2,410	3,550	5,960	54,721
1924-----	18,202	5,155	22,960	1,143	24,103	425	14,598	15,023	381	9,946	10,327	25,350	2,410	3,550	5,960	56,341
1925-----	18,388	5,028	21,280	732	21,962	491	14,598	15,023	406	9,924	10,330	25,419	2,410	3,550	5,960	53,619
1926-----	18,388	5,028	21,416	824	22,240	491	14,598	15,023	406	9,924	10,330	25,419	2,410	3,550	5,960	56,442
1927-----	19,022	3,881	22,953	943	23,896	491	14,598	15,023	406	10,091	10,497	26,586	2,410	3,550	5,960	56,689
1928-----	18,823	4,125	22,948	793	23,741	491	16,006	16,497	406	10,095	10,501	26,998	2,410	3,550	5,960	56,689
1929-----	18,575	4,172	22,747	793	23,540	491	13,562	14,053	406	10,095	10,501	24,554	2,440	3,550	5,960	54,084
1930-----	18,595	2,497	21,092	1,063	22,155	491	13,562	14,053	406	9,999	9,905	23,958	2,452	3,550	5,902	52,115

1931	18,397	2,767	21,164	1,063	22,227	491	13,562	14,053	406	9,499	9,906	22,968	2,452	3,560	6,002	82,187
1932	19,398	3,495	22,853	1,063	23,916	491	13,726	14,217	406	9,499	9,905	24,122	2,452	3,560	6,002	84,040
1933	19,312	3,068	23,010	1,063	23,992	491	13,920	14,411	406	8,430	8,836	24,247	2,452	3,560	6,002	83,241
1934	19,387	2,532	21,919	1,012	22,931	491	16,893	17,384	406	8,387	8,793	26,177	2,452	3,560	6,002	83,110
1935	20,563	3,320	23,883	985	24,868	491	16,505	16,996	406	8,577	8,983	26,979	2,452	3,560	6,002	86,849
1936	21,277	3,741	26,018	999	26,017	491	16,709	16,200	406	7,609	8,015	24,215	2,452	3,560	6,002	86,234
1937	22,324	4,029	26,353	915	27,268	491	14,957	15,448	406	6,937	7,343	22,791	2,452	3,560	6,002	86,961
1938	22,911	4,216	27,036	1,111	28,147	492	14,645	15,037	388	6,961	7,367	22,396	2,357	3,550	5,907	86,450
1939	21,480	26,696	26,018	1,084	26,780	492	13,866	14,357	388	6,961	7,367	22,396	2,357	3,550	5,907	84,600
1940	21,932	4,066	26,018	1,089	27,067	492	13,214	13,706	388	6,525	6,923	20,629	2,357	3,550	5,907	83,623
1941	23,427	4,267	27,694	1,069	28,614	502	12,435	12,927	388	7,347	7,700	19,970	2,357	3,550	5,907	84,491
1942	23,374	4,314	27,688	1,049	28,737	457	12,775	13,267	353	7,942	8,296	20,532	2,357	3,550	5,907	85,576
1943	23,040	4,069	27,109	1,030	28,139	457	13,497	13,989	353	7,347	7,700	20,532	2,357	3,550	5,907	84,491
1944	23,004	3,666	26,670	1,663	28,333	462	20,467	20,959	358	8,537	8,891	22,249	2,357	3,550	5,907	86,295
1945	23,275	3,498	26,773	1,149	27,922	467	20,467	20,959	358	8,537	8,891	22,249	2,357	3,550	5,907	86,295
1946	23,264	3,498	26,773	1,149	27,922	467	20,467	20,959	358	8,537	8,891	22,249	2,357	3,550	5,907	86,295
1947	24,734	3,965	28,699	1,220	29,919	450	18,274	18,725	345	10,669	11,014	29,739	2,370	3,540	5,911	84,485
1948	24,813	4,332	29,145	1,893	30,038	378	18,410	18,861	327	10,669	11,014	29,739	2,370	3,540	5,911	84,485
1949	24,709	4,349	29,118	1,086	30,204	365	18,700	19,065	260	11,321	11,593	30,521	2,310	3,560	5,960	86,419
1950	24,145	4,336	28,481	1,065	29,576	362	18,826	19,187	258	11,875	12,135	31,200	2,324	3,560	5,960	87,288
1951	23,556	4,301	27,857	1,235	29,092	350	18,960	19,310	245	11,865	12,123	31,310	2,257	3,470	5,884	86,994
1952	24,854	3,767	28,621	1,715	29,336	359	19,015	19,374	245	12,141	12,396	31,696	2,257	3,380	5,637	86,425
1953	19,476	2,907	22,311	495	22,806	365	17,915	18,275	245	11,461	11,706	31,060	2,346	3,569	5,905	86,321
1954	19,476	3,377	22,853	772	23,625	375	16,810	17,175	260	11,945	12,195	30,470	2,345	3,569	5,905	86,321
1955	18,432	3,627	22,059	1,049	23,108	392	16,980	17,372	278	12,440	12,700	29,885	2,377	3,638	5,440	88,716
1956	18,385	2,710	21,095	1,647	21,742	415	16,980	17,372	300	12,620	12,888	30,270	1,567	2,171	3,738	87,116
1957	18,145	3,573	21,718	1,066	21,742	415	16,985	17,400	300	12,805	13,105	30,500	1,567	2,171	3,738	87,116
1958	18,127	3,728	21,855	1,650	22,505	415	16,980	17,395	300	12,850	13,150	30,550	1,567	2,070	3,637	86,971
Means:																
1914-45	19,482	4,040	23,522	831	24,353	465	15,127	15,592	391	8,538	8,929	24,521	2,409	3,550	5,969	84,833
1952-58	19,546	3,384	22,930	771	23,701	391	17,350	17,771	276	12,434	12,710	30,481	1,905	2,539	4,444	88,628
1914-58	20,123	3,950	24,073	859	24,982	443	15,943	16,386	359	9,535	9,895	26,280	2,320	3,387	5,707	86,919

¹ Includes Muddy River and Meadow Valley Wash Basins.

TABLE A-2.—Acreages irrigated within the natural drainage area of the Lower Colorado River Basin, tabulated at selected points—Con.

Water year	Bill Williams River Basin, Arizona	Hoover Dam to international boundary										Total, in lower basin
		Gila River Basin					Areas adjacent to Colorado River between Hoover Dam and international boundary ¹					
		Upstream from Gillespie Dam			Gillespie Dam to Dome, Ariz.	Total	Arizona			Nevada	Total	
		Arizona	New Mexico	Mexico			Total					
1914	3,953	266,498	8,838	4,021	279,357	3,024	23,087	36,069	115	59,271	345,605	396,955
1915	3,953	275,229	8,791	4,027	288,047	3,024	25,311	36,627	115	62,063	357,077	408,185
1916	3,953	302,259	8,777	4,023	315,059	3,024	25,157	37,010	115	62,282	384,318	435,256
1917	4,078	308,458	8,779	4,020	321,257	3,024	32,325	38,473	115	70,913	399,272	450,348
1918	4,203	328,061	8,780	4,016	340,857	3,024	39,284	40,381	115	79,780	427,864	479,051
1919	4,203	326,251	9,460	4,012	339,723	4,524	46,791	41,980	115	88,886	437,336	491,001
1920	3,953	330,520	9,027	4,009	343,556	4,424	347,980	42,389	115	91,379	443,312	499,580
1921	3,728	343,403	9,027	4,005	356,435	2,724	46,143	38,461	115	84,719	447,606	504,414
1922	3,748	341,934	8,933	4,001	354,868	2,384	357,252	47,972	115	88,926	449,926	509,729
1923	3,748	339,958	7,982	3,998	351,938	8,724	360,662	49,044	115	90,598	455,008	509,729
1924	3,748	366,957	8,041	3,994	378,992	15,224	49,500	43,038	45	92,538	490,547	545,960
1925	3,748	365,102	9,032	3,990	378,124	14,854	53,791	45,945	45	99,781	496,507	549,848
1926	3,748	370,696	10,783	3,987	385,466	15,454	49,070	41,860	45	100,992	505,600	559,279
1927	3,773	389,572	11,263	3,983	404,818	15,794	53,793	40,234	45	94,072	518,457	573,899
1928	3,773	409,918	11,733	3,979	425,630	16,994	55,088	41,103	45	96,236	542,633	599,332
1929	3,723	392,399	11,733	3,976	408,108	10,681	418,789	43,429	45	100,554	523,066	577,150
1930	3,678	429,187	11,733	3,972	444,892	14,478	499,370	36,348	45	93,331	536,379	608,494
1931	3,730	418,850	11,703	4,005	434,558	15,948	56,365	34,865	45	91,275	545,511	597,698
1932	3,750	402,061	11,703	4,003	417,767	15,498	48,639	28,879	45	77,563	514,578	568,618
1933	3,730	466,639	11,703	3,986	482,328	14,038	51,845	28,434	45	80,324	580,420	633,601

1934	3,731	430,798	11,948	3,994	446,740	14,377	461,117	52,452	28,775	45	81,272	546,120	605,220
1935	3,731	478,693	12,369	3,991	496,043	15,824	511,867	55,541	32,992	45	88,578	604,176	661,025
1936	3,731	500,410	13,128	3,988	526,471	17,947	544,418	54,985	36,267	45	91,297	639,446	695,960
1937	3,651	582,407	13,138	3,983	599,528	19,173	618,701	56,179	37,541	45	93,765	716,117	772,178
1938	3,564	512,785	12,911	3,955	529,651	19,734	549,385	56,838	34,487	45	91,370	644,319	700,769
1939	3,539	493,593	11,834	3,976	499,403	20,440	519,843	58,098	36,998	45	95,141	618,523	673,123
1940	4,244	537,352	11,558	3,992	552,902	21,394	574,296	58,165	41,663	45	98,873	678,413	732,086
1941	4,069	629,892	13,073	3,945	646,900	22,371	680,271	60,188	43,511	45	108,744	777,084	831,975
1942	3,969	648,995	13,073	3,913	665,966	24,024	690,010	61,298	45,609	45	109,922	805,901	859,477
1943	3,894	608,028	13,058	3,981	625,067	22,643	647,710	62,396	44,489	45	106,920	768,524	814,819
1944	3,819	617,829	12,953	3,977	634,759	23,060	687,819	61,791	47,593	45	109,429	771,067	835,131
1945	3,691	576,037	12,815	3,974	597,826	22,240	615,066	61,170	49,314	45	111,029	729,786	794,271
1946	4,161	541,298	12,596	3,970	557,834	23,018	580,852	71,823	53,178	0	125,001	710,014	773,548
1947	4,163	622,253	12,398	3,969	638,610	23,804	662,414	73,242	59,015	0	132,257	798,834	864,759
1948	5,330	687,918	11,728	3,962	703,608	29,193	731,801	79,420	63,676	0	143,096	890,227	946,646
1949	6,577	755,614	12,703	3,956	773,273	29,232	801,525	81,624	66,051	0	147,685	935,277	1,028,075
1950	7,790	867,500	13,922	3,960	715,392	33,344	748,746	94,894	64,522	0	159,416	935,932	962,696
1951	8,990	868,624	14,245	3,960	884,829	28,906	913,735	101,351	69,946	0	121,277	1,094,002	1,160,427
1952	7,840	928,982	11,750	2,969	943,701	33,195	976,896	119,570	75,925	0	165,495	1,246,552	1,246,552
1953	8,060	938,796	11,827	3,124	953,747	41,677	995,424	122,625	81,034	0	203,659	1,207,163	1,265,879
1954	8,060	898,590	11,994	3,182	901,646	44,654	945,390	119,573	80,587	0	200,160	1,154,540	1,213,065
1955	8,360	870,703	11,940	3,202	885,885	50,514	936,399	130,688	84,141	0	214,830	1,159,609	1,216,725
1956	8,580	795,740	12,062	3,202	811,622	52,092	863,714	121,688	86,366	0	208,054	1,083,848	1,128,928
1957	8,880	789,530	12,148	2,820	804,498	59,811	864,399	123,775	88,022	0	211,797	1,084,986	1,141,957
1958	9,180	856,239	12,225	2,840	873,284	77,029	948,313	134,118	88,205	0	222,323	1,179,816	1,236,573
Means:													
1914-45	3,830	430,930	10,959	3,988	445,877	13,440	459,317	50,787	39,392	67	90,246	533,393	608,226
1952-58	8,432	868,798	11,995	2,991	891,769	51,282	933,051	124,577	83,488	0	208,045	1,149,628	1,208,154
1914-58	4,858	533,966	11,852	3,829	549,177	21,235	570,412	66,657	49,360	48	116,066	601,835	748,253

* Does not include Imperial and Coachella Valleys in the Salton Sea drainage area.

SUMMARY OF DEPLETIONS BY TYPES OF USE AND VIRGIN FLOWS, OCT 1, 1913,
TO SEPT. 30, 1958TABLE A.—*Colorado River at Lee Ferry, Ariz.*

[1,000 acre-feet]

Water year	Historic year	Upper basin water uses				Virgin flow
		Irrigation depletions	Storage change	Transbasin diversions	Total depletions	
1914.....	19,334.8	1,763.6	-----	124.0	1,887.6	21,222.4
1915.....	12,500.4	1,464.5	-----	63.0	1,527.5	14,027.9
1916.....	17,324.8	1,771.6	-----	105.0	1,876.6	19,201.4
1917.....	21,893.1	2,054.7	-----	90.0	2,144.7	24,037.8
1918.....	13,649.6	1,651.5	-----	63.0	1,714.5	15,364.1
1919.....	10,858.4	1,531.5	-----	73.0	1,604.5	12,462.9
1920.....	19,738.7	2,093.7	-----	119.0	2,212.7	21,951.4
1921.....	20,714.8	2,192.7	-----	108.0	2,300.7	23,015.5
1922.....	16,302.4	1,904.6	-----	99.0	2,003.6	18,306.0
1923.....	16,261.3	1,904.6	-----	104.0	2,008.6	18,269.9
1924.....	12,481.1	1,671.6	-----	49.0	1,720.6	14,201.7
1925.....	11,341.1	1,630.5	-----	62.0	1,692.5	13,033.6
1926.....	14,008.5	1,767.6	-----	77.0	1,844.6	15,853.1
1927.....	16,586.9	1,918.7	-----	111.0	2,029.7	18,616.6
1928.....	15,323.3	1,850.6	-----	106.0	1,956.6	17,279.9
1929.....	19,223.4	2,096.7	-----	109.0	2,205.7	21,429.1
1930.....	13,070.1	1,739.6	-----	76.0	1,815.6	14,885.7
1931.....	6,387.5	1,339.4	-----	42.0	1,381.4	7,768.9
1932.....	15,286.3	1,863.6	-----	94.0	1,957.6	17,243.9
1933.....	9,745.4	1,532.5	-----	79.0	1,611.5	11,356.9
1934.....	4,396.4	1,214.4	-----	30.0	1,244.4	5,640.8
1935.....	9,912.1	1,546.5	-----	91.0	1,637.5	11,549.6
1936.....	11,970.3	1,670.6	-----	160.0	1,830.6	13,800.9
1937.....	11,896.9	1,670.6	-----	173.0	1,843.6	13,740.5
1938.....	15,440.0	1,891.7	-----	214.0	2,105.7	17,545.7
1939.....	9,393.7	1,532.5	-----	153.0	1,685.5	11,079.2
1940.....	7,081.6	1,380.5	-----	139.0	1,519.5	8,601.1
1941.....	16,052.0	1,918.7	-----	178.0	2,096.7	18,148.7
1942.....	17,029.4	1,973.7	-----	123.0	2,096.7	19,126.1
1943.....	11,263.0	1,642.6	-----	198.0	1,840.6	13,103.6
1944.....	13,221.4	1,766.6	-----	167.0	1,933.6	15,155.0
1945.....	11,545.4	1,656.6	-----	209.0	1,865.6	13,411.0
1946.....	8,744.7	1,490.0	-----	191.0	1,681.0	10,425.7
1947.....	13,514.4	1,780.0	-----	177.0	1,957.0	15,471.4
1948.....	13,687.2	1,781.0	-----	145.0	1,926.0	15,613.2
1949.....	14,359.0	1,824.0	-----	193.0	2,017.0	16,376.0
1950.....	11,057.2	1,626.0	-----	211.0	1,837.0	12,894.2
1951.....	9,830.7	1,554.0	-----	262.0	1,816.0	11,646.7
1952.....	17,980.0	2,092.0	+337.0	256.0	2,685.0	20,665.0
1953.....	8,805.0	1,513.0	-76.0	394.0	1,831.0	10,636.0
1954.....	6,116.0	1,343.0	-297.0	499.0	1,545.0	7,661.0
1955.....	7,307.0	1,431.0	-41.0	491.0	1,881.0	9,188.0
1956.....	8,750.0	1,520.0	+6.0	473.0	1,999.0	10,749.0
1957.....	17,340.0	2,059.0	+274.0	423.0	2,756.0	20,096.0
1958.....	14,260.0	1,851.0	-3.0	382.0	2,230.0	16,490.0
Means:						
1914-45.....	13,788.6	1,737.8	-----	112.1	1,849.9	15,638.5
1931-58.....	11,513.3	1,659.4	+7.2	219.5	1,886.1	13,399.4
1952-58.....	11,508.3	1,687.0	+28.6	416.8	2,132.4	13,640.7
1914-58.....	13,177.5	1,721.6	+4.4	170.8	1,896.8	15,074.3

TABLE H.—Colorado River at international boundary

(11,000 acre-feet)

Water year	Historic flow	Upper basin depletions at Lee Ferry	Lower basin water uses						Channel salvage			Change in ground-water storage	Total depletion	Virgin flow
			Crops	Non-cropped areas	Cities, towns, and farmsteads	Trans-basin diversions	Reservoir losses		Evapora-tion	Replac-ment	Growth change			
							Evapora-tion	Storage change						
1914	18,606.2	1,887.6	1,051.6	52.5	91.4	1,647.7	55.9	-27.1	130.1	246.2	+8.9	+69.0	4,461.2	23,067.4
1915	14,275.5	1,527.5	1,169.9	57.8	94.0	1,729.9	75.7	+1,148.7	127.0	267.8	-183.6	+774.9	6,000.0	20,275.5
1916	19,672.8	1,876.6	1,349.4	64.9	97.4	2,006.8	82.5	-40.1	112.2	287.5	-153.1	+439.5	5,314.2	24,987.0
1917	20,262.7	2,144.7	1,242.8	60.7	98.0	2,010.9	80.4	-118.5	127.8	289.0	-156.0	-271.5	4,674.7	24,937.4
1918	10,864.9	1,714.5	1,251.0	57.1	99.1	2,390.8	69.8	-743.9	122.8	298.0	+73.1	-26.6	4,494.1	15,359.0
1919	8,176.4	1,604.5	1,365.5	65.6	102.2	2,315.3	66.9	+284.5	125.2	323.0	-122.5	+368.8	5,692.6	7,692.6
1920	19,659.9	2,212.7	1,356.3	65.8	103.1	2,406.5	82.9	+446.9	127.4	334.5	-118.4	+1,274.7	7,398.6	13,779.0
1921	17,275.3	2,300.7	1,282.4	61.0	102.9	2,244.7	75.4	-351.2	130.4	307.8	-99.7	-240.7	5,136.7	22,412.0
1922	15,709.7	1,288.4	1,288.4	59.8	104.3	2,190.6	76.1	-120.2	130.6	293.5	-40.4	+14.8	5,133.9	20,843.6
1923	14,333.2	2,008.6	1,506.1	70.0	108.8	2,640.9	71.9	-153.3	130.5	326.3	+30.5	-119.5	5,688.2	20,041.4
1924	10,492.2	1,729.6	1,629.0	73.4	111.5	2,544.5	73.9	-30.0	128.0	335.2	+11.5	-327.9	5,275.8	15,788.0
1925	9,094.5	1,692.9	1,428.0	63.8	110.0	2,435.6	58.1	-326.3	119.8	333.6	+99.3	-383.7	4,600.3	18,714.8
1926	11,337.9	1,844.9	1,528.5	65.9	112.0	2,385.1	91.4	+322.6	145.8	350.0	-94.2	-124.4	5,585.1	16,943.0
1927	14,298.4	2,028.0	1,612.7	70.1	114.0	2,440.6	76.6	+437.6	130.2	331.1	+38.7	-279.3	5,069.9	17,081.6
1928	12,011.7	2,936.0	1,612.7	69.9	116.7	2,853.1	63.4	-63.7	131.4	337.0	-58.7	-434.1	5,795.3	20,965.3
1929	15,140.1	2,236.7	1,654.7	72.4	118.7	2,827.8	78.4	+38.8	139.5	360.2	-53.4	-435.3	5,585.2	15,212.3
1930	9,415.9	1,815.6	1,629.9	71.3	120.1	2,454.2	83.5	+256.0	135.6	355.9	-107.9	-246.8	5,143.1	19,638.2
1931	12,871.0	1,957.6	1,510.7	70.5	120.2	2,452.7	127.4	+94.5	185.6	345.6	-188.9	+302.7	6,767.2	11,634.9
1932	6,799.3	1,611.5	1,516.8	63.3	121.4	2,257.8	119.9	-664.5	130.3	327.6	-43.8	-138.9	4,545.6	8,357.1
1933	1,988.5	1,244.4	1,466.1	64.8	122.9	1,869.1	84.0	+5,551.4	112.7	314.8	+20.8	-338.9	3,418.6	5,357.1
1934	2,132.0	1,637.5	1,692.4	75.3	125.9	2,098.6	185.7	+5,965.3	231.0	337.5	-350.0	-169.5	10,298.8	12,450.8
1935	2,089.4	1,830.6	2,079.6	79.8	128.7	2,679.6	405.5	+7,191.6	244.2	390.3	-259.0	-316.9	11,680.4	13,769.5
1936	1,922.3	1,843.0	2,870.1	93.5	132.7	2,870.1	635.8	+7,191.6	274.9	455.1	-806.0	+52.0	13,840.1	15,762.7
1937	1,980.4	2,105.7	1,898.4	83.2	131.5	2,949.4	811.5	-8,872.7	289.8	408.7	-188.0	-422.9	15,543.0	17,523.4
1938	4,114.7	1,685.5	1,880.0	73.6	128.9	2,859.9	941.9	+1,409.4	158.7	383.1	-34.8	-662.5	7,520.2	11,634.9
1939	3,660.6	1,519.5	1,840.5	82.1	133.2	2,745.6	970.8	-716.5	134.5	423.7	+30.5	-811.1	5,236.4	8,897.0

TABLE H.—*Colorado River at international boundary—Continued*

Water year	Historic flow	Upper basin depletions at Lee Ferry	Lower basin water uses					Channel salvage			Change in ground-water storage	Total depletion	Virgin flow
			Crops	Non-cropped areas	Cities, towns, and farmsteads	Trans-basin diversions	Reservoir losses		Evaporation	Replacement			
							Evaporation	Storage change					
1941	8,390.0	2,096.7	2,121.6	100.7	141.6	2,753.6	1,121.6	+7,795.2	308.3	493.7	+182.3	15,345.4	23,735.4
1942	13,085.5	2,096.7	2,422.5	109.9	150.6	2,505.9	1,152.2	-1,648.6	158.3	522.3	-672.9	5,452.8	19,438.3
1943	17,018.9	1,840.6	2,253.4	100.3	163.8	2,571.8	1,136.9	-1,507.0	131.8	486.1	-697.2	5,296.9	13,214.5
1944	10,293.9	1,853.6	2,354.3	104.7	168.8	2,575.8	1,079.1	-1,857.0	136.7	496.2	-805.9	5,002.2	15,268.0
1945	8,653.1	1,865.6	2,431.2	110.2	167.2	2,739.6	1,012.1	-1,584.6	139.6	517.2	-972.0	5,203.2	13,868.8
1946	6,700.6	1,881.0	2,391.5	106.4	202.6	2,013.7	950.0	-2,387.5	145.7	442.9	-969.4	3,313.7	10,014.3
1947	6,458.2	1,857.0	2,317.2	108.7	226.0	2,985.8	950.0	+2,345.1	234.6	455.9	-1,109.9	8,540.1	15,094.3
1948	8,490.2	1,875.0	2,317.2	119.0	239.0	3,183.2	1,006.4	+2,383.2	213.5	522.9	-1,407.1	7,023.8	15,094.3
1949	5,897.2	2,077.0	2,531.0	134.7	246.8	3,203.3	1,076.5	+1,331.0	263.1	562.1	-1,035.6	8,022.9	17,104.0
1950	7,604.3	1,837.0	2,723.3	124.7	255.8	3,483.9	1,044.6	-2,562.1	162.1	543.5	-1,363.6	4,721.7	12,328.0
1951	3,402.0	1,816.0	2,868.2	131.0	273.0	3,863.1	1,098.6	+3,366.1	180.8	663.9	-1,601.5	7,770.9	11,272.9
1952	5,486.3	2,085.0	3,088.2	138.0	288.8	4,019.8	1,098.6	-5,439.0	319.5	722.1	-2,018.7	13,869.3	22,478.8
1953	7,319.5	1,831.0	3,725.6	187.1	293.7	4,100.0	1,111.6	-5,439.0	283.9	700.9	-2,340.2	2,731.5	10,101.8
1954	4,426.7	1,545.0	3,455.4	165.0	273.7	4,002.7	1,043.2	-5,915.2	262.0	700.9	-1,932.4	2,731.5	7,221.1
1955	3,862.2	1,831.0	3,498.0	169.4	289.3	4,033.1	942.5	-2,522.4	243.7	743.0	-2,003.6	5,496.2	9,377.4
1956	1,841.9	1,999.0	3,297.1	149.6	304.0	3,999.5	959.2	-2,522.4	216.3	735.0	-1,807.7	8,348.1	10,190.0
1957	1,816.8	2,766.0	3,270.3	151.1	309.5	4,062.6	969.4	+10,228.0	284.1	749.9	-1,717.6	18,628.5	20,345.3
1958	6,400.2	2,230.0	3,594.4	180.6	337.6	3,845.0	1,201.0	+2,765.3	288.1	832.0	-1,626.0	11,169.5	17,569.7
Means:													
1914-45	10,344.5	1,849.9	1,635.6	74.7	120.6	2,433.2	346.7	+927.1	156.3	364.4	-176.3	6,628.1	16,972.6
1931-58	5,904.1	1,886.1	2,457.0	114.4	197.9	3,077.9	828.4	+1,199.9	208.7	519.5	-955.9	7,979.4	13,863.5
1952-58	4,862.4	2,132.4	3,502.0	170.1	291.6	4,008.0	1,046.5	+810.3	284.1	739.5	-1,921.3	9,013.7	13,896.1
1914-58	9,025.0	1,896.8	2,054.5	95.7	163.2	2,792.5	542.5	+750.8	179.4	442.9	-592.6	7,005.9	16,030.9

CENTRAL ARIZONA PROJECT

211

TABLE N.—Colorado River at international boundary

[1,000 acre-feet]

Water year	Historic flow	Depletions ¹							Virgin flow
		Arizona	California	Nevada	New Mexico	Utah	Mexico	Undistributed	Total
1914	18,606.2	840.2	1,729.0	16.0	11.3	45.5	6.2	1,813.0	4,416.2
1915	14,275.5	2,649.3	2,815.8	14.3	13.0	41.9	5.5	1,460.2	6,000.0
1916	19,672.8	1,327.4	2,096.7	15.8	14.1	47.1	6.8	1,804.3	5,314.2
1917	20,262.7	1,428.7	2,104.0	15.2	11.9	43.6	6.8	2,064.5	4,674.7
1918	10,864.9	297.9	2,484.3	13.9	9.3	42.9	4.5	1,641.3	4,404.1
1919	8,176.4	1,568.4	2,421.8	12.6	13.3	40.1	6.7	1,539.7	5,602.6
1920	19,659.9	2,630.7	2,519.5	17.6	14.3	48.0	6.8	2,131.7	7,368.6
1921	17,275.3	2,488.2	2,348.6	16.9	13.4	48.4	5.4	2,220.8	5,136.7
1922	15,709.7	832.9	2,293.5	18.3	9.9	48.3	4.3	1,926.7	5,133.9
1923	14,353.2	926.3	2,747.7	17.6	11.9	45.5	5.6	1,933.6	5,688.2
1924	10,492.2	898.6	2,664.5	12.5	11.2	31.6	6.4	1,651.0	5,275.8
1925	9,024.5	454.7	2,549.1	13.1	7.6	34.1	4.9	1,626.8	4,690.3
1926	11,357.9	1,262.5	2,493.8	13.0	7.8	32.9	5.7	1,769.4	5,585.1
1927	14,298.4	1,383.7	2,552.1	17.0	10.5	42.6	5.6	1,956.7	5,968.2
1928	12,011.7	423.6	2,693.5	14.5	9.8	38.7	4.6	1,885.2	5,069.9
1929	15,140.1	798.5	2,801.2	16.3	11.2	38.5	4.6	2,125.0	5,795.3
1930	9,627.1	844.4	2,930.9	14.8	6.5	35.7	5.0	1,747.9	5,585.2
1931	3,415.9	1,178.7	2,832.1	13.1	8.9	30.5	5.0	1,324.8	5,143.1
1932	12,871.0	2,283.7	2,524.9	18.5	8.2	46.6	5.9	1,879.4	6,767.2
1933	6,799.3	602.4	2,335.9	12.2	11.0	31.8	5.2	1,547.1	4,545.6
1934	1,938.5	226.6	1,948.7	10.4	8.4	32.7	4.8	1,187.0	3,418.6
1935	2,192.0	1,364.1	2,114.6	10.0	7.0	38.4	4.4	6,720.3	10,258.8
1936	2,069.4	816.1	2,689.6	8.0	8.7	33.9	4.5	8,119.3	11,680.1
1937	1,922.3	1,850.3	2,882.7	9.4	8.5	41.7	6.1	9,041.7	13,840.4
1938	1,980.4	502.1	2,917.0	9.1	8.0	43.7	4.5	12,058.6	15,543.0
1939	4,114.7	571.7	2,920.7	11.1	7.6	34.1	4.2	4,006.2	7,520.2
1940	3,660.6	571.7	2,868.9	11.5	10.8	34.9	4.9	1,735.7	5,236.4
1941	8,390.0	4,257.2	2,805.9	12.0	7.3	43.2	5.9	8,213.9	15,845.4
1942	13,985.5	958.0	2,641.3	15.6	9.2	37.1	5.5	1,786.1	5,452.8
1943	7,918.9	822.8	2,702.1	26.9	8.9	35.9	4.3	1,694.7	5,295.6
1944	10,283.9	796.7	2,716.1	27.9	7.7	49.1	4.2	1,430.4	5,002.1
1945	8,653.1	939.8	2,874.9	21.3	8.7	47.1	4.8	1,306.6	5,205.2
1946	6,700.6	451.1	3,201.8	27.0	16.3	48.2	3.5	-434.2	3,813.7
1947	6,286.2	399.3	3,102.6	27.5	15.1	57.5	3.7	5,264.4	8,840.1
1948	8,160.2	476.8	3,322.3	21.8	14.5	47.8	3.5	3,137.1	7,023.8
1949	8,097.2	1,568.1	3,303.5	22.4	19.2	53.2	4.7	3,441.8	8,402.9
1950	7,604.3	378.1	3,636.1	23.6	15.6	50.5	3.4	614.4	4,721.7
1951	3,502.0	657.6	4,028.7	23.6	18.0	46.2	3.6	2,993.2	7,770.9
1952	8,459.5	2,173.2	4,180.3	30.8	24.1	55.7	4.3	7,520.9	13,989.3
1953	7,319.8	750.9	4,849.7	17.6	9.1	36.7	1.8	-2,394.3	2,781.5
1954	4,426.7	992.4	4,260.8	20.9	16.9	38.4	3.2	-2,539.2	2,793.4
1955	3,882.2	902.6	4,285.7	22.7	20.3	37.0	3.1	223.8	5,495.2
1956	1,841.9	523.3	4,228.6	17.7	7.7	31.8	1.7	3,637.3	8,348.1
1957	1,816.8	765.1	4,211.1	18.3	18.6	34.5	3.3	13,477.6	18,528.5
1958	6,400.2	1,742.4	4,069.3	32.2	23.2	49.5	3.9	5,239.0	11,159.5
Means:									
1914-45	10,344.5	1,116.5	2,524.0	14.9	9.9	40.2	5.3	2,917.3	6,628.1
1931-58	5,904.1	1,050.5	3,203.7	18.7	12.4	41.7	4.2	3,648.2	7,979.4
1952-58	4,882.4	1,121.4	4,226.5	22.9	17.1	40.5	3.0	3,582.3	9,013.7
1914-58	9,025.0	1,054.9	2,909.9	17.4	11.9	41.6	4.7	2,965.5	7,005.9

¹ Depletions are listed for the States in the Lower Colorado River Basin and the portion of Mexico in the Gila River drainage area. Undistributed depletions are the depletions by the Upper Colorado River Basin combined with depletions by the reservoirs on the main stream of the Colorado River less estimated salvage from channel evaporation.

TABLE B.—*Little Colorado River at Grand Falls, Ariz.*

[1,000 acre-feet]

Water year	Historic flow	Crops	Lower basin water uses				Channel salvage			Export water	Net depletion	Virgin flow
			Non-cropped areas	Cities, towns, and farmsteads	Reservoir losses		Evapora- tion	Replace- ment	Growth change			
					Evapora- tion	Storage change						
1914	190.2	28.5	2.7	6.7	11.3	0.1	4.4	-0.5	44.2	234.4		
1915	338.8	35.5	3.4	7.1	13.6	.1	5.3	-1.4	53.8	392.6		
1916	859.4	35.2	3.3	7.2	13.7	.2	5.2	-1.1	53.9	913.3		
1917	303.9	30.1	2.9	7.6	11.8	.1	4.5	+2	48.0	351.9		
1918	103.7	21.7	2.0	7.8	9.3	.1	3.1	+3	37.9	141.6		
1919	261.5	35.7	3.3	8.2	14.2	.1	5.2	+9	57.0	318.5		
1920	461.0	36.4	3.5	8.3	14.7	.1	5.4	+1.2	58.6	519.6		
1921	170.6	29.6	2.8	8.3	13.1	.1	4.6	+1.1	50.2	220.8		
1922	308.9	35.0	3.4	8.4	13.8	.1	5.0	+1.8	57.3	366.2		
1923	271.6	35.5	3.3	8.6	15.1	.1	5.4	+1.9	58.9	330.5		
1924	221.8	30.5	2.9	8.7	13.5	.1	4.8	+2.0	52.7	274.5		
1925	150.4	26.4	2.5	8.8	10.9	.1	3.8	+1.9	46.6	197.0		
1926	181.5	27.4	2.7	8.9	11.1	.1	3.9	+2.4	48.5	230.0		
1927	393.8	38.5	3.7	9.0	15.0	.1	5.6	+3.3	63.8	457.6		
1928	87.6	23.0	2.2	9.0	10.5	.1	3.4	+2.0	43.2	130.8		
1929	510.8	38.6	3.7	9.1	14.4	.1	5.7	+4.0	64.0	574.8		
1930	189.3	27.5	2.9	9.1	13.4	.1	3.8	+3.3	49.3	238.6		
1931	165.0	33.4	3.3	9.2	13.0	.1	4.6	+3.3	57.3	222.5		
1932	465.9	39.0	3.8	9.4	15.2	.1	5.7	+4.9	66.3	532.4		

1933	129.2	32.4	3.1	9.4	14.7	+3.4	58.3	187.0
1934	71.0	24.6	2.6	9.4	11.5	+3.0	48.0	119.0
1935	215.3	33.8	3.4	9.5	14.4	+4.5	61.2	276.5
1936	165.0	33.5	3.2	9.6	14.8	+4.4	60.7	225.7
1937	339.4	38.0	3.7	9.6	16.0	+6.4	68.2	407.6
1938	170.2	28.4	2.8	9.6	12.8	+4.9	54.3	224.5
1939	83.2	23.8	2.3	9.8	11.6	+4.0	47.8	131.0
1940	132.2	35.1	3.4	10.0	15.1	+4.8	63.1	195.3
1941	586.9	47.7	4.7	11.0	18.4	+7.7	82.0	668.9
1942	149.0	28.6	2.8	10.9	12.5	+6.4	55.6	204.6
1943	103.0	28.0	2.8	11.0	12.9	+5.0	56.1	159.1
1944	129.1	27.6	2.7	10.9	12.3	+5.6	54.8	183.9
1945	159.5	34.0	3.4	11.0	14.0	+6.4	63.5	223.0
1946	116.4	37.9	4.3	12.9	26.6	+8.0	83.7	200.1
1947	127.0	34.4	3.9	13.1	27.6	+8.5	82.5	208.5
1948	182.3	36.1	4.1	13.1	29.6	+9.9	87.4	298.7
1949	268.4	46.1	5.1	13.1	37.0	+9.9	104.2	372.6
1950	41.1	24.2	2.8	13.2	19.1	+5.5	61.3	102.5
1951	48.8	29.8	3.2	13.2	19.8	+5.7	67.4	116.2
1952	321.6	45.4	6.6	13.0	37.5	+5.0	107.0	428.6
1953	51.4	45.4	2.3	12.8	23.1	+11.6	43.6	97.9
1954	107.5	23.6	3.1	13.1	27.7	-11.6	72.4	179.9
1955	162.3	36.2	3.8	13.6	34.3	+8.6	92.0	244.3
1956	18.7	18.7	1.9	13.6	21.7	-10.1	41.2	59.9
1957	169.8	32.7	3.4	14.1	32.6	+7.4	86.1	255.9
1958	161.1	32.2	3.3	14.3	33.8	+13.1	95.9	257.0
Means:								
1914-45	252.1	32.0	3.1	9.1	13.3	+3.1	55.8	307.9
1931-58	172.6	32.6	3.4	11.6	20.7	+7	68.6	241.2
1952-58	140.8	30.7	3.5	13.6	30.1	+3.0	76.9	217.7
1914-58	218.6	32.2	3.3	10.3	17.7	+5	62.5	281.1

TABLE C.—*Virgin River at Littlefield, Ariz.*

[1,000 acre-feet]

Water year	Historic flow	Lower basin water uses					Channel salvage replacement	Net depletion	Virgin flow
		Crops	Non-cropped areas	Cities, towns, and farmsteads	Trans-basin diversions	Reservoir evaporation losses			
1914	307.3	35.4	3.1	4.2	0	1.9	5.7	38.9	346.2
1915	258.9	32.3	2.8	4.2	0	1.8	5.1	36.0	294.9
1916	527.7	36.7	3.2	4.3	0	2.0	5.8	40.4	568.1
1917	277.8	33.7	3.0	4.4	0	1.8	5.4	37.5	315.3
1918	266.1	32.8	2.9	4.5	0	1.8	5.2	36.8	302.9
1919	187.1	31.0	3.8	4.4	0	1.7	4.9	35.0	222.1
1920	279.1	37.8	3.4	4.6	0	2.1	5.9	42.0	321.1
1921	261.4	36.6	3.2	4.6	1.7	2.0	5.7	42.4	303.8
1922	522.3	35.5	3.1	4.7	2.0	1.9	5.7	41.5	563.8
1923	286.6	33.2	2.9	4.7	1.8	1.8	5.3	39.1	325.7
1924	120.6	22.1	1.9	4.5	1.3	1.2	3.6	27.4	148.0
1925	150.0	24.2	2.2	4.6	1.3	1.3	3.9	29.7	179.7
1926	138.5	23.8	2.1	4.6	1.3	1.3	3.8	28.8	167.3
1927	254.0	31.0	2.7	4.7	1.7	1.7	5.0	36.8	290.8
1928	171.6	28.2	2.5	4.8	1.5	1.5	4.6	33.9	205.5
1929	226.5	27.3	2.4	4.8	1.6	1.5	4.4	33.2	259.7
1930	188.1	25.0	2.2	4.7	1.5	1.3	4.1	30.6	218.7
1931	199.3	20.7	1.9	4.8	1.2	1.1	3.4	26.3	145.6
1932	381.9	33.5	3.0	5.1	2.0	1.8	5.5	39.9	421.8
1933	127.5	21.8	1.9	5.0	1.3	1.2	3.6	27.6	155.1
1934	78.0	23.2	2.0	5.1	1.1	1.3	3.6	29.1	107.1
1935	164.9	28.5	2.5	5.3	1.4	1.6	4.5	34.8	199.7
1936	131.0	24.9	2.2	5.3	1.3	1.4	4.0	31.1	162.1
1937	240.3	30.8	2.7	5.5	1.7	1.7	5.0	37.4	277.7
1938	278.6	32.5	2.9	5.7	1.8	1.8	5.3	39.4	318.0
1939	154.9	23.2	2.1	5.6	1.4	1.3	3.8	29.8	184.7
1940	173.7	23.3	2.1	5.7	1.5	1.3	3.8	30.1	203.8
1941	400.0	30.5	2.8	5.9	2.0	1.6	5.1	37.7	437.7
1942	214.9	24.9	2.2	5.8	1.6	1.3	4.0	31.8	246.7
1943	178.1	23.9	2.1	5.8	1.5	1.3	3.8	30.8	208.9
1944	182.7	36.7	3.3	6.1	1.5	2.0	5.6	44.0	226.7
1945	166.3	35.3	3.1	6.1	1.4	1.9	5.3	42.5	208.8
1946	121.3	34.8	3.0	5.9	1.4	2.9	4.4	43.6	164.9
1947	192.3	42.6	3.7	6.0	1.8	3.6	5.3	52.4	244.7
1948	116.4	34.7	3.0	6.0	1.4	2.9	4.2	43.8	160.2
1949	155.9	39.1	3.4	6.0	1.6	3.3	4.6	48.8	204.7
1950	127.0	36.5	3.2	6.0	1.5	3.1	4.4	45.9	172.9
1951	99.9	33.6	2.9	6.0	1.3	2.8	4.0	42.6	142.5
1952	273.7	40.3	4.3	5.6	1.5	4.3	6.6	49.4	323.1
1953	99.5	25.8	2.7	5.3	1.6	2.7	4.8	33.3	132.8
1954	136.5	27.9	2.8	5.4	1.1	2.9	5.1	35.0	171.5
1955	135.5	27.8	2.8	5.4	.6	2.9	5.2	34.3	169.8
1956	92.8	23.6	2.4	5.3	.1	2.5	4.8	29.1	121.9
1957	99.8	24.4	2.5	5.4	1.9	2.6	4.9	31.9	131.7
1958	294.6	35.5	3.5	5.6	4.2	3.7	6.2	46.3	340.9
Means:									
1914-45	231.7	29.4	2.6	5.0	1.2	1.6	4.7	35.1	266.8
1931-58	176.3	30.0	2.8	5.6	1.5	2.2	4.7	37.4	213.7
1952-58	161.8	29.3	3.0	5.4	1.6	3.1	5.4	37.0	198.8
1914-58	208.0	30.4	2.7	5.2	1.3	2.0	4.8	36.8	244.8

TABLE E.—*Bill Williams River at Planet, Ariz.*

[1,000 acre-feet]

Water year	Historic flow	Lower basin water uses			Channel salvage replacement	Net depletion	Virgin flow
		Crops	Non-cropped areas	Cities, towns, and farmsteads			
1914.....	78.2	8.5	0.7	0.3	5.8	3.7	81.9
1915.....	115.8	10.3	.8	.3	7.0	4.4	120.2
1916.....	312.4	11.2	.9	.3	7.6	4.8	317.2
1917.....	120.8	10.9	.9	.3	7.4	4.7	125.5
1918.....	94.8	9.9	.8	.3	6.7	4.3	99.1
1919.....	202.2	11.9	.9	.3	8.0	5.1	207.3
1920.....	254.0	11.2	.9	.3	7.5	4.9	258.9
1921.....	83.0	8.3	.6	.3	5.5	3.7	86.7
1922.....	209.8	10.7	.8	.3	7.2	4.6	214.4
1923.....	164.2	10.7	.8	.3	7.1	4.7	168.9
1924.....	52.4	6.9	.5	.3	4.6	3.1	55.5
1925.....	115.2	9.8	.8	.3	6.6	4.3	119.5
1926.....	139.4	10.9	.8	.3	7.3	4.7	144.1
1927.....	432.4	10.7	.8	.3	7.2	4.6	437.0
1928.....	21.3	5.4	.5	.3	3.6	2.6	23.9
1929.....	31.2	5.8	.5	.3	3.9	2.7	33.9
1930.....	33.0	5.8	.5	.3	3.9	2.7	35.7
1931.....	108.9	9.4	.8	.3	6.3	4.2	113.1
1932.....	319.6	10.6	.8	.3	7.2	4.5	324.1
1933.....	13.3	4.9	.3	.3	3.3	2.2	15.5
1934.....	11.6	4.9	.3	.3	3.3	2.2	13.8
1935.....	110.2	9.5	.8	.3	6.4	4.2	114.4
1936.....	21.8	5.3	.5	.3	3.5	2.6	24.4
1937.....	253.0	10.4	.8	.3	7.0	4.5	257.5
1938.....	112.9	9.3	.7	.3	6.3	4.0	116.9
1939.....	231.5	10.1	.8	.3	6.8	4.4	235.9
1940.....	30.8	6.6	.6	.3	4.5	3.0	33.8
1941.....	436.8	11.5	1.0	.3	7.9	4.9	441.7
1942.....	26.8	6.0	.5	.3	4.1	2.7	29.5
1943.....	14.2	5.3	.5	.3	3.7	2.4	16.6
1944.....	114.4	9.8	.9	.3	6.7	4.3	118.7
1945.....	60.1	7.1	.6	.3	4.9	3.1	63.2
1946.....	12.3	5.8	.6	.8	5.5	1.7	14.0
1947.....	18.6	6.1	.7	.8	5.8	1.8	20.4
1948.....	7.3	7.0	.8	.8	6.6	2.0	9.3
1949.....	48.7	12.3	1.4	.8	11.7	2.8	51.5
1950.....	7.9	10.2	1.1	.9	9.8	2.4	10.3
1951.....	56.9	17.9	2.0	1.0	17.0	3.9	60.8
1952.....	148.9	17.9	1.8	1.1	12.6	8.2	157.1
1953.....	12.5	8.4	.8	.9	13.0	-2.9	9.6
1954.....	55.6	14.8	1.5	1.1	13.0	4.4	60.0
1955.....	29.7	15.8	1.7	1.2	13.5	5.2	34.9
1956.....	12.6	11.0	1.2	1.2	13.8	-4	12.2
1957.....	14.6	12.1	1.4	1.2	14.3	.4	15.0
1958.....	47.1	20.1	2.4	1.4	14.8	9.1	56.2
Means:							
1914 to 1945.....	135.2	8.7	.7	.3	5.9	3.8	139.0
1931 to 1958.....	83.5	10.0	1.0	.6	8.3	3.3	86.8
1952 to 1958.....	45.9	14.3	1.5	1.2	13.6	3.4	49.3
1914 to 1958.....	106.6	9.8	.9	.5	7.6	3.6	110.2

TABLE F.—*Gila River at Gillespie Dam, Ariz.*
[1,000 acre-feet]

Water year	Historic flow	Lower basin water uses					Channel salvage			Import Water	Change in ground water storage	Net depletion	Virgin flow
		Crops	Non-cropped areas	Cities, towns, and farmsteads	Reservoir losses		Evaporation	Replacement	Growth change				
					Evaporation	Storage change							
1914	658.4	729.8	34.6	67.9	21.7	-27.1	11.8	111.0	+53.0	---	-102.4	654.7	1,313.1
1915	2,970.1	833.7	39.2	69.8	39.3	+1,148.7	17.0	126.5	-44.9	---	+457.9	2,402.2	5,370.3
1916	4,365.9	1,004.7	45.7	72.8	45.8	-40.1	5.8	141.7	-27.5	---	+660.8	1,614.7	5,980.6
1917	1,304.2	800.0	41.6	72.4	45.8	-118.5	8.2	135.6	-29.5	---	+169.2	927.2	2,231.4
1918	470.8	885.9	38.3	72.9	37.7	-743.9	9.0	105.3	+98.2	---	+123.5	368.3	839.1
1919	999.7	957.9	44.5	74.9	37.0	+284.5	13.7	143.7	-14.3	---	-81.5	1,138.6	2,138.3
1920	2,468.6	923.3	42.9	75.2	45.1	+446.9	6.0	144.3	-21.2	---	+370.0	1,731.9	4,200.5
1921	702.0	880.0	40.0	75.3	39.3	-351.2	10.0	129.4	+94.9	---	-195.2	1,443.7	1,743.7
1922	953.1	866.0	37.5	76.3	39.3	-123.2	9.1	106.9	+20.9	---	-4.2	790.6	1,743.7
1923	593.9	1,051.8	46.9	80.0	33.9	-159.3	14.9	140.3	+51.6	---	-80.3	875.4	1,469.3
1924	804.4	1,154.4	50.7	82.2	38.1	-36.6	12.4	158.3	+60.5	---	-201.5	877.1	1,836.5
1925	322.8	936.0	40.9	80.4	24.8	-336.3	10.5	123.9	+99.9	---	-364.3	317.0	1,390.8
1926	664.0	960.1	43.5	82.1	27.9	+322.6	17.1	145.0	+32.4	---	-189.5	1,117.0	1,781.0
1927	1,031.2	1,030.3	45.5	83.9	38.8	+457.6	15.7	139.1	-16.4	---	-126.7	1,368.2	2,389.4
1928	217.4	1,143.4	48.3	86.3	36.7	-637.6	17.7	128.9	+46.3	---	-229.1	353.3	570.7
1929	203.4	1,069.8	45.9	86.2	28.4	+96.7	17.7	129.1	-12.5	---	-385.4	752.3	955.7
1930	170.1	1,154.7	49.5	88.4	45.6	+33.8	18.7	157.2	+1.4	---	-354.1	843.2	1,013.3

1931	325.5	1,120.8	48.9	88.5	53.3	+256.0	23.8	156.3	-25.5	---	-207.3	1,154.6
1932	557.8	1,048.6	46.8	88.4	89.3	+945.5	34.5	154.7	-15.7	---	+338.3	1,480.1
1933	102.8	1,088.5	47.9	89.5	82.9	-504.5	16.0	146.9	-8.1	---	-18.8	2,809.8
1934	70.7	1,040.0	44.6	89.0	50.1	-886.2	12.3	134.4	+39.5	---	-188.2	733.5
1935	212.9	1,238.1	52.9	89.5	58.3	+622.6	25.8	168.4	-61.0	---	-131.6	313.7
1936	106.9	1,323.8	53.1	93.0	59.5	-173.2	20.8	190.7	+5.7	---	-185.6	1,691.0
1937	400.0	1,520.7	57.1	95.0	72.2	+347.6	28.3	220.2	+7.4	---	-185.6	1,077.6
1938	271.0	3,367.4	57.0	96.8	51.5	-571.6	18.7	196.1	+88.7	---	-359.8	1,885.1
1939	100.1	1,178.4	50.5	95.1	28.7	-120.9	18.7	170.9	+41.8	---	-519.7	583.1
1940	79.3	1,593.2	56.7	97.6	25.6	+2,490.1	16.6	168.1	-18.6	---	-338.4	503.6
1941	1,103.1	1,824.3	68.2	101.1	107.3	-426.3	46.2	246.4	+75.8	---	-338.4	501.2
1942	86.5	1,855.8	81.7	112.7	137.6	-426.3	20.9	284.7	+88.0	---	-518.5	694.5
1943	84.8	1,704.9	72.7	116.8	106.1	-467.6	17.1	293.7	+101.3	---	-524.4	1,095.0
1944	86.5	1,735.0	74.1	116.8	89.0	-467.6	17.3	284.3	+89.0	---	-647.3	845.5
1945	110.2	1,831.9	77.9	120.9	71.9	-190.3	19.4	298.8	+73.6	---	-808.6	994.0
1946	96.7	1,941.8	70.5	133.4	47.7	-430.7	11.1	165.2	+165.2	---	-922.6	447.6
1947	55.4	1,844.1	70.7	173.7	37.1	-248.3	11.8	168.1	+85.5	---	-1,149.7	426.9
1948	55.4	1,744.0	79.0	186.6	33.2	-52.9	19.4	189.2	+36.3	---	-1,322.4	450.6
1949	57.2	2,020.3	93.3	194.7	74.4	+608.0	52.8	239.5	-46.2	---	-1,267.5	1,094.7
1950	43.9	1,874.7	84.9	202.0	56.3	-484.5	16.8	206.3	+78.9	---	-1,266.9	376.2
1951	143.3	1,829.0	87.9	217.1	23.6	+19.5	8.7	221.4	+37.0	---	-1,703.3	367.1
1952	51.6	2,616.5	141.7	208.3	86.4	+1,253.6	30.9	241.8	+177.5	---	-1,824.3	510.4
1953	29.6	2,695.7	147.2	218.1	76.7	-418.6	23.2	248.3	+37.0	---	-2,240.1	2,298.1
1954	43.6	2,862.6	123.1	222.3	70.3	-84.8	28.6	223.1	+149.6	---	-1,816.3	384.6
1955	122.5	2,367.9	122.4	236.0	69.9	-250.7	30.7	225.4	+147.7	---	-1,993.2	671.7
1956	20.9	2,233.5	107.5	230.8	62.7	-900.4	20.4	224.9	+141.2	---	-1,794.1	453.5
1957	13.5	2,157.4	104.0	254.9	49.0	+212.2	17.8	214.5	-88.8	---	-1,729.7	165.5
1958	25.2	2,379.4	124.0	281.0	76.5	+620.4	22.2	233.4	-89.6	---	-1,656.2	735.4
Means:												1,476.2
1914-45	712.4	1,167.8	51.3	88.3	53.2	+30.4	16.9	166.1	+26.8	0	-154.4	1,090.4
1931-38	165.9	1,727.4	80.8	163.5	66.0	+32.4	22.4	209.0	+41.4	.3	-884.1	1,792.8
1952-58	43.8	2,401.8	124.3	238.8	70.2	+104.5	24.8	230.2	+53.4	1.2	-1,862.0	1,151.6
1914-58	524.7	1,440.8	66.6	125.0	54.8	+24.3	18.6	180.4	+33.0	.2	-561.9	1,508.1

TABLE G.—*Gila River near Dome, Ariz.*

[Thousand acre-feet]

Water year	Historic flow	Lower basin water uses					Channel salvage			Import water	Change in ground-water storage	Net depletion	Virgin flow
		Crops	Non-cropped areas	Cities, towns, and farmsteads	Reservoir losses		Evaporation	Replacement	Growth change				
					Evaporation	Storage change							
1914	179.8	740.0	35.0	68.5	21.7	-27.1	22.0	113.8	-24.6	+69.0	746.7	926.5	
1915	2,324.5	843.9	39.6	70.5	39.3	+1,148.7	24.3	129.3	-221.6	+774.9	2,541.7	4,866.2	
1916	4,361.1	1,014.9	46.1	73.5	45.8	-40.1	5.8	144.5	-204.2	+429.5	1,215.2	5,576.3	
1917	1,458.3	900.2	42.0	73.1	45.8	-118.5	14.4	138.5	-206.0	-271.5	312.2	1,770.5	
1918	326.9	896.1	38.7	73.6	37.7	-743.9	17.1	108.2	+30.3	-26.6	180.6	607.5	
1919	227.0	973.2	45.1	73.8	30.0	+284.5	26.8	148.0	-185.9	+368.8	1,416.7	1,643.7	
1920	1,293.8	938.2	43.5	76.1	45.1	+446.9	9.7	148.5	-196.5	+1,274.7	2,469.8	3,763.6	
1921	437.7	889.2	40.4	76.1	39.3	-351.2	17.0	132.0	+35.5	-240.7	339.9	777.3	
1922	685.8	874.9	37.8	77.1	39.3	-129.2	20.0	109.4	-108.4	+4.8	666.9	1,352.7	
1923	329.1	1,081.2	48.0	81.2	33.9	-153.3	23.0	148.5	-43.3	-119.5	748.7	1,077.8	
1924	686.5	1,205.8	52.7	83.7	38.1	-36.6	28.2	172.6	-74.3	-357.9	712.7	1,399.2	
1925	64.9	986.2	42.9	81.9	38.1	-336.3	22.1	137.9	+11.4	-383.7	267.2	1,332.1	
1926	270.1	1,012.3	45.5	83.6	27.9	+322.6	36.4	159.5	-88.6	-124.4	1,083.0	1,353.1	
1927	763.9	1,083.6	47.6	85.5	38.8	+457.6	34.9	154.0	-181.0	-160.5	1,182.7	1,946.6	
1928	24.3	1,200.8	50.2	87.9	36.7	-637.6	26.3	144.9	-40.9	-279.3	246.6	270.9	
1929	3.0	1,109.9	47.5	87.6	28.4	+66.7	36.7	140.3	-139.6	-424.1	599.4	602.4	
1930	15.6	1,203.6	51.4	89.7	45.6	+33.8	39.1	170.8	-136.0	-435.3	642.9	688.5	
1931	102.7	1,174.7	48.3	90.1	53.3	+266.0	47.1	171.3	-133.0	-246.8	976.9	1,079.6	
1932	266.3	1,100.9	48.8	90.0	89.3	+945.5	71.3	169.3	-238.5	+302.7	2,098.1	2,374.4	

1933	1.1	1,135.9	48.7	90.9	82.9	-504.5	33.8	190.1	-107.8	-138.9	414.3	415.4
1934	5.9	1,088.5	40.5	90.9	50.1	-086.2	24.9	147.5	-36.5	-38.9	42.0	42.2
1935	0	1,291.5	94.4	98.3	98.3	+422.6	54.4	183.3	-26.4	-169.5	1,290.2	1,296.1
1936	0	1,384.9	86.5	96.5	59.5	-173.3	43.7	207.7	-146.9	-189.9	711.9	711.9
1937	153.7	1,586.1	70.2	99.8	72.2	+347.6	59.6	248.4	-189.9	+52.0	1,730.0	1,883.7
1938	45.9	1,494.7	60.5	98.3	51.5	-670.6	28.2	204.8	+11.2	-662.5	429.7	475.6
1939	3.5	1,494.7	60.5	98.3	51.5	-670.6	28.2	204.8	+11.2	-662.5	429.7	475.6
1940	589.7	1,372.2	99.1	59.5	25.6	-93.2	34.1	190.3	-62.0	-662.5	352.4	355.9
1941	0	1,601.5	72.2	105.6	107.3	+2,490.4	100.3	267.9	-82.3	-162.3	349.4	349.4
1942	0	1,939.4	84.7	113.3	137.6	-438.1	44.5	308.0	-77.1	-672.9	734.2	734.2
1943	0	1,784.5	75.8	114.3	106.1	-426.3	40.2	280.9	-49.3	-697.2	587.0	587.0
1944	0	1,830.3	77.4	118.5	89.9	-467.6	36.9	277.6	-20.0	-805.9	517.1	517.1
1945	0	1,915.3	81.1	122.6	71.9	-190.3	41.5	292.0	-54.4	-972.0	640.7	640.7
1946	0	1,627.7	73.8	155.2	47.7	-650.7	41.3	198.0	-156.7	-699.4	88.3	88.3
1947	4	1,635.4	74.1	175.5	37.1	-249.3	41.9	203.8	-153.9	-1,090.9	73.7	73.7
1948	0	1,841.3	82.7	188.7	33.2	-52.9	52.8	226.5	-262.4	-1,073.1	144.2	144.2
1949	0	2,119.2	87.0	196.8	74.3	+008.0	119.5	277.2	-381.2	-1,035.6	1,231.9	1,231.9
1950	6.0	2,079.7	92.1	219.3	66.3	+484.5	43.3	243.8	-144.0	-1,363.2	43.2	43.2
1951	1.3	2,079.7	92.1	219.3	66.3	+484.5	43.3	243.8	-144.0	-1,363.2	43.2	43.2
1952	9.9	2,845.7	145.9	211.2	86.4	+19.5	37.6	263.2	-165.1	-2,018.7	65.7	65.7
1953	12.6	2,534.8	128.6	225.3	70.3	-81.8	47.9	319.0	+152.4	-2,340.2	144.7	144.7
1954	7.7	2,594.8	128.6	225.3	70.3	-81.8	47.9	319.0	+152.4	-2,340.2	144.7	144.7
1955	12.6	2,594.8	128.6	225.3	70.3	-81.8	47.9	319.0	+152.4	-2,340.2	144.7	144.7
1956	7.7	2,402.9	114.2	254.0	62.7	-600.4	34.5	345.8	+92.1	-2,003.6	224.2	224.2
1957	3.3	2,358.4	112.9	258.5	46.0	+212.2	55.8	353.2	-247.2	-1,717.6	333.2	333.2
1958	9	2,589.9	136.0	284.8	76.5	+620.4	48.1	411.7	-243.9	-1,029.0	1,033.7	1,033.7
Means:	456.9	1,214.1	53.1	89.6	53.2	+30.4	34.5	179.0	-103.9	-176.3	946.7	1,403.6
1931-58	42.6	1,827.0	84.7	155.5	66.0	+32.4	49.3	255.6	-115.1	-921.9	736.7	779.3
1932-58	2.5	2,574.1	131.2	240.0	70.2	+104.5	51.4	349.2	-51.1	-95.3	542.7	645.2
1914-58	325.5	1,513.6	69.5	126.7	54.8	+24.3	39.8	213.1	-111.0	-592.6	800.0	1,125.5

! Indicated virgin flow is -57,000 acre-feet.

Senator ANDERSON. Senator Moss.

Senator Moss. Thank you, Mr. Chairman.

Mr. Secretary, Senator Jackson asked you questions about this Goss plan and about the scheme of the pumpback of water. Is this basically the same sort of thing we use at the Grand Coulee Dam?

Secretary UDALL. No, the Goss plan is a pump-storage project.

Senator Moss. Isn't that what we have at Grand Coulee? We pump the water up into the high coulee during the off-times, and do not pump during use of the power flow, the peak powerload?

Secretary UDALL. No, at Grand Coulee Dam pumping is for irrigation. The idea of pump storage is to find an ideal location where you have a high mountain right close by, and you pump up high and drop it back down to generate electric power.

I think the thing that Senator Jackson was trying to point out is that a pump-storage scheme is strictly pump storage. It is single storage. It must be if you are going to concentrate all your energies on achieving the maximum peaking generation which you can with such a plan.

Senator Moss. The difference being, then, that this Goss plan is for producing hydroelectric power, whereas at Grand Coulee the pump-storage is for irrigation water.

Secretary UDALL. Yes. This is primarily the case.

Mr. DOMINY. Just to make the answer complete, we have a number of units already in place at Grand Coulee that pump from Franklin D. Roosevelt Lake to Banks Lake to stabilize Banks Lake for irrigation.

Since the type of storage and equipment available has advanced a great deal since the original units were put in, the new ones that we are going to put in, on that project, will be reversible pump turbines. We will have some pump storage capacity available at Grand Coulee, but the third powerhouse is not a pump-storage proposition.

Senator Moss. This is not such a new and novel idea. In fact, it is an advancement of the state of the art that has been developed; is that right?

Secretary UDALL. The first major pump-storage projects are 5 or 6 years old. This is new, and it is a result of the development of reversible turbines to act as both pumps and generators.

Senator Moss. Since the Goss plan was proposed and was testified to in the House hearings, have you assigned your Department to study it in any detail, Mr. Secretary?

Secretary UDALL. Senator, we were asked by the House committee to make a quick preliminary study and analysis. We submitted that to the House committee. I believe it was submitted for the record here. I can deliver to you a copy of that analysis. It is preliminary, a sort of horseback study.

The Bureau had not previously studied this site as a pump-storage site. It is obviously a good one, but there are no detailed studies of the kind the Bureau would normally make and present to this committee on behalf of an authorizing piece of legislation.

Senator Moss. As I understood your testimony earlier, you said the Goss plan was a new sudden flash that had come on, and that it hadn't really been studied. To what extent has your Department com-

pleted the kind of detailed study that you feel you would need to make a judgment of the Goss plan?

Secretary UDALL. I think that you would indeed need to study all aspects of the problem, because the Goss proposal presents many new policy considerations, both in terms of power marketing and in terms of the new conservation issues it raises for that stretch of the river. That is the reason I said, in my reaction to the Goss plan, that it is the administration's view that there ought subsequently to be a study in depth by the National Water Commission and by the Department of what the future of that site holds. I don't think we know at this time.

Senator MOSS. To what extent are you pursuing this now to find out?

Secretary UDALL. We are not pursuing it because we don't feel at this point that this is the right thing to do, that this is the time to do it.

Senator MOSS. Is it somewhat the same attitude you have on the diversion of water from Idaho? You don't believe it should happen, and therefore you are not willing to have it studied?

Secretary UDALL. The problems, I think, are quite different because it is our view that there is no need to face up to the problem of the future of Hualapai at this point. I think what the Goss plan has done is to say, "Well, look, the previous study made by the Bureau of Reclamation does not envision the maximum hydropower production, and we should look at in terms of a larger project than the project contemplated."

Of course, this will take considerable study. If, every time, every year we come before the committee, something new is tossed in and it is said, let's wait another 2 years and study it, you never get to the point where you make a decision. This is part of it.

Senator MOSS. Of course, if you prejudge what is good and what is bad, then there is no need for a study, because you have already made the judgment; is that correct?

Secretary UDALL. I made a very strong judgment, Senator, on power marketing. Senator Jackson, I think, made the record on that rather forcefully. I think this is the wrong time for Hualapai. I can say flatly to you right now that I think if the Goss plan, or if the Bureau's plan for Hualapai, is sound, that it should be built, but you should begin to build it probably 10 years or more from now. I think that now it is premature.

That is very clear to us in terms of our power-marketing responsibilities.

Senator MOSS. What did you mean this morning when you said Hualapai is a gun pointed at the Columbia?

Secretary UDALL. I said that I think the authorization of this project now, when it is not needed to make the central Arizona project feasible, would serve obviously, the only purpose of producing the magnitude of revenues that you would only need for a very large importation program.

A weather modification program will not have a high cost, nor necessarily should a desalination program, so that in that sense, there could only be one purpose in authorizing Hualapai at this time. It is not needed for the central Arizona project. It would be because you have already made the decision that you are going to the Columbia River.

Senator Moss. I, of course, am not convinced yet that Hualapai is not needed. I have heard of a memorandum prepared by your Department not very long ago that would indicate that Hualapai was a desirable feature of the Lower Basin plan. How much of Arizona's entitlement of water is it now taking out of the river? How much is Arizona using at the present time?

Mr. DOMINY. Just a little over 1 million acre-feet on the average, Senator Moss, at the present time.

Senator Moss. I have a set of figures that would indicate that it is about 1.5 million acre feet. Would that be too large an amount?

Mr. DOMINY. I think that is a little higher than the actual depletion. They may divert that much, but there is a return flow. Maybe I misunderstood your question.

Senator Moss. This is accounting for the return flow. The series that I have shows there is a diversion of about 2.3 million acre-feet, but a return flow of 808,000, giving a net consumption of about 1.5 million. I don't know whether that is what your figures show.

Mr. DOMINY. Let me get a tabulation for the record.

Senator Moss. All right, if you would insert that in the record.
(The tabulation referred to follows:)

Records for past 3 years showing net uses of water from main Colorado River by Arizona

[1,000 acre-feet]

Calendar year	Diversions	Return flows	Consumptive use
1964.....	1,816.2	689.0	1,127.2
1965.....	1,687.5	679.0	1,008.5
1966.....	1,766.9	693.8	1,073.1

Senator Moss. If Arizona's present diversion should be as high as 1.5 million, and they are entitled only to 2.2 million, then we are only talking about 735,000 or 740,000 acre-feet additional.

Mr. DOMINY. The entitlement to Arizona, of course, is 2.8 million acre-feet. We estimate that Arizona used about 1,130,000 acre-feet in 1964.

Senator Moss. 1,130,000?

Mr. DOMINY. That is right.

Senator Moss. Now, on the payback of the water under the plan submitted by the administration, there would only be this traditional diversion of water for earned revenues that would be paid back; is that right?

Mr. DOMINY. That is correct, plus some return from the sale of power as pumping requirements go down. There would be about \$70 million in surplus revenues deriving from power.

Senator Moss. The point I am trying to make is that we cannot calculate that there is 2.8 or 2.2 million acre-feet, even, of water that can be sold under this new proposal in payback, but something considerably less than that; is that right?

Mr. DOMINY. The availability of water from the river to satisfy Arizona's entitlement remains the same under the proposal that the

administration is backing, as compared to the plan that Congress was considering last year. There is no difference in that item, Senator Moss.

So the amount of water to be sold for agriculture, municipal, and industrial purposes remains the same. The only decrease in revenues is because the pumping power cost is slightly higher under the present plan, but that is offset by the proposal the Secretary has made for either an ad valorem tax or a slight increase in the municipal and industrial water rate, so the repayment plans are on all fours as compared to the previous proposal.

Senator Moss. But the more than 1 million acre-feet that are now being diverted cannot be counted against the payback, can they?

Mr. DOMINY. No, sir; but in the early years of the project, there is enough water in the river so that 1.6 million acre-feet can be diverted by the full capacity of the 2,500-second-foot canal. As the Upper Basin States complete their projects and utilize a higher portion of the amount of water that is compacted to them for their use, then the amount does decrease that is available for the central Arizona project.

Senator Moss. As I understand the proposal, Mr. Secretary, the Federal Government is to advance the principal portion of the capital needed to build the thermogenerating plants, and at the same time enter into a contract to receive power over a period of time from the utility operating the thermoplant; is that right?

Secretary UDALL. Yes; this is generally the plan. The Federal Government would, however, advance roughly a third of the capital, a proportionate amount. It is actually in the neighborhood of a third.

Senator Moss. If this is to be a profitable contract with a guaranteed sale, why shouldn't the private utility provide for all of the capital?

Secretary UDALL. Well, the genius of the plan is essentially, and as I say it has been tried out before by others, that by investing money in construction rather than simply buying power month by month, or year by year, over a 50-year period, you get tremendous economies. The power rates then reflect interest and tax savings because of the Federal investment at the outset. The Bureau of Reclamation would not own part of the plant. It simply would have a very prudent long term contract for power service because of the investment at the time the plant was built.

Senator Moss. Do you think that this is not a departure from the policies we have always held, that this is a feasible proposal?

Secretary UDALL. I think, as I said this morning, Senator, that those who are interested in the future of reclamation ought to welcome it. Why should we rigidly put reclamation in a straitjacket? Why not develop new techniques, particularly, if we can get the Bureau of the Budget to approve?

Senator Moss. If we have that forebay down there below the Hualapai Dam, there would be about 7 miles of the canyon that might be discolored on the walls; was that your testimony?

Secretary UDALL. Something in that neighborhood.

Senator Moss. And above the reservoir, all the way up to Grand Canyon Dam, would be 140 to 180 miles?

Mr. DOMINY. There would be 93 miles involved in the Hualapai Reservoir, and then there would be about 160 river miles from Kanab Creek on up to Glen Canyon Dam.

Senator Moss. There would be 160 miles of free-flowing river and about 93 miles of reservoir lake.

Secretary UDALL. In that range.

Senator Moss. Then there would be the short stretch of 7 miles where the fluctuation would be over 100 feet?

Mr. DOMINY. If you put the afterbay at the downstream $7\frac{1}{2}$ -miles site, then the fluctuation would have to be as much as 140 feet.

There are other sites involving longer reaches of the Canyon which would not involve so great a fluctuation and which would be considered in a detailed engineering study. There would still be major fluctuations, however, because there is not much capacity in the inner gorge of the canyon. It is very narrow.

Senator Moss. The fluctuation on the lake behind Hualapai would be 4 to 5 feet maximum; is that right?

Mr. DOMINY. That is correct. Under the proposal that we had originally considered of 1,500 megawatts, we would hold fluctuation within a 4-foot range, and the studies indicate that under the Goss plan you would only have about a 5-foot fluctuation. The big fluctuation would be in the afterbay reservoir.

Senator Moss. Mr. Secretary, you are acquainted with Lake Powell and the tremendous drawing power it has for recreation and scenery. What would be your estimate of the lake that would be behind the Hualapai Dam, if it were built?

Secretary UDALL. From a recreational standpoint?

Senator Moss. Yes.

Secretary UDALL. Fish, wildlife, recreation? I would say in one way it would be superior, in that there would be a much smaller drawdown. It would hold at practically a steady level. In terms of number of miles of shoreline and other assets, it would be substantially inferior to Lake Powell or Lake Mead, because both are much larger.

They also have many more side canyons. There are different ways that you can compare them, but Hualapai Reservoir would be a much smaller and narrower area.

Senator Moss. It is in a much deeper gorge, isn't it?

Secretary UDALL. It is in a deeper gorge than either of the other large dams or the large lakes, yes.

Senator Moss. But it would present a recreational outlet of a view from the bottom of the gorge upward rather than the traditional, from the top down; is that correct?

Secretary UDALL. That would be one of the features, yes.

Senator Moss. What advantages, if any, would it have for the Hualapai Indian Tribe which lives in that area?

Secretary UDALL. The Hualapai Indian Tribe owns land on one side of the lake, and it would be in somewhat the same position that the Navajos are with regard to Lake Powell, although I would say I have been sorely disappointed that the Navajos have not moved, we haven't been able to help them move, to develop their side of the lake. As you know, they have not done anything up to this point.

Senator Moss. You indicated when you were answering Senator Church that you did not think it was ever going to be feasible to divert water from one river basin to another river basin without the amount of controversy that is politically unbearable. You say that,

realizing that there is already considerable diversion out of the Colorado, which is a water-short river; is that correct?

Secretary UDALL. No, you are overstating my position, Senator. I think that we already have a clear precedent established, and I think wisely so. In New Mexico, Colorado, and Utah there are transmountain diversions, and there are others within other States. But here the States have been wise enough to put the politics together. I will be very surprised, water being as dear as it is, and Congressmen and Senators willing to battle to the death for it, if plans for upstream diversions from one State or from one river basin into another, do not prove to be politically untenable. It will be very difficult to accomplish this type of project, unless you look to the river mouth for diversion or to some point where a State can be persuaded, as I think they can, that in the long run there will be benefits to the State which has water which will otherwise be wasted.

I think once you have developed a plan and you can show that there are benefits for both regions, then you are in business. In other words, I have been involved enough as a middleman in this Northwest-Southwest thing to think that it may be possible to have an interregional diversion program. But I think you have got to tailor it so that there are benefits for both regions, and it is not just a picture of one region reaching out and saying, "We want your water."

Senator MOSS. What do you think of the voluntary proposal of the northern California area district that their water be impounded and diverted south into the Colorado River?

Secretary UDALL. I think this is the very sort of thing that should be studied. Any time we find a group anywhere, and this is the only one I know of at the moment, that is saying, "Look, we have surplus water; come and get it," I think we ought to study it.

Senator MOSS. If this group voluntarily says that, it doesn't appear that we have to go to the Columbia to get water right away, does it?

Secretary UDALL. Senator, it is my own feeling, as I said this morning, that in terms of priorities, I predict that the first thing that will be done to augment the Colorado River Basin water supplies will be, No. 1, the cheapest; and No. 2, the least controversial. It certainly would be much less controversial to go to Northern California, because southern California would benefit, than to go to the Columbia.

So I would agree with you on that point, Senator.

Senator MOSS. Do you have any feeling as to the attitude of the House on this bill, if the Hualapai Dam is not authorized by the House committee?

Secretary UDALL. I would not want to express a judgment at this point, Senator. I don't know what the prospect is on the House side.

Senator MOSS. Thank you, Mr. Chairman.

Senator ANDERSON. Senator JORDAN.

Senator JORDAN. I yield to Senator Kuchel. Then I want to be heard.

Senator KUCHEL. I have just two questions: My recollection is that the Arizona Legislature passed a statute giving priority to existing Colorado River water uses in Arizona over any new uses connected with the construction of the central Arizona project: is that true?

Mr. WEINBERG. I am not familiar with any late legislation that may have been adopted by Arizona, Senator. Arizona legislation dealing

with the Colorado River Commission of Arizona directs the Commission to concern itself with Colorado River water available for use in Arizona after the satisfaction of all existing mainstream Colorado River water contracts with the United States. The statute is section 45-512B of the Arizona Revised Statutes.

Senator KUCHEL. It just occurred to me that we have something like that. Let me ask Senator Fannin. Do you have a statute in Arizona that creates a priority of the use?

Senator FANNIN. I would like to answer the distinguished Senator from California by saying that this is an intrastate matter, and I do not think it is involved in this particular controversy.

Senator KUCHEL. I have got to fall back on the staff. I ask that we have included in the record at this point the State statute which applies priority between existing uses and the new contemplated use, for such worth as it may be to the committee.

(The statute is printed on p. 274.)

Senator KUCHEL. I want to refer to the printed hearings on H.R. 4671 in the House of Representatives in various States in August and September of 1965, particularly, to a letter dated May 17, 1965, signed by the distinguished Secretary of the Interior, Mr. Udall, addressed to Hon. Wayne Aspinall, the chairman of the Committee on Interior and Insular Affairs of the House of Representatives, which is set forth on pages 9, 10, 11, 12, 13, 14, and 15 of that hearing, and I ask consent that the entire letter be inserted in the record at this point.

Senator ANDERSON. You have previously inserted that letter.

(The letter appears on p. 155.)

Senator KUCHEL. Mr. Secretary, I will not belabor this record. That letter, which has gone into the record, is your response to Chairman Aspinall on H.R. 4671, in which to your great credit, I think very clearly you endorse.

Are your views as they are expressed in that letter, Mr. Secretary, your views today, if this committee were to consider legislation similar to H.R. 4671 of the last Congress?

Secretary UDALL. Senator, the important thing is not the views of me or my Department or the Bureau are, but the finally formulated position of the administration. It is considerably different today than it was.

Senator KUCHEL. It would be different today?

Secretary UDALL. Yes, different than it was 2 years ago. The position that we have taken this year is different in some details from last year. Sir, what we are trying to do is achieve a result and not simply take a fixed and inflexible position. But in the main, this letter is an endorsement of the central Arizona project, of the construction of Marble Dam, which we were for at that time, and of the other details of the legislation, so I suppose most of the features are in Senator Hayden's bill.

Senator KUCHEL. No, I think there is quite a difference. Let's be specific. For example, some of us recommended that when the Senate approved the treaty with the Republic of Mexico, a national burden was created by the action of the Senate, a burden therefore which should be borne by more than the States of the basin. That would become important, if augmentation of the waters of the river were ever to take place.

Your views in that letter are spelled out very clearly. These are the views that a number of us up here have. We would make it a national obligation, if augmentation were to take place. Are those still your views?

Secretary UDALL. This, Senator, is not in the current bill.

Senator KUCHEL. This is true.

Secretary UDALL. For a very good reason.

Senator KUCHEL. What is that reason?

Secretary UDALL. Well, the reason was that the earlier legislation established a basin account. I think if you are going to set up a basin account, such language is pertinent.

If you are not, you have no vehicle to which to tie the Mexican treaty problem. If you want to set up a basin account, and to envision from that basin account and from a regional augmentation plan that you are going to take care of the Mexican treaty first and have it be non-reimbursible, then this is something that fits into that type of overall legislation. This is the reason that it dropped out in this particular time. I think our position earlier was if Congress wanted to take that approach, there was no objection to it.

Senator KUCHEL. Will you state to this committee whether you believe the Mexican burden should be national?

Secretary UDALL. I have consistently taken that position, and I will take it again here today, I think it should be.

Senator KUCHEL. All right; so that if this committee saw fit to consider augmentation, that the making of the Mexican burden a national obligation would not be in derogation of your views or of the Department's views?

Secretary UDALL. I think I would have to say that I don't see that it is.

Senator KUCHEL. It is true that the Department has changed its position and where as in the last Congress the Department approved legislation that did contain a dam, it does not so recommend this year? You have testified to that, and I don't want to belabor the point.

With respect to the basin account, have you not said, Mr. Secretary, that you would not quarrel with the committee considering the basin account to be created out of the revenues accruing under the Boulder Canyon Project Act?

Secretary UDALL. The Hoover——

Senator KUCHEL. What?

Secretary UDALL. If the committee should decide it wants to set up a basin account from Hoover-Parker-Davis revenues, we have no objection to it.

Senator KUCHEL. If that basin account would be created from the provisions of this bill, what would you envision those moneys would be used for from that account?

Secretary UDALL. For augmentation of the river's future use.

Senator KUCHEL. That is the point.

The next question is, Do you think that would be pointing a gun at my friends from the State of Washington?

Secretary UDALL. Senator, the Hoover-Parker-Davis complex is in existence. It has been built. It is there. It is half paid out.

There are many problems that the river has, such as, for example, improving the channel of the river and other kinds of water conservation programs.

I am simply saying if you are going to take the Hoover-Parker-Davis revenues and add to them Hualapai Dam revenues, you create such a tremendous generation of revenues there is only one thing you can use it for. I don't think this is true of Hoover-Parker-Davis revenues alone.

Senator KUCHEL. Is it not true that this bill, which incidentally was sponsored by Representative Udall in the House of Representatives, that no gun was pointed at any one area in the country, but that you simply were clothed with an unanswerable responsibility to search out and determine which area would be the most feasible to use as a source for supplemental water? Isn't that true?

Secretary UDALL. No. The position of the administration in the last 2 years has been that we ought not to step in, that the study ought to be by a national water commission, and this is an integral part of the administration's approach at this point.

Senator KUCHEL. But, Mr. Secretary, didn't I make a truthful statement?

Secretary UDALL. No; I can't agree with it in its entirety.

Senator KUCHEL. Do you disagree?

Secretary UDALL. You would have to read it back to me, Senator.

Senator KUCHEL. Will you read that statement back to the Secretary?

(Whereupon, the statement referred to was read back by the reporter.)

Secretary UDALL. Senator, the problem of singling out the Department and asking it to make a study of feasible sources has been rejected for 2 years now in favor of a national water commission approach, where it would make the initial study, and then we would follow on after its report was in, presumably implementing it.

I would like to say, in light of the last two questions you have asked, that combining either weather modification or the very large saline water plant that we are studying with Mexico at the mouth of the Colorado River with revenues from Hoover-Parker-Davis comprises a way of augmenting the River and taking care of Mexican treaty requirements on a nonreimbursable basis. This, I think, is something that is sound and can be considered right now.

Senator KUCHEL. Mr. Secretary, you are mistaken in what was in the Udall bill in the last Congress, and I ask consent that the appropriate provisions of that bill, which clothe the Secretary with certain authority relative to augmentation studies be set forth at this point in the record.

Senator ANDERSON. Without objection, that will be done.

(The excerpt referred to is sec. 206 to sec. 209 of H.R. 4671 as reported by the House Interior and Insular Affairs Committee in the 89th Cong.)

SEC. 206. (a) The Council in consultation with the Commission, acting in accordance with the procedure prescribed in section 103 of the Water Resources Planning Act, shall within one hundred twenty days following the effective date of this Act establish principles, standards, and procedures for the program of

investigations and submittal of plans and reports relating to the Southwest authorized by this section and section 208. The Secretary of the Interior (hereinafter referred to as the "Secretary"), under the direction of the Commission, in conformity with the principles, standards, and procedures so established, and in accordance with the authority granted in section 205, is authorized and directed to—

(1) prepare estimates of the long-range water supply available for consumptive use in the Southwest and in each of its major constituent parts, of current water requirements therein, and of the rate of growth of water requirements therein to at least the year 2030;

(2) investigate sources and means of supplying water to meet the current and anticipated water requirements of the Southwest and of each of its major constituent parts, including reductions in losses, importations from sources outside the natural drainage basins of the Southwest, desalination, weather modification, and other means;

(3) investigate projects within the lower basin of the Colorado River, including projects on tributaries of the Colorado River where undeveloped water supplies are available or can be made available by replacement or exchange;

(4) undertake investigation, in cooperation with other concerned agencies, of the feasibility of proposed development plans in maintaining an adequate water quality throughout the Southwest;

(5) investigate means of providing for prudent water conservation practices to permit maximum beneficial utilization of available water supplies in the Southwest;

(6) investigate and prepare estimates of the long-range water supply in States and areas from which water may be imported into the Southwest, together with estimates of the probable ultimate requirements for water within those States and areas of origin, for all purposes, including, but not limited to, consumptive use, navigation, river regulation, power, enhancement of fishery resources, pollution control, and disposal of wastes to the ocean, and estimates of the quantities of water, if any, that will be available in excess of such requirements in the States and areas of origin for exportation to the Southwest; and

(7) investigate current and anticipated water requirements of areas outside the natural drainage areas of the Southwest which feasibly can be served from importation facilities en route to the Southwest.

(b) The Secretary is authorized and directed to prepare reconnaissance reports of a staged plan or plans for projects adequate, in its judgment, to meet the requirements reported under subsection (a) of this section, in conformity with section 207.

(c) The plan for the first stage of works to meet the future requirements of the areas of deficiency and surplus as determined from studies performed pursuant to this section shall include, but not limited to, import works necessary to provide two million five hundred thousand acre-feet annually for use from the main stream of the Colorado River below Lee Ferry, including satisfaction of the obligations of the Mexican War Treaty and losses of water associated with the performance of that treaty. Plans for import works for the first stage may also include facilities to provide water in the following additional quantities:

(1) Up to two million acre-feet annually in the Colorado River for use in the Lower Colorado River Basin;

(2) Up to two million acre-feet annually in the Colorado River system for use in the Upper Colorado River Basin, directly or by exchange;

(3) Such additional quantities, not to exceed two million acre-feet annually, as the Secretary finds may be required and marketable in areas which can be served by said importation facilities en route to the Colorado River system.

(d) The Congress declares that the satisfaction of the requirements of the Mexican Water Treaty constitutes a national obligation. Accordingly, the States of the upper division (Colorado, New Mexico, Utah, and Wyoming) and States of the lower division (Arizona, California, and Nevada) shall be relieved from all obligations which may have been imposed upon them by article III(c) of the Colorado River compact when the President issues the proclamation specified in section 305(b) of this Act.

(e) *The Secretary shall submit annually to the Commission, the President and the Congress reports covering progress on the investigations and reports authorized by this section.*

SEC. 207. (a) *In planning works to import water into the Southwest from sources outside the natural drainage areas of the Southwest, the Secretary shall make provision for adequate and equitable protection of the interests of the States and areas of origin, including (in the case of works to import water for use in the lower basin of the Colorado River) assistance from the development fund established by title IV of this Act, to the end that water supplies may be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.*

(b) *All requirements, present or future, for water within any State lying wholly or in part within the drainage area of any river basin and from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of that river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.*

SEC. 208. (a) *On or before December 31, 1969, the Secretary shall submit a proposed reconnaissance report on the first stage of the staged plan of development for the Southwest to the Commission and affected States and Federal agencies for their comments and recommendations which shall be submitted within ninety days after receipt of the report. The Secretary shall proceed promptly thereafter with preparation of a feasibility report on the first stage of said plan of development if he finds, on the basis of reconnaissance investigations pursuant to section 206, that a water supply surplus to the needs of the area of origin exists, benefits of the proposed first stage exceed costs, and repayment can be made in accordance with Titles III and IV of this Act. Such feasibility report shall be submitted to the Commission and to the affected States and Federal agencies not later than December 31, 1971.*

(b) *After receipt of the comments of the Commission and affected States and Federal agencies on such feasibility report, but not later than June 30, 1972, the Secretary shall transmit his final report to the President and, through the President, to the Congress. All comments received by the Secretary under the procedure specified in this section shall be included therein. The letter of transmittal and its attachments shall be printed as a House or Senate document.*

SEC. 209. *There are hereby authorized to be appropriated such sums as are required to carry out the purposes of this title.*

Secretary UDALL. Senator, the bill of Congressman Udall was not the administration bill last year.

Mr. KUCHEL. I didn't say that. I said the letter which you wrote, which is now in the record, in 1965, to the chairman, endorsed that bill. It was to your credit.

You went back and quoted yourself in January 1964, and said the regional plan has now flowered, and all I wanted to say was what I did. I have no disrespect for you. I have respect for you. But you forgot what was in that bill.

Secretary UDALL. There is no one I would rather be corrected by.

Senator ANDERSON. Senator Jordan.

Senator JORDAN. Thank you, Mr. Chairman.

Mr. Secretary, I am just a little confused. I heard you say this morning that the authorization of the Hualapai Dam would point a gun at the Columbia River. Then, later in your remarks, you said something like this, and I am improvising: "But imported water from the Columbia would be \$65 an acre-foot, and would of course not be feasible when weather modification will produce water at \$1 an acre-foot." Mr. Secretary, in point of time, how close are we to a realization of a weather modification program that will produce water in quantities at \$1 an acre-foot?

Secretary UDALL. Eight or 10 years.

Senator JORDAN. Eight or 10 years. Then any transferral of water from any basin would be unrealistic to study, even at this time, would they not?

Secretary UDALL. You are correct in the sense that you would then have several options and alternatives.

Senator JORDAN. Yes.

Secretary UDALL. Weather modification would be one alternative. Better water conservation would be another by which many hundreds of thousands of acre-feet could be saved through such measures as recycling and reuse of sewage effluent from large cities. Another alternative is desalination. I think the modern method is to look at all of these, and do that which is most economical and least controversial.

Senator JORDAN. Yes, and let's start with your best.

Secretary UDALL. Yes.

Senator JORDAN. Do the best first.

Secretary UDALL. And move down the line from there.

Senator JORDAN. Exactly, and you think that we are within eight or 10 years of realization of water produced by weather modification in quantity at the place we want it; is that your statement?

Secretary UDALL. That is right. Senator, I think this fits right in with the argument for a National Water Commission, because, if we take 5 years and have a National Water Commission put all of this in sharp focus, I think then we can really make some intelligent decisions. I think the people in the Northwest can. I think the people in the Southwest can. I think the Congress can.

Senator JORDAN. I am glad you approve of the National Water Commission Act. I am cosponsor of it, and I am proud to be a cosponsor.

I believe this is a bill that should be enacted at this session of the Congress. I hope that it will achieve what you expect of it and what I expect of it, because I believe it is a step forward in taking a long-range view of the balancing of water needs against water supplies throughout the whole country. Do you agree generally with the purpose of the bill?

Secretary UDALL. Yes.

Senator JORDAN. Under the National Water Commission Act, as I understand it, supplies would be balanced against requirements in one basin, and if it appeared necessary to import water from another basin, conceivably you would go the closest way to see if that couldn't be done, could you not?

Secretary UDALL. Yes.

Senator JORDAN. Of course, the area which is very close to my heart is the Snake River Valley. We have studies going forward in my State that would indicate when we reach a stage of ultimate development in the Snake River Valley we will have a water deficient area, and I think this is not in the too far distant future.

Conceivably, under the provisions of the National Water Commission Act, that might come to the attention of such a group as might be selected under the act, could it not?

Secretary UDALL. Yes, I would certainly think so. I would think that this would be the very type of question they would want to go into in depth.

Senator JORDAN. And I think that even though we can prove that at a time in the not too distant future the Snake River Valley will be a water deficient area, I do not anticipate that we will want to levy against the waters of the Colorado, or even the waters of northern California, but I do believe that we might turn to the Salmon River, Mr. Secretary, because it is wholly within our own State, and transfers are possible from the Salmon to the Snake. So it seems to me that under a National Water Commission Act, we might effect an intrastate interbasin transfer that might be beneficial to the program of the whole area. Would you not agree to that?

Secretary UDALL. That would be an issue for the State of Idaho, basically, Senator.

Senator JORDAN. Yes, sir; and maybe not exactly appropos to this discussion here today, but if this comes about, it would be most foolhardy for us at this time to commit the waters of the Salmon River to a single-purpose use; would it not?

Secretary UDALL. Senator, I could see such an interbasin transfer, if it were proposed, as possibly developing into a war between the sportsmen and the farmers.

Senator JORDAN. Yes.

Secretary UDALL. Within a State there are varying viewpoints. I suspect that if I were in Idaho, feeling that the Salmon is one of the great rivers of the country, one of the great scenic rivers, that I would be on the side of those who would say, "Let's leave it alone."

But if it comes to that in your State, you are going to have a hard choice, and you would fight it out in your own State.

Senator JORDAN. If it comes to a hard choice, you would think that the State authorities might have some consideration in the matter, would you not?

Secretary UDALL. I am in favor of letting everybody be heard. The only equitable way to make policy, is to make sure that all sides are heard on these matters.

Senator JORDAN. I think that is all I have, Mr. Chairman.

Senator MOSS. Could I ask just one question, Mr. Chairman?

Senator ANDERSON. Senator MOSS.

Senator MOSS. I would like to ask Commissioner Dominy if he could tell me when the definite plans on the Dixie project will be complete.

Mr. DOMINY. As you know, Senator, we have been working diligently in an effort to put that project into focus after we had to give up the site that we had originally thought would be the proper one. We expect to have a definite plan report on the revised proposal completed in June of this year.

Senator MOSS. Will there be carryover funds to keep the St. George field office operating on the Dixie project?

Mr. DOMINY. We have money for the balance of this fiscal year, and we hope we can maintain a small staff there to keep working on it as we move forward, but we may have some problems in fiscal 1968.

Senator MOSS. Do you have an amount of money now that is available for continuing the fiscal year?

Mr. DOMINY. Yes; we have \$350,000 for fiscal 1967.

Senator MOSS. If the Hualapai proposal goes out of the bills that we are considering here, where would Dixie have to look for supplemental funds to make it a feasible project?

Mr. DOMINY. Dixie needs development fund financial assistance of some sort, whether it is from Hoover-Parker-Davis revenues supplemented by Hualapai, or not. It needs about \$29 million of development fund assistance in order to be a financially feasible undertaking.

Senator MOSS. This is an authorized project, but we are struggling with the financing now because of the changes that are necessary on the site.

Mr. DOMINY. That is correct.

Senator MOSS. Thank you.

Thank you, Mr. Chairman.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Mr. Chairman.

As I recall it, Mr. Secretary, you are the chairman of the various river basin committees; is that correct?

Secretary UDALL. No. I am Chairman of the Water Resources Council, Senator. The President appoints the chairman of the various river basin commissions, and he serves with the Governors of the States to carry out the work of the river basin commissions.

Senator ALLOTT. What sort of responsibilities are these commissions charged with, Mr. Secretary?

Secretary UDALL. Long-term water resource planning.

Senator ALLOTT. I have had placed before me something which perturbs me very greatly, and it worries me about the National Water Commission. This is a release, Bureau of Reclamation, Department of the Interior, on March 8, 1967, entitled "Press Information." It carries a dateline of Wenatchee, Wash., AP:

The Chairman of the newly created Pacific Northwest River Basins Commission said Tuesday his group will seek to protect diversion of Northwest water to the Southwest by establishing that it needs the water more than Southwest States.

Now, I might say that the leader on this article is "River Basin Leader Vows To Keep Water." This doesn't look like a very objective study to me, and then going down further, he says:

He said the Commission was prohibited from making any studies associated with possible diversion of Columbia River water to the Southwest as proposed in California and Arizona.

Hodde said the only protection the Northwest will have against transportation of its surplus water to other areas is to establish a priority exceeding that of any national priority.

"This the Commission will do; That's my concept of protection," Hodde said. He was in Wenatchee for the 4th Annual Conservation Congress sponsored by the Wenatchee Daily World.

I would like, Mr. Chairman, that all of this article be placed in the record because I think it is an indication of some of the troubles we are going to have on the basin, and also with the National Water Commission.

Senator ANDERSON. Without objection.

(The article referred to follows:)

[From the Salem (Oreg.) Statesman, Mar. 8, 1967]

RIVER BASIN LEADER VOWS TO KEEP WATER

WENATCHEE, WASH. (AP).—The chairman of the newly created Pacific Northwest River Basins Commission said Tuesday his group will seek to protect diversion of Northwest water to the Southwest by establishing that it needs the water more than Southwest states.

Charles W. Huddle, 60, the chairman said "The biggest thing to be done by the commission is to develop a comprehensive plan for the Pacific Northwest." President Johnson announced in San Antonio, Tex., Monday the creation of the commission and appointment of Huddle as its chairman.

Studies prohibited

He said the commission was prohibited from making any studies associated with possible diversion of Columbia River water to the Southwest as proposed in California and Arizona.

Hodde said the only protection the Northwest will have against transportation of its surplus water to other areas is to establish a priority exceeding that of any national priority.

"This the commission will do. That's my concept of protection," Hodde said. He was in Wenatchee for the 4th Annual Conservation Congress sponsored by the Wenatchee Daily World.

Secretary UDALL. This basin planning commission is now in existence. The Governors of the Columbia River and Northwest States, and their water people, serve on it, and they will be making their studies during the next 5 years, at the same time as the planning commission will.

In fact, the planning commission will presumably meet with them and see what their ideas are.

I would like to say, as I wanted to say a moment ago to Senator Jordan but did not get the opportunity, that I have always appreciated the very statesmanlike position that he took a couple of years ago. He served on the joint commission, and I think this is where he got a broad outlook. This was the first time I was bold enough to start talking about the mouth of the Columbia River. I felt that his opponent in the campaign last fall took very unfair advantage of the very statesmanlike position that he had taken, because he, of course, was not proposing that Idaho give away any of its water, and yet this interpretation was given to it, and I think that it was unfair.

I still do. I don't know whether he still holds the same views because he was very bold when he first expressed them. But when he began talking about the mouth of the Columbia River, it was the first time I felt that as Secretary of the Interior I could begin talking about the mouth of the Columbia River. But this is the only possible point of diversion that I have talked about.

Senator ALLOTT. The distinguished Senator from Idaho, of course, led out in this area, and he is to be congratulated. I admired him for his courage in stepping out, too.

But it does not get away from the problem that he poses here, because the so-called Northwest Basin Committee might as well have been called, if we are going to follow the line that Mr. Hodde suggested, the Northwest Water Protective Association and end their activities there. That is all it will amount to.

I would like to get one thing straight. Mr. Dominy, a while ago you gave some answers to questions from the Senator from Utah. You mentioned the 2.8 allocation to Arizona.

Mr. DOMINY. Yes, sir.

Senator ALLOTT. And I think you mentioned the 2.1, or 1.2; which is it, present use?

Mr. DOMINY. About 1.1 on the average.

Senator ALLOTT. 1.1, which would leave about 1.7.

Mr. DOMINY. That is correct.

Senator ALLOTT. And in the meantime, all of the unused waters of the Upper Basin will flow down and empty into the central Arizona canal current, and there they will be sold to help retire the indebtedness on the central Arizona project; is that correct?

Mr. DOMINY. That is correct to the extent that the 2,500-cubic-foot-per-second canal would be capable of diverting at a maximum annual amount of 1,600,000 acre-feet.

Senator ALLOTT. You are talking about enlarging it now.

Mr. DOMINY. If it were to be a larger canal, and there are some of the bills before your committee embracing a larger size, then you could divert more than the 1.6 million acre-feet when water is available in the river.

Senator ALLOTT. And to the extent that that water was utilized and sold, then the waters of the Upper Basin States would be utilized for the purpose of paying out the central Arizona project.

Mr. DOMINY. Well, except—

Senator ALLOTT. No except to it. It is there.

Mr. DOMINY. I beg your pardon, but I think there is an exception. These are not waters belonging to the Upper Basin States, if they can't use them. They are there for use in the Upper Basin if you have the capacity and the project builds the storage capacity to use them. Then they won't be available in the river to come down to the Lower Basin.

Senator ALLOTT. That is exactly the point.

Mr. DOMINY. Well, in that case—

Senator ALLOTT. Only two of the five projects in Colorado were authorized, and we still have a long way to go in Colorado to reach any Upper Basin State to utilize the waters that are available to us, and I will document this later in the hearing.

Mr. Secretary, one remark, and perhaps a question, and then I shall desist. I do appreciate your time and your patience today.

It seems to me that what you are saying, of course, is the pistol-pointing thing of the Hualapai Dam. Now, in the House hearings in the question, this is on August 23, 1965, I think you are very correct. You were asked the question, and I don't know who asked this question:

It is a premature question at this time to ask what of the river systems are going to be looked to as the source of water for import?

Secretary UDALL. I do not think it is premature, Congressman. I suspect if you did not ask the question someone else would. I might as well be quite candid about it. I think there are three possible major sources of supply in addition to conservation of salvage water, which is the cheapest source and the one we really ought to tackle aggressively first.

However, these three sources are the possibility of desalting, and returning of municipal and industrial water is one possibility. Northern California is a second source, and I think that the third and most likely source, and we might as well be very frank about it, is the mouth of the Columbia River below Bonneville Dam. After the water use of the Columbia River, which is a great hydroelectric River in this country, and which has 12 to 13 times more water than the Colorado River, has been completed and the water is ready to waste into the ocean, I think this can be considered also a third likely source to study.

Now, I think that was a candid statement. The thing that concerns me about this whole thing as of now, and your testimony today, is that it isn't a question of whether we are going to augment the supply

of the Colorado River from the Columbia or from northern California. What you are saying, really, in effect, is that until we wait for this nebulous Water Commission, or National Water Commission, that we must not even look at this; that the Department won't even look at it; that we shouldn't even explore mentally the possibility of augmenting the Colorado River with water from other basins.

Now, I would not think, and I would not ask, and I would not have the gall to ask this committee or the Congress to import water from Idaho or a State that needs the water, but when there are places where there is apparently, and I use the word "apparently," surplus water outside of the Colorado River Basin, I don't know why we should be so restricted in our horizons that we should be bound by a hard and fast concept that we shouldn't even explore it.

Now, I don't believe this is objectivity. I think this committee, I think the Department of the Interior, even before the creation of the National Water Commission, has an obligation to explore. You have repeated over and over again the vital necessity of the situation in Arizona and in the Colorado River Basin, and maybe it would turn out that no plan that we could possibly conceive would be of advantage economically to the Colorado River Basin.

But not to explore it, and to say that we don't want the Hualapai because it points a gun at the Columbia River, and to say that we must not even explore it, you must not even look, we have got to wait for a nebulous commission to meet, doesn't make sense. If we are to be bound and crippled in this way, we will never solve the problem of the Colorado.

Secretary UDALL. Senator, if I may reply, because I want my posture to be understood by all, I don't think that we should take a passive attitude at all, and that isn't our position. I would say if somebody were to propose a 10-year study, or a 15- or a 20-year study, that this is too long.

I do not think the problems are so critical that 5 years represents a critical delay, particularly, if in that period we are moving very dynamically in weather modification and in desalination. There is a very creative period in these two fields right now. We are going to know a great deal more 5 years from now than we know today.

We are going to know a great deal more of what we can do in terms of salvage and conservation of water, and I think we can make much more intelligent decisions, keyed to the long-term conservation interests of the country five years from now than we can today. I don't think that delay would be crucial. That is all I am trying to say.

Senator ANDERSON. We are going to have to terminate this hearing now. We will have to hear from Mr. Parker tomorrow morning. We will have to release you today.

(Whereupon, at 4:50 p.m., the committee adjourned, to reconvene at 10 a.m., Wednesday, May 3, 1967.)

CENTRAL ARIZONA PROJECT

WEDNESDAY, MAY 3, 1967

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER RESOURCES OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room 1202, New Senate Office Building, Senator Clinton P. Anderson (chairman of the subcommittee) presiding.

Present: Senators Anderson, Jackson, Hayden, Moss, Kuchel, Allott, Jordan of Idaho, Fannin, and Hansen.

Also present: The Honorable Morris K. Udall, U.S. Representative from the Second Congressional District of the State of Arizona.

Staff members present: Jerry T. Verkler, staff director; Stewart French, chief counsel; William Van Ness, special counsel; Roy Whitacre and Mike Griswold, professional staff members; E. Lewis Reid, minority counsel, and Darryl Hart, assistant minority counsel.

Senator ANDERSON. Mr. Parker of the Hualapai Tribe.

**STATEMENT OF RUPERT PARKER, CHAIRMAN, HUALAPAI TRIBE;
ACCOMPANIED BY ROYAL D. MARKS, GENERAL COUNSEL FOR
HUALAPAI TRIBE, PHOENIX, ARIZ.; AND ARTHUR LAZARUS, JR.,
STRASSER, SPIEGELBERG, FRIED, FRANK & KAMPELMAN,
WASHINGTON, D.C.**

Mr. PARKER. Mr. Chairman, I appreciate the opportunity to present this statement on behalf of the Hualapai Tribe.

My name is Rupert Parker. I am chairman of the Hualapai Tribe, Peach Springs, Ariz., and have been asked by the Hualapai Tribal Council to appear here today to make sure that the rights and interests of our people in the site of the proposed Hualapai (Bridge Canyon) Dam, and related facilities, are fully recognized and protected in any legislation to authorize either the central Arizona project or the Colorado River Basin project.

As the members of this committee may recall, our Washington attorney, Arthur Lazarus, testified before you in 1964 about my tribe's interest in development of the Colorado River, and George Rocha, the tribal chairman before me, testified on the same subject before the House committee in 1965 and 1966. I am here today for the specific purpose of reporting briefly how my tribe now feels about the pending bills so that you may act on the basis of the latest available information.

At the very beginning of my statement, let me make quite clear what I and other representatives of the Hualapai Tribe have been saying for years:

If proper consideration is given to, and payment made for, our ownership of the damsite, the development of the Colorado River at Bridge Canyon for power and recreational purposes is the only hope we Hualapais have for bringing a decent standard of living to our reservation.

I think a few facts about the Hualapai Tribe will show what I mean here. Our tribal enrollment now is 1,020, and out of this total over 600 persons, or 80 to 85 families, live on the reservation. I believe that about 15 heads of these families, of whom eight work for BIA and four for the tribe, have permanent employment—giving us an employment rate of over 80 percent. During the summer tourist season a number of our women can get work as domestics in the local motels and some of our men can get other temporary jobs, but there are no real opportunities for additional year-round employment on the reservation.

Our tribal income amounts to about \$70,000 per year, a large part of which comes from the operation of a tribal cattle herd. We once had a small timber contract, but that has expired, and we have been told that our reservation does not contain any minerals in paying quantities. When Interstate Route 40 is completed in a few years, we will not even have the income we now receive from our tribal stores, service stations, and a motel on Highway 66. In short, the site of a dam at Bridge Canyon is the one asset we have that can provide my people a real chance to raise themselves out of continued poverty. Needless to say, we look forward to and support such development.

Three of the bills under consideration by this committee—S. 861, S. 1242, and S. 1409—would authorize the construction, operation, and maintenance of a high Hualapai Dam at Bridge Canyon as part of the Colorado River Basin project. Our lawyers have studied these proposals and have advised us that, although the bills differ with respect to certain other features, all provide for the payment of compensation and the grant of other benefits to the Hualapai Tribe in connection with Hualapai Dam. According to my information, the language of these bills in each case is comparable to the text of H.R. 4671, which was favorably reported by the House Committee on Interior and Insular Affairs last year and which the Hualapai Tribe fully endorsed. On behalf of the Hualapai people, I wish to express our sincerest gratitude to the Senators who sponsored S. 861, S. 1242, and S. 1409 for recognizing our interest in the site of Hualapai Dam, and to go on record in favor of section 303 of these bills, as now written.

In order that the record may be complete, I wish also to point out that the compensation to be paid and the benefits which would be granted to the Hualapai Tribe under section 303 for the use of its property in connection with Hualapai Dam are not based upon guesswork or any attempt to get rehabilitation funds for my people through the back door. As our attorney testified before this committee 3 years ago, the Hualapai Tribe in 1961 entered into a written contract with the Arizona Power Authority for the use of tribal lands in the event

that this agency was licensed by the Federal Power Commission to build a low dam at Bridge Canyon. Section 303 of the pending bills would provide for the Hualapai Tribe no more or less than the power authority promised. We feel, and the House committee last year agreed, that the Federal Government certainly should be able to give us in connection with a Federal development at least as much as a private organization could offer.

Two of the bills under consideration by this committee—S. 1004 and S. 1013—would authorize the construction of the central Arizona project without a dam at Bridge Canyon, and the administration's proposal (S. 1013) would go so far as to prohibit such a dam. As I have stated, the Hualapai Tribe supports legislation to have the Federal Government build Hualapai Dam, and so do our Indian neighbors, the Havasupai Tribe and other members of the Arizona Inter-Tribal Council, as long as our rights are protected. I wish to submit resolutions from the Havasupai and the Hualapai Tribes at this time for the record, Mr. Chairman.

(The resolutions referred to follows:)

RESOLUTION OF THE GOVERNING BODY OF THE HAVASUPAI TRIBE OF THE HAVASUPAI RESERVATION

Whereas there is pending in the House of Representatives of the 2nd session 89th Congress, H.R. 4671, and

Whereas in said bill there is a section providing for the building of Hualapai Dam (Bridge Canyon), and

Whereas there is included in the latest Committee Print # 24 amendments to H.R. 4671 which would benefit our neighbors, the Hualapai Tribe, and

Whereas the members of the Havasupai Tribal Council have read in the papers and magazines statements by members of the Sierra Club and others that by building Hualapai Dam the lake behind it would flood the Grand Canyon and ruin it, and

Whereas the Havasupai people have lived in the area now called Grand Canyon for hundreds of years and the Havasupai Reservation is located down in the Canyon, and

Whereas the Havasupai Tribe would have long ago protested the building of the Hualapai Dam if the lake behind it would ruin the Grand Canyon and flood out their homes and interfere with the beautiful falls, a part of our home place, but the tribal representatives of the Havasupai Tribe know it will not do such a thing: Now, therefore, be it

Resolved by the Havasupai Tribal Council in meeting assembled this 21 day of July 1966, That it endorses the actions taken by their neighbors, the Hualapai Tribe, in their efforts to keep Hualapai Dam (Bridge Canyon) included in H.R. 4671; and be it further

Resolved that copies of this resolution be sent to officers of the Sierra Club and to others interested in H.R. 4671 and Hualapai Dam.

CERTIFICATION

I, the undersigned, as Chairman of the Havasupai Tribal Council hereby certify that the Havasupai Tribal Council of the Havasupai Tribe is composed of seven (7) members of whom 5, constituting a quorum, were present at a meeting thereof this 21 day of July 1966; and that the foregoing resolution was duly adopted by the affirmative vote of 5 members. Pursuant to authority of Article V, Section 1(a) of the Constitution and Bylaws of the Havasupai Tribe, approved March 27, 1939.

RALPH PAYA, *Chairman.*

Attest:

REED WATAHOMIGIE, *Secretary.*

RESOLUTION OF THE GOVERNING BODY OF THE HUALAPAI TRIBE OF THE HUALAPAI RESERVATION

Whereas there have been introduced in the 90th Congress, First Session, several bills to authorize the construction, operation and maintenance of the Colorado River Basin Project; and

Whereas hearings have been held before the House Committee on Interior and Insular Affairs and hearings are now scheduled before the Senate Committee on Interior and Insular Affairs beginning May 1, 1967; and

Whereas certain of said bills introduced in the Senate give recognition to the rights and interests of the Hualapai Tribe in carrying out said Project; however, S. 1004, introduced by Senator Hayden for himself, Senator Fanning, Senator Cannon and Senator Jackson, proposes to eliminate the building of Hualapai Dam, at least for the present; and

Whereas the construction of Hualapai Dam in connection with said Colorado River Basin Project, if the rights and interests of the Hualapai Tribe are protected, would benefit not only the Tribe but the whole State of Arizona and other states interested in said Project; now, therefore, be it

Resolved by the Hualapai Tribal Council in regular meeting assembled this 1st day of April, 1967, That it re-affirms the stand the Hualapai Tribe has previously taken in connection with legislation pending before Congress on the Colorado River Basin Project, respectfully requesting the Congress to recognize the rights and interests of the Hualapai Tribe; and be it further

Resolved, That the Chairman, Rupert Parker, and the Tribal Attorneys, Royal D. Marks and/or Arthur Lazarus, Jr., are authorized to testify on behalf of the Hualapai before the Senate Committees concerning said legislation, particularly the bills that are pending before the Senate Committee on Interior and Insular Affairs (S. 1004 and S. 861), or any other bills concerning the Colorado River Basin Project; and be it further

Resolved, That copies of this Resolution be transmitted to the Arizona Congressional delegation, to members of the Senate Interior and Insular Affairs Committee of the 90th Congress, and to other persons interested in the Colorado River Basin Project; and be it further

Resolved, That if funds are available other representatives of the Tribe be authorized to accompany the Chairman to the Senate hearings.

CERTIFICATION

I, the undersigned as Secretary of the Hualapai Tribal Council, hereby certify that the Hualapai Tribal Council of the Hualapai Tribe is composed of seven (7) members of whom seven (7) constituting a quorum were present at a regular meeting thereof held on this 1st day of April, 1967; and that the foregoing resolution was duly adopted by the affirmative vote of six (six) members, pursuant to authority of Article VI, Section (a) of the Revised Constitution and Bylaws of the Hualapai Tribe approved October 22, 1955.

[SEAL]

MALINDA HAYATONE, *Secretary, Hualapai Tribal Council.*

Mr. PARKER. If Congress decides that the Federal Government should not build Hualapai Dam, however, we request that this committee reject the proposal that everyone else be prohibited from constructing that project. Given the fact that the site of a dam at Bridge Canyon is the only important asset my tribe has, we ask that you leave us free to file our own application with the Federal Power Commission to build our own Hualapai Dam without using Federal money.

Finally, I would like to mention the fact that many conservation groups are opposing the construction of Hualapai Dam because of its effect upon the Colorado River and Grand Canyon. I can understand why these conservationists are so concerned, for after all, we Indians occupied this country for thousands of years in the natural state which they are trying to preserve. We did not see a need for change then; we do now. When it comes to a clearcut choice between opening up new

opportunities for my people and saving the wilderness for a select few, the Hualapai Tribe has only one way to go, and that is toward the end of advancing our people.

Senator ANDERSON. In the very beginning you mentioned the fact that your ownership of the damsite is important. How well established is that? I am trying to find out if there is conflict. Are all the people agreed on that?

Mr. LAZARUS. Mr. Chairman, if I might answer that question, the matter of title was most recently raised in a question that came from Congressman Reinecke on the House side in the hearings 2 months ago. As a result of that I wrote Congressman Reinecke a letter which is part of the record on the House side, which I would like to submit for the record here.

I think it shows quite clearly that the site of the dam, at any rate the southern half of the dam, would lie on land to which the Hualapai Tribe has clear title.

Senator ANDERSON. We will take that and without objection we will incorporate it in the record.

(The letter referred to follows:)

STRASSER, SPIEGELBERG, FRIED, FRANK & KAMPELMAN,
Washington, D.C., March 15, 1967.

Re Hualapai Tribe of Indians Colorado River Development.

HON. ED REINECKE,
House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN REINECKE: As counsel for the Hualapai Tribe of Indians, I attended the meeting of the Subcommittee on Irrigation and Reclamation yesterday afternoon at which, during the course of testimony by the Secretary of the Interior on pending legislation to authorize the Colorado River Basin Project, you raised a question concerning the legal rights of the Hualapai Tribe in the site of the proposed Hualapai (Bridge Canyon) Dam. According to my notes, Secretary Udall correctly responded that the tribe owns the south half of the dam site and a substantial additional acreage which will be inundated by the reservoir or otherwise needed for project purposes, but I am taking the liberty of submitting this further answer to your question in order that the record on the subject may be entirely clear.

Physically, one-half of Hualapai Dam, a significant portion of the reservoir pool and such project facilities as the operating townsite, transmission lines, access roads, etc. will be located within the exterior boundaries of the present Hualapai Reservation. Historically, the Federal Government has long recognized the Hualapai Tribe's ownership of the reservation. Legally, therefore, the tribe possesses a vested interest in such property, and thus would be entitled to just compensation for the taking or use of its land by the United States as a matter of constitutional right.

The Hualapai Reservation—established by Executive Order on January 4, 1883—actually consists of part of a far larger tract in northern Arizona to which the Hualapai Tribe held original Indian title. In one of the leading cases about Indian land titles, the Supreme Court ruled that the creation of this reservation in effect constituted an agreement between the Federal Government and the tribe under which the Hualapais released "any tribal rights which they may have had in lands outside the reservation * * * on condition that permanent provision was made for them too." *United States as guardian of the Hualapai Indians v. Santa Fe Pacific Railroad Company*, 314 U.S. 339, 358 (1942). In the light of this finding, the Court upheld the Hualapais' title to alternate sections of land within the reservation as against a railroad claiming under a Federal statutory grant. Equally important, the Court's opinion makes crystal clear that the Hualapai Tribe gave up a valuable consideration for establishment of the reservation and was not merely the beneficiary of a revocable trust or other gratuity.

In addition to the property rights for which it bargained in 1883, and such other rights to own land vested in Indian tribes generally under existing law, the Hualapai Tribe is organized under Section 16 of the Act of June 18, 1934, 48 Stat. 984, 987, 25 U.S.C. 476, which specifically empowers these Indians to prevent the sale, disposition, lease, or encumbrance of tribal lands, interests in lands, or other tribal assets without the consent of the tribe * * *." The United States may not lawfully disregard this statutory protection over Indian land (and the Hualapai Tribal Constitution, approved by the Secretary of the Interior on December 17, 1938, pursuant to 25 U.S.C. 476, defines the 1883 Reservation as tribal land) without being liable for damages. In other words, Congress heretofore has recognized and vested in the Hualapai Tribe such ownership interests in reservation property that, no matter how worthy the project—and the Hualapais have endorsed Hualapai Dam—the use by the Federal Government of lands within the Hualapai Reservation without payment to the tribe would be a taking of private property for public use without payment of just compensation in violation of the Fifth Amendment.

I hope and trust that the foregoing summary of the applicable legal authorities is sufficient to prove that the Hualapai Tribe has vested property rights in the site of the proposed Hualapai Dam and adjacent reservation lands. If you have further questions or wish any additional information about this subject, however, I would welcome your calling upon me.

Sincerely yours,

ARTHUR LAZARUS, JR.

Senator ANDERSON. I am only trying to say that I know the Navaho Indians had some question about a damsite on the Colorado River on their reservation. You believe it is firmly established on the part of the Hualapai Tribe?

Mr. LAZARUS. Yes. There was a Supreme Court case, Your Honor, in 1942, called the *United States v. Santa Fe Pacific Railroad*, in which the question involved was ownership of land within the Hualapai Reservation.

The railroad had a grant under a statute which gave it right of way plus alternate sections of land on either side of the right of way. The question was, in that case, whether the railroads grant took precedence over the title of the Hualapai Tribe or whether the title of the Hualapai Tribe took precedence notwithstanding the grant to the railroad in the reservation.

The Supreme Court held that the title of the Hualapai antedated the railroad, and therefore until the United States extinguished the title to the tribe, it had precedence over that of the railroad. I think that is a clear recognition of Hualapai title within the reservation.

In addition to that of course, the Hualapai Tribe is organized under the Wheeler-Howard Act, which gives an organized tribe the statutory right to veto the disposition of its property. This is tantamount in my opinion to a recognition of its title to that property.

Senator ANDERSON. Therefore, you are saying that you very deeply desire to have the Hualapai Dam built.

Mr. PARKER. That is right.

Senator ANDERSON. And you have mentioned later on that if the committee rejects the proposal, the tribe would like to build the dam itself.

Mr. PARKER. Yes; we would like to.

Senator ANDERSON. It would be an investment of a great many millions of dollars. Do you think you could handle it?

Mr. MARKS. If the Senator please, we have had the opportunity of having engineering studies that have been made for the Arizona

Power Authority, and it has been shown and proven that it is an economically feasible project to stand on its own.

In fact, I attended hearings in our State legislature on some legislation that they had, and heard the top bonding attorneys and bonding engineers from New York testify that they would have no problem in selling bonds necessary to build this project, and that the bonds would pay themselves out over the period of about 50 years.

Senator ANDERSON. You wouldn't need any Federal money at all?

Mr. MARKS. That is correct, if they built the dam themselves under a Federal Power Commission application and license.

Senator ANDERSON. I am sure you know there has been Federal money in most dams.

Mr. MARKS. Yes.

Senator ANDERSON. And you wouldn't need any.

Mr. MARKS. They have an application now, as the Senator knows, before the Arizona Power Authority which, I believe, is pending.

Senator ANDERSON. The Arizona Power has, which I believe is somewhat different from the national situation, is it not?

Mr. MARKS. This tribe, under its charter and constitution, could organize and have a Hualapai Power Authority of its own. They now have a Hualapai Housing Authority, which is recognized, and for which bonds have been issued to build houses for self-help housing.

Senator ANDERSON. Senator Kuchel.

Senator KUCHEL. No questions.

Senator ANDERSON. Senator Moss.

Senator MOSS. I have no questions at this point, Mr. Chairman.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. I have none, Mr. Chairman.

Senator ANDERSON. Senator Jordan.

Senator JORDAN. No questions.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Mr. Chairman, I do not have any questions. I would just like to commend the tribal chairman for his remarks and his response to questions. I know of their sincere interest in doing something for this Indian tribe.

Senator ANDERSON. Senator Hansen.

Senator HANSEN. I have no questions, Mr. Chairman.

Senator ANDERSON. Thank you for being here.

Mr. PARKER. Thank you.

Senator ANDERSON. Dr. Smith?

STATEMENT OF DR. SPENCER M. SMITH, JR., SECRETARY, CITIZENS COMMITTEE ON NATURAL RESOURCES

Mr. SMITH. Mr. Chairman and members of the committee, I am Dr. Spencer M. Smith, Jr., secretary of the Citizens Committee on Natural Resources, a national conservation organization with offices in Washington, D.C.

The number of measures dealing with the Colorado River Basin in general and the central Arizona project in particular have been considered for so long that almost anything that is said at this point is redundant. The need for water and the infinite purposes which this

resource serves; the management and distribution of available supplies; and the problems of this management, when related to other needs and other resources, all have been the subject of a number of measures before both bodies of the Congress for a number of years.

As a result, Mr. Chairman, my discussion will be summary in nature and at the risk of being dogmatic will not dwell on the details that have been available so long. I am sure that all the members of the committee are very much aware now of the arguments, pro and con, regarding the water supply, the economics of water management and the involvement of scenic and park resources. I would suspect that the attitudes of most organizations and the many individuals therein are fairly well crystallized.

Despite this, there has been a great effort on the part of many to establish a viable compromise, of which the framers would hope to achieve the sufficient support for its enactment.

Though we have long been a devotee of expanding the national park to include the existing national monument and essentially the rest of the Grand Canyon, we have not been unmindful, unsympathetic, nor unconcerned about the great number of problems that are evidenced in this general area. Time and time again the economic development, the political dialog and the general prosperity of the region, both present and future, seem to come back to water.

The basic problem that is evident to all is the failure of the Colorado River to supply sufficient water to meet the demands of the States in both the Lower and Upper Colorado River Basins. The 1922 compact divided the river basin with 7.5 million acre-feet to the lower basin States and 7.5 million acre-feet to the Upper Colorado Basin States. In addition to the 15 million acre-feet, there is the obligation of 1.5 million acre-feet to Mexico. The basic problem is that of an insufficiency of water to satisfy the total amount of the 1922 compact.

In the Court decision of *Arizona v. California*, a ruling was handed down to the effect that the withdrawal by the State of Arizona out of the Gila River was not to be counted as its water allotment for the Colorado Basin. As a result, there was a resurgence on the part of those in Arizona to obtain their remaining entitlement from the river by constructing a 335-mile canal, which would transport approximately 1.2 million acre-feet of water from Lake Havasu to Orme Dam, south of Tucson near the Mexican border. During 1965 no State in the basin was using the amount of water allocated to it by the 1922 compact, with the exception of California, whose allotment was 4.4 million acre-feet but who actually consumed slightly over 5 million acre-feet. This is understandable in terms of that State's development. The great increase in population, which the State has experienced, especially throughout the last decade, needs no elaboration here.

There has been concern at the possibility of constructing the central Arizona project, even though it is within the allotment granted by the compact to Arizona. Upper Basin States and others, who have not been using their allotment, are concerned that in the event the CAP is constructed they may be contravened from ultimately being allowed to use their quota guaranteed by the compact. By the same

token, California, with continued population pressures, will be most concerned over the prospects of water availability below their current uses.

While these concerns and conflicts seem to be obvious to all, it is natural to seek a common denominator upon which there could be wide agreement. This basic common denominator has turned on the augmentation of water in the Colorado River Basin. Augmenting the flow of the Colorado has been described generally by the Bureau of Reclamation and others as depending upon desalinization, weather modification, and importation from other sources. Though technology is increasing at a considerable pace, there does not seem to be in the offing in the very near future sufficient water from either desalinization or from weather modification to compensate for the deficiencies of the Colorado.

As a result, by far the greatest reliance would have to be upon importation, and the only body of water that is sufficient to meet the requirements of the Colorado River Basin is the Columbia. Two problems are significant. First, is it possible to mechanically achieve this transfer, and second, is it appropriate to do so on any economic criteria? It is impossible for me to make any assertions about the technical possibilities of such importation, for so little is known about the prospects for a success in this matter. The economics of water utilization open up a multivariable argument, the complexities of which do not make many sufficiently sanguine to suggest that it is possible to state all of them correctly and/or resolve them in a definitive conclusion. Almost any thesis or theory as to proper use, no matter how carefully reasoned or meticulously established, can be broached with one or a number of exceptions.

Not too many years ago the economics of industrial location had a number of agreed upon criteria, though the evaluation or force of any one could usually be argued. Nevertheless, there was a frame of reference that was sufficiently delineated to find its way into most courses of economic studies in the universities. The application of such an analysis was used rather widely by businesses of all types and sizes. Most simply, it was an inventory of the resource needs and services of a particular firm or branch and an attempt to find an area most suitable to these needs. No one should be misled that this represented an exact science or that the computer was able to quantify all the aspects of the problem. The future was inevitably a best judgment projection as was a number of existing factors. I feel these remarks are germane here, however, to show that there was a significant effort to ascertain the best location for a plant or firm consistent with the given resources of an area.

Anyone that was ever engaged in such a study always has been aware of the frustrations of abandoning a particular area because of the unavailability of water, though most of the other elements might have been ideal, only to find that once the plant was constructed elsewhere water became available as a result of a Federal impoundment at the original site. In other words, at no time could it be said that the complete freedom of opportunity was available to prospective locators of industry and were never colored by certain governmental subsidies, local, State, or Federal. The location of industry

has become infinitely more complex, however, not only due to the increased economic activity and greater development throughout the country but due to the introduction of special tax laws, special local and civic privileges, extension of certain unique services below cost to the prospective firm and the cooperation of local and State organizations with the prospective locator to put resources in an area where none now exists. The latter instance is especially related to water, thus a change has taken place in this type of analysis of industrial location. It has been subtle and one of degree rather than marked by any sweeping or immediate change. In short, the axiom of locate industry and economic development where the resources are available to support such development is changing to bring the resources to where the people are.

We are trying very hard not to extend and overemphasize this aspect of resources relocation, for as I indicated at the outset some such element was probably a factor from the beginning. I cite it here for purposes of showing that the change has been one of degree.

Because of such circumstances, it would appear to us that the National Water Commission, if authorized, may well find itself deep in the consideration of the economics of water management and water investment than has been attempted heretofore. The question of overinvestment in water supply may prove to be more of a factor than the underdevelopment of existing water resources. We are using water overinvestment in much the same fashion as did Prof. Jerome W. Millman of Indiana University, who testified before this committee when the National Water Commission was under discussion last year.

A number of impoundments have been suggested from time to time in addition to those already constructed on the Colorado River. The Bridge Canyon, or Haulapai, Site and Marble Canyon have been a matter of controversy for some time. The principal reason for authorizing these structures is to provide peaking power in order to obtain revenues for the basin account with which the cost of increasing the water available in the Colorado River Basin could be defrayed. We have been hopeful, that if it becomes the policy of the Congress to import water into the Colorado River Basin, that other means of defraying this expense should be available in order to preserve the Grand Canyon area for its park and scenic purposes. It is difficult to rationalize the inclusion of these impoundments before a searching investigation has been undertaken as to economic impact that would result both in the area from which the water is taken and in the area in which the water is used. Without a most careful consideration of these factors, it would appear to be premature to authorize such impoundments.

The case for the central Arizona project is a difficult question and a close one. The longtime contention of Senator Hayden that such a project can be financed by the water users appears to us as a strong possibility. If this can be accomplished, there would appear to be a significant justification for the construction of this project.

It is not popular or easy to suggest that large areas of the country may not receive water in the abundance that would insure its economic expansion and development. Such a suggestion would certainly meet with a considerable opposition of those representing the interests of

these States involved and who could with considerable justification point to the heavy investment and subsidies of the Government elsewhere to support their argument of the necessity for subsidies in their own areas. We are not suggesting herein that no Government moneys be utilized for subsidizing means by which water may be made available but we are suggesting that a greater search for criteria to establish the degree, or if you will, the limitation to which subsidies for water use is put, appears necessary and inevitable.

I am sure it would be the desire of this committee that we advance an argument sufficiently compelling for the preservation of the Grand Canyon in its natural state and without Federal impoundments within its 280 miles. One of the most egregious tasks is the justification of such preservation without the tools of quantification, which are so available to us in other areas. It seems quite possible, however, that the case can be made for preserving an area even though the ability to support such a decision by profit and loss statements and similar calculations are not available to us. The decision as to whether the Grand Canyon is of greater importance to the people of the United States in its present state or whether a part of its resources are utilized for commercial purposes is a subjective decision in the main. We feel that the people, by and large, support its preservation, and since most of the alternative uses suggested for the Canyon and its riverway do not relate directly to the increases in water resources, we would hope that the committee would not propose these alternatives.

Thank you very much, Mr. Chairman.

Senator ANDERSON. Dr. Smith, there are five bills I think in front of us.

Are there any of these bills which you or your organization can endorse?

Mr. SMITH. Pardon? I did not quite get that.

Senator ANDERSON. Do you endorse any of these five bills?

Mr. SMITH. Yes, Senator Jackson's bill and Senator Hayden's bill both would be supported by our organization. There are some slight differences, but we would support either or both.

Senator ANDERSON. Senator Kuchel?

Senator KUCHEL. I have no questions.

Senator ANDERSON. Senator Hayden?

Senator HAYDEN. No questions.

Senator ANDERSON. Senator Moss?

Senator MOSS. Is your support of these two bills based on the so-called invasion of the canyon? Is that the principal reason? The lake that would be formed?

Mr. SMITH. I would say that is the most compelling argument among our own people, the matter that the Senator mentioned, yes.

Senator MOSS. What is the opinion of your group about Lake Powell formed behind Glen Canyon Dam farther up the river? Is this an advance or a recession?

Mr. SMITH. This is a good question. I am sure the charge has been both ways. In a genuine sense it has been an increase of recreational opportunities for a lot of people.

Senator ALLOT. I wonder if you could speak up, sir. I can't hear you.

Mr. SMITH. Yes, Senator.

It has been an increase in recreation for a lot of people. There has obviously been a decrease of certain kinds of values the canyon had before the dam was built.

Now, as I indicate, these matters are subjective arguments or a subjective basis as to what you want. A number of people think that recreation is kind of a monolithic term and involves monolithic organizations and people, and nothing could be further from the fact.

If we want to go to extremes, we have those who would support it as the epitome of recreation, and we have others who feel a complete untrammelled wilderness is the epitome of recreation. Therefore you would expect that we would have, shall I say, a spirited difference of opinions within the ranks as to what the impact of Lake Powell has been.

Senator Moss. As I take it, you recognize that those in the field of recreation and conservation vary over a rather wide spectrum in their point of view?

Mr. SMITH. We definitely recognize that, yes, sir.

Senator Moss. The point that I was trying to get at was to see if there was a consensus within your organization. For instance, Lake Powell is a lake of 180 miles of still blue water in this canyon, but above it there is another 100 miles of free flowing river that is through a national park and will be free flowing forever, we assume.

Mr. SMITH. Yes.

Senator Moss. I think a somewhat similar situation might be projected for Hualapai, were it built. You would have a lake of about 93 miles of still blue water in the bottom of the canyon, but above it you would have 140 miles of fast flowing, free flowing river, so you would have both kinds of outlets for recreation.

Mr. SMITH. I would accept what the Senator says. It would appear to be that if the Hualapai Dam were constructed, it would be quite comparable to that which exists at Lake Powell. That would be my judgment. I think that the argument counter to this is based on the fact that first of all the canyon is unique. Secondly, that these particular areas are in far lesser quantity than those of the impoundment, man-made impoundment, though they do provide recreation. This it seems to me is the argument that turns most of these points, and it is just a question of which you value the most highly.

Senator Moss. Thank you very much.

Mr. SMITH. Thank you, Senator.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Dr. Smith, I would like to ask one or two questions.

On Page 2 you say this—

In the Court decision of *Arizona vs. California*, a ruling was handed down to the effect that the withdrawal by the State of Arizona out of the Gila River was not to be counted as its water allotment from the Colorado Basin.

Mr. SMITH. Yes, sir.

Senator ALLOTT. Do you know how many States of the Colorado River Basin were party to that suit?

Mr. SMITH. I have it here, sir. There are a number that were joined originally. In No. 8, the original October term, 1962, the *State of Arizona*, plaintiff, vs. the *State of California, et al.*, the State of Arizona invoked original jurisdiction of the court against the State of Cali-

fornia, and seven of its public agencies, later Nevada, New Mexico, Utah in the United States were added either as parties voluntarily or on motion.

Senator ALLOTT. The State of Colorado was not a party to that suit, was it?

Mr. SMITH. To the best of my knowledge it was not, sir.

Senator ALLOTT. It was not?

Mr. SMITH. It was not.

Senator ALLOTT. I must just state that as a fact. Therefore it can hardly be contended that the decision in that case, and you are not contending now that the decision in that case, in which the State of Colorado was not a party, could be binding on Colorado as far as anything in the Gila River is concerned.

Mr. SMITH. No; I am not contending that.

Senator ALLOTT. All right, I just wanted to make certain. I agree with you.

Now I want to ask one or two questions. You say you supported the increase of this area as a national park.

Mr. SMITH. Yes.

Senator ALLOTT. Did your organization ever support the Dinosaur National Monument for a national park?

Mr. SMITH. Yes, we did support it. I think perhaps the Senator is talking in respect to the bill that he introduced.

Senator ALLOTT. Yes.

Mr. SMITH. The bill that the Senator introduced we did not support, because we were concerned with the uses that would be included in that particular measure, and therefore did not feel it was compatible with a national park. As a result we either were in disagreement with the bill as proposed or we would have supported the bill with some amendments. If my memory serves me correctly, that was our position, although I would have to go back and look at the matter in detail, sir.

Senator ALLOTT. I don't recall receiving any substantial support from your group for that bill.

Mr. SMITH. I don't think you did, sir.

Senator ALLOTT. No.

Now referring in general to the third paragraph on page 3 of your statement, you set out the two problems that are significant. "First, is it possible to mechanically achieve this transfer, and second, is it appropriate to do so on any economic criteria?"

Is it possible to make any assertions about the technical possibilities of such importations, et cetera. Do you think in water management that there is anything wrong with trying to explore what the various alternatives and possibilities are?

Mr. SMITH. No, sir.

Senator ALLOTT. Do you know how this can be done without a reconnaissance study or a feasibility study?

Mr. SMITH. No, Senator Allott. I would assume not only this but there are many areas in the country that are going to have to have thorough studies made, and I am sure this is one.

Senator ALLOTT. The point I am making is simply this: that everybody raises these questions such as you have raised, and I think rightly

so and perhaps correctly so at this point, but unless someone in the executive branch, and that is the Department of the Interior, does look at this thing, how will we ever get any idea of any of the answers to the questions you pose?

Mr. SMITH. We are suggesting, it should be implicit at least in our statement, that such an analysis should be made. I feel that such an analysis is going to have to be made probably in four or five major areas of our country. I am assuming that, if the National Water Commission bill does pass, this will be one of the primary efforts that they will make. I do appreciate the Senator's concern. What if it doesn't? It had a chance last year. Are we going to wait forever to get the matter studied. I think the Senator has a point. I think it does deserve study. I would prefer that it be done by the National Water Commission.

Senator ALLOTT. My concern basically is this. I am concerned first of all with the Colorado River situation. I am concerned with the situation in Utah and in the State of Arizona and in the State of Colorado, which is as of this date, although we supply 70 percent of the water from the Colorado River, but it is the most undeveloped State as far as the use of water within its boundaries is concerned, so that the main impact of the shortages at the moment seem to fall on the lower States. If we are going to resolve these difficulties—you were present yesterday, were you not?

Mr. SMITH. I was present part of the time, Senator.

Senator ALLOTT. And see the deteriorating water supply available even to the central Arizona project as introduced by Senator Hayden and Senator Fannin, it seems to me that to anybody with a concern for the future and water development is not a development of tomorrow, where you turn on the tap or the next minute, where you turn on the tap. It is a matter of 10, 15, 20, or 25 years and we had better start going in this direction.

I am sure you would not mean to suggest that we are going to get any answers to the questions you pose on page 3, simply by sitting here and never having any department of the government look at the possibilities for the implementation of water. You pointed out and correctly I think desalinization and weather modification are still too ethereal to count on any positive help in this area for the Colorado River Basin.

Mr. SMITH. Yes, I think they are. I am not a scientist, Senator, but from everything that I can read, it simply does not seem these methods would be productive in the near future to supply the additional water that would be required to make up these deficiencies in the basin.

Senator ALLOTT. Thank you very much, Doctor.

Senator ANDERSON. Senator Jordan.

Senator JORDAN. No questions.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. No questions.

Senator MOSS. Could I ask just one more, Mr. Chairman?

In asking you about your support of the bill, Dr. Smith, the bill 1409 and also Senator Allott's bill and Senator Kuchel's bill, I believe, provide for eliminating the proposed Marble Canyon Dam, which

was in last year's legislation, although they would keep the Hualapai Dam.

Does your organization have any position on that? Do you think Marble is a compromise that might be a good halfway point?

Mr. SMITH. We have some problems. In the first place, Marble technically is a pool and the actual construction of it would not invade any park or monument either by its impoundment or construction. In that sense it is more desirable. As a technical matter, it does probably have a greater impact on some of the most beautiful country of the area, and if we were forced, as I say, and this is a highly iffy question, but, if the issue comes down to something like this, if you are going to build an impoundment, where would you rather have it be, I would suspect that Bridge Canyon would be the place that hopefully it would be built. We hope that neither, and I want to make that perfectly clear, we hope that neither would have to be constructed, but in the event you build one I would suspect, not taking into consideration a precedent as far as the area is concerned, I would suspect that Bridge would be the best place to do it.

Senator MOSS. I think we have moved forward by saying, "All right, we will put Marble Canyon in the national park," even though we still cling to Hualapai.

Mr. SMITH. I think that is a step forward, Senator, yes.

Senator MOSS. Thank you.

Senator ANDERSON. Just one final question, Dr. Smith.

You and I have been on the same side of many controversies.

Mr. SMITH. Yes, sir.

Senator ANDERSON. The Wilderness Association opposed the Hooker Dam in New Mexico.

Mr. SMITH. They have opposed this, you say?

Senator ANDERSON. Yes. I was somewhat shocked. I have some photographs of the land that is being taken. Would you be interested in trying to identify the scenic spots in these photographs?

Mr. SMITH. Senator, candidly I will have to confess, I will even leave it on the record, I don't know very much about Hooker Dam. We were planning to come around and see you and get an explanation regarding it.

Senator ANDERSON. I wish you would sometime.

Mr. SMITH. Whenever Hooker Dam or the Gila Wilderness or something in the Gila Wilderness is mentioned, I am more or less at a loss. If the chairman of this committee is seeking our counsel, I am sure we go to him far more often in seeking his counsel on things of this nature. I don't think we took a position on Hooker Dam until we talked to the chairman of this committee, and found out from him what his knowledge is about it. This is kind of odd. I am sure the witness is not supposed to say this or do this, but this is our feeling.

Senator ANDERSON. We had a very tough meeting on this at one time.

Mr. SMITH. You sure did.

Senator ANDERSON. A good many years ago, and I was the only person, elected by popular vote at least, to appear against it. There was a good solid delegation trying to get this done. I was a bit surprised that the Wilderness Association worried about this dam.

Mr. SMITH. Of course, I haven't gone into the details, although I know that apparently some part of the proposal goes into the wilderness area. I suppose as a general feature we are about as sensitive to invasion of parks and wilderness as anything else, and as a general matter this is a concern, but before we would come to any significant conclusions, we would sure like to go into some detail and find out about it. I am sure the Senator probably has far more information than we do. We would be very much guided by his thoughts on it.

Senator ANDERSON. It is a matter of some 15 or 20 years now since we had a settlement in the primitive area, and many of you wanted to eliminate it entirely, the great central part of it, but we tried to incorporate it, and I wondered if your organization was worried about this.

Mr. SMITH. My own reaction is that, as the chairman of this subcommittee, Senator, you have probably been more in the forefront in establishing wilderness areas and in specific wilderness areas than anyone else. You would inhibit us greatly if you say that this isn't going to be a serious factor, this is going to go a very long way with our organization. There is no question about that.

Senator ANDERSON. Thank you very much.

Mr. SMITH. Thank you.

Senator ALLOTT. With respect to the area of the river which would impound water with respect to the Hualapai Dam, what developed roads are there into that 93-mile stretch of the river?

Mr. SMITH. I don't know that there are any, Senator. There may be. I am not aware of any.

Senator ALLOTT. At least there are none that have ever come to your attention.

Mr. SMITH. I don't know of any. I would have to say in all honesty, Senator, I am not an authority. We have many on our board within our organization who are highly knowledgeable about this, who live in that area. I am really not an authority by being on the scene, to tell you very much about it physically.

Senator ALLOTT. Could you tell me how many visitors, not people who reside there in that area, but how many visitors this section of the river has each year?

Mr. SMITH. I would think it would be quite few. I am just guessing now. I don't know the exact number, but I would assume that there would be a relatively small number of visitors.

Senator ALLOTT. Thank you very much.

Senator ANDERSON. Thank you, Dr. Smith. We appreciate your testimony.

Mr. SMITH. Thank you, Senator.

Senator ANDERSON. Mr. Gianelli, do you represent the Governor of the State?

STATEMENT OF WILLIAM R. GIANELLI, DIRECTOR, DEPARTMENT OF WATER RESOURCES, STATE OF CALIFORNIA, AND NORTH-CUTT ELY, SPECIAL COUNSEL, COLORADO RIVER BOARD OF CALIFORNIA, AND SPECIAL ASSISTANT ATTORNEY GENERAL, STATE OF CALIFORNIA; ACCOMPANIED BY DALLAS E. COLE, CHIEF ENGINEER, COLORADO RIVER BOARD OF CALIFORNIA; BURTON J. GINDLER, DEPUTY ATTORNEY GENERAL; W. DON MAUGHAN, PRINCIPAL HYDRAULIC ENGINEER, DEPARTMENT OF WATER RESOURCES, STATE OF CALIFORNIA, AND MYRON HOLBURT, HYDAULIC ENGINEER, COLORADO RIVER BOARD OF CALIFORNIA

Mr. GIANELLI. Yes, sir. I am William Gianelli, director of the Department of Water Resources of the State of California. Mr. Chairman, I have a suggestion. The first five agenda items involve California witnesses who will appear together; the sixth item concerns Mr. Floyd Goss, of the Department of Water and Power, City of Los Angeles, who will appear separately. If it pleases the committee, I think perhaps we can consolidate some of these presentations and save the time of the committee.

Senator ANDERSON. You are very kind. We would appreciate that a lot.

Mr. GIANELLI. I would first like to introduce the people who are at the time with me. On my right is Mr. Ely, who is special counsel of the Colorado River Board and special assistant attorney general of the State of California. With Mr. Ely is Mr. Burton Gindler, deputy attorney general of the State of California, and Mr. Dallas Cole, chief engineer of the Colorado River Board.

To my left is Mr. Don Maughan, who is principal hydraulic engineer of the State of California's Department of Water Resources, and Mr. Myron Holburt, principal hydraulic engineer, Colorado River Board of California.

My statement will be presented on behalf of the Governor and Mr. Ely's for the Colorado River Board and the attorney general. We will proceed in that manner, Mr. Chairman.

Senator ANDERSON. Very well.

Mr. GIANELLI. Mr. Chairman and members of the committee, I welcome this opportunity to make known the official views of California's new administration on the important water legislation now before this subcommittee. The necessity for finding a legislative solution to the Colorado River water supply problem has been one of the paramount concerns of my administration since it took office. We concluded early that California's new administration would join with sister States and the Congress in an all-out effort to obtain constructive legislation at the earliest practicable date.

I see no reason to replot ground that has already been thoroughly plowed. There is no need to recite in detail the importance of water to California and the West, and there is nothing I need add to reinforce the fact that the Colorado River Basin and the Pacific Southwest face imminent and widespread water deficiencies. The record compiled at

previous hearings on the central Arizona project and the Pacific Southwest water plan before this distinguished body, and on the Colorado River Basin project legislation before the counterpart of this body in the House, established those facts beyond a shadow of a doubt.

California's administration is concentrating on the support of basic principles, is determined not to be detracted by nonproductive argument over seemingly important, but often overemphasized, peripheral issues. All of the Colorado River Basin States have made accommodations to each other, to interests opposed to dams, and to the Northwest. California has participated, and will continue to do so, in negotiations which are essential to enactment of the legislation needed in this area.

Our goals are clear and, we believe, are above argument. The need for action is unmistakable. What the entire Pacific Southwest needs now is legislation which satisfies the region's immediate needs through added development of the limited resources of the Colorado River, but recognizes also the area's longer-range requirements and sets in motion a program to augment the supplies of the Colorado. It is my objective today to bring to your attention those elements that California believes essential in this legislation.

We ask first that the legislation recognize the accepted fact that the dependable natural supply of the Colorado River is insufficient to meet all compact and decree apportionments to the seven States of the Colorado River Basin; and the further fact that the dependable supply available to the Lower Basin will be unable to meet existing uses and the added burden of the central Arizona project beyond perhaps 1990 or the turn of the century, even with California's existing uses limited to 4.4 million acre-feet per year. While it appears that the lower Colorado supply has the potential of satisfying existing uses and those of the central Arizona project until then, this is the case only because several of the other States are not at this time using all of the water to which they are entitled and because California's present uses will be cut back from 5.1 to 4.4 million acre-feet per year when the central Arizona project goes into operation.

The only certain way of assuring continued development and prosperity in the Pacific Southwest and of bringing peace to the Colorado River is to increase the natural supplies of the region. The legislation, then, should contain a reasonable promise that the additional burden of the central Arizona project will be relieved within a quarter of a century by augmentation of supply of the Colorado. In the meantime, existing economies should be provided with reasonable protection.

The merits of protecting existing water uses in the Lower Colorado River Basin, with California's uses being protected to the extent of 4.4 million acre-feet per annum, are based on a solid moral and economic foundation. The Colorado River Basin States struggled with this problem for months before resolving it early in 1965 in favor of protection existing economies. This solution was found acceptable last year to the House Committee on Interior and Insular Affairs, and to the national administration. This is no cogent reason to upset this accord.

Existing projects in the Lower Colorado River Basin were built on what has turned out to be an overly optimistic estimate of water supply. The economies that rely on these projects, all vital to the States and the Nation, now face added hazard. The economy in California dependent

upon the Colorado must scale back from an existing use of 5.1 million acre-feet per year to 4.4 as a result of the lesser supply in the river and the U.S. Supreme Court's decision in *Arizona v. California*. The logical way to protect the economy dependent upon the remaining supply of 4.4 million acre-feet and the enormous investment in physical works constructed to service this economy during the time interval preceding actual augmentation of the Colorado River is to provide in the legislation that existing uses shall have a priority over new uses until the augmentation is effected. With the 4.4 priority, the \$0.5 billion Colorado River aqueduct and distribution system of the Metropolitan Water District of Southern California will flow less than half full. Without it, the aqueduct will face imminent danger of being dried up completely.

Hence, we urge that existing uses in the Lower Basin, including 4.4 million acre-feet per year of use in California, be afforded priority over the central Arizona project until such time as the supply of the river is augmented. To do otherwise is to create another burden on the river without doing anything to relieve the basic problem of short supply. Relief from shortage and continued development of the economics of the Pacific Southwest can only come from a program that includes early augmentation of the area's limited supplies.

A primary purpose of the legislation should be to initiate studies leading to a well-founded decision on how best to accomplish augmentation of the Colorado River. The Nation can ill afford delays in getting those studies underway. We believe the essential ingredients of an acceptable augmentation study to be: (1) That it be conducted under the supervision of an impartial body; (2) that it be completed on a timely basis; (3) that all related factors be considered, including those outside the purely engineering and economic fields; (4) that the rights of the States and regions be fully respected; (5) that the affected States be permitted to participate effectively; and (6) that the expertise of existing State and Federal agencies be used to the maximum extent possible.

In recent weeks, several proposals have been advanced that call for a feasibility-level study of the north coastal area of California as the initial source of export water supply for the Pacific Southwest. The State of California does not now, nor has it ever, objected to inclusion of its north coast as one of the areas to be studied. We have asked and still ask, however, that the selection of California's north coastal resources as a source of supply for the initial stage of the regional program be based upon a demonstration, using comparable levels of investigation, that it is, in fact, the best source for the Pacific Southwest. The people of the Southwest and of the Nation at large have a right to expect that the project eventually constructed to relieve the water supply problems of the Pacific Southwest is the best of all available alternatives. This is not only existing Federal and State policy, it's good economics.

California, like any other potential States of origin, must insist on full legal and economic protection to assure all users within its boundaries that water supplies will be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water. The protective provisions must

also give the users within the States of origin a priority of use, so that those users have in effect a right of recall, or a right to replacement with water of equal quality and no greater cost. Such provisions are included in S. 861, S. 1242, and S. 1409, but omitted from S. 1004 and S. 1013.

These provisions would apply to all interstate supplies regardless of source. As the new economy developed in the Pacific Southwest would not be allowed to perish, recall would be unlikely, and the State of origin would probably have to rely on replacement of its supplies. This would require that large sums of money be available within the program at the point in time to finance the replacement. Hence, California strongly supports creation of the proposed development fund, construction of projects that will make revenues available to the development fund, and dedication of a portion of the fund to protection of the States of origin.

Success of the regional program of development will depend in large measure upon the financial strength of the development fund. We must make it as strong as we can, and can ill afford to forgo construction of justified projects that will return surplus revenues to the fund. Hence we support construction of the optimum development of the Hualapai site than can be justified considering all potential uses and needs, giving full recognition to the scenic and recreational needs, as well as to hydroelectric peaking power needs and values.

I say this in full knowledge of the strong stand conservationists have taken on the Hualapai Dam issue. The important values associated with the preservation of open spaces and wild areas must be given full consideration in reaching decisions as to the future use of the Colorado River and the natural areas associated therewith. However, reality also requires that full recognition be given to the requirements of meeting the food, fiber, power, and recreation demands of an expanding population.

Some of the bills before you contain, in addition to the central Arizona project, authorizations for the construction, operation, and maintenance of five new projects in the Upper Basin. Since it is our understanding that these features are favored by the State directly affected; are economically justified on the basis of Bureau of Reclamation studies; and, on the basis of both entitlement and physical availability, can reasonably be expected to have an adequate water supply, we support their authorization.

As previously stated, we believe that the studies of alternative sources of supply to augment the Colorado should be supervised by an impartial body, should include effective State participation, should be free from duplication of work force and work effort, and should make maximum use of expertise already available. California supports the formation of the National Water Commission to review national water policy. We also support use of the National Water Commission as an impartial supervisor of the studies of means of augmenting the supplies of the Pacific Southwest. This support, however, is conditioned on (1) immediate implementation of the Pacific Southwest regional study so that alternative solutions will be available for comparison by the early seventies, and (2) assurances that the Commission will not be used as a mechanism for delaying those studies.

For the augmentation studies to be meaningful they must also be timely. A high Federal official recently stated that he was confident

that the Colorado River would be augmented by 1990. We certainly hope that is the case. But less than 23 years remain to accomplish this objective. Augmentation could come from any, or a combination of several alternatives, including sea water conversion and weather modification. The critical time demands, however, relate to the possibility that broad scale interstate exchanges of water represent the best solution. If so, many have proclaimed that 25 years' leadtime will be required for such a regional program. The leadtime, however, will be at least 5, and perhaps as much as 10 years longer if the planning studies are deferred until the National Water Commission attempts to first solve the Nation's water policy problems. If that happens, the Southwest will face a major water crisis before the turn of the century.

The Northeastern States have not been asked to defer their regional water planning to await the findings of a National Water Commission. The Northeast U.S. water supply study is already underway.

California is concerned over the possibility of too many national and Federal water bodies and agencies becoming involved in Western States regional water planning. Certainly, every effort is needed to avoid duplication of future planning efforts, and redoing of that which has already been done, and the bypassing of local authorities and expertise. Coordination of existing agencies and commissions is already a most difficult task. The Senate bill to create the National Water Commission, S. 20, as passed by the Senate, obviously seeks to avoid duplication, particularly as regards the Water Resources Council. However, it is equally obvious that the measure does not contemplate the Commission actually performing western, northeastern, or any other specific regional planning effort.

The provisions of the legislation authorizing studies of means of augmenting the supplies of the Pacific Southwest should recognize the planning expertise of the State organizations and the 11-State Western States Water Council. For example, the National Water Commission could be directed to consult with the Western States Water Council in developing policy involving Western States water programs.

We regard the national administration's position as announced by Secretary Udall on February 1, and as contained in S. 1004 and S. 1013, as a long step backward from the regional approach which he initiated in 1963 and which had its first legislative hearing before this subcommittee. The piecemeal approach now proposed by the Secretary avoids the fundamental water problem facing the entire West. The administration's proposal would add materially to the burden of demand on the river without attempting to solve the basic problem of an insufficient supply in the Colorado. California urges the subcommittee to reject the administration's proposal and to continue to seek a regional solution to what is truly a regional problem.

That concludes my statement, Mr. Chairman. If it pleases the committee, we would like to have Mr. Ely present his, and we will all be available for cross-examination by the committee at your pleasure.

Senator ANDERSON. If the committee is willing, I think it is better for Mr. Ely to go ahead and make his presentation now, if there is no objection.

**STATEMENT OF NORTHCUTT ELY, SPECIAL ASSISTANT ATTORNEY
GENERAL, AND SPECIAL COUNSEL TO THE COLORADO RIVER
BOARD OF CALIFORNIA**

Mr. ELY. Thank you, Mr. Chairman.

My name is Northcutt Ely. I am a member of the law firm of Ely & Duncan, Washington, D.C. I appear today as special assistant attorney general of the State of California and special counsel to the Colorado River Board of California. I am accompanied by Dallas E. Cole, chief engineer of that board, and by Burton J. Gindler, deputy attorney general.

Attorney General Thomas C. Lynch of California, who is unable to be here because of prior commitments that take him out of the country, has authorized me to present the following statement on his behalf, as well as on behalf of the Colorado River Board of California.

STATEMENT OF POSITION

I appear in support of S. 861, introduced by Senators Kuchel and Moss. The differences between that bill and Senator Moss' S. 1409 and Senator Allott's S. 1242 are minor. I appear in opposition to S. 1013, the administration bill, and S. 1004, Senator Hayden's bill.

The Kuchel, Moss, and Allott bills, and their counterpart in the House, H.R. 3300 by Chairman Aspinall, all embody the principles on which the seven Colorado River Basin states agreed last year. These were stated in S. 1019, 89th Congress, Senator Kuchel's bill, and in bills introduced in the House by 35 of California's 38 Congressmen and all three of Arizona's. These bills stated the conditions on which the other States could support authorization of the central Arizona project. California's position, as stated in S. 861, is essentially unchanged.

THE REAL ISSUES

All of the bills before this committee have one common denominator: authorization of the proposed central Arizona project. This is in the teeth of the fact that the Colorado River Basin is a water deficient area. The dependable water supply of the Colorado is insufficient to meet the combined demands of the Mexican Treaty burden, existing uses, authorized projects, and the proposed central Arizona project. This is so even with California limited to 4.4 million acre-feet per annum, and I might add, it is so even if uses of the Upper Basin are substantially less than the 7½ million acre-feet apportioned to that Basin by the Colorado River compact.

It is perhaps unusual that most of the controversies about a bill to authorize the three-quarters of a billion dollar central Arizona project do not involve the features of that project. Rather, the real questions are whether the bill recognizes the consequences of the water deficiency that will result and then at least starts to do something about that deficiency in a realistic way.

The bills that we support recognize the situation for what it is. If the central Arizona project is to be authorized, the legislation must also undertake a number of steps in the interests of all the Colorado River Basin States to initiate a realistic solution for the inevitable

water shortage that will follow. These steps implement several principles that were hammered out in the give-and-take of interstate negotiations and legislative proceedings in the House of Representatives that have extended over more than 2 years. In that time, we have developed a delicately structured series of compromises that are inter-related in many ways.

The bills that we oppose would simply authorize the proposed central Arizona project—and stop there. These bills fail to recognize the water shortage problem that will follow, and they do not initiate any kind of a program designed to solve that problem. These bills are all “take” and no “give.”

What are these principles that we insist upon? Why are they important? How are they interrelated? These are the kinds of questions that I shall deal with in the balance of my statement.

1. PROTECTION OF EXISTING PROJECTS

First and foremost, as Mr. Gianelli has said for Governor Reagan, any bill to authorize a central Arizona project must contain a provision to protect existing projects against shortages caused by the water demands for the new central Arizona project. Although existing projects in Arizona and Nevada would thereby be fully protected in their water supply as against the central Arizona project, California's protection would be limited to 4.4 million acre-feet per annum.

What is the protection that S. 861 gives to existing projects? Section 305 provides that whenever there is less than 7.5 million acre-feet available for consumptive use from the main Colorado River for Arizona, California, and Nevada, the central Arizona project's diversions shall be limited so as to assure water to supply the requirements of all existing projects in Arizona and Nevada and of existing projects in California not in excess of 4.4 million acre-feet. In fact, California projects have been using 5.1 million acre-feet for several years, and our projects are designed and constructed to take 5.4 million acre-feet each year. This priority for existing projects as against the proposed central Arizona project terminates when 2.5 million acre-feet of surplus water is imported from another basin into the main Colorado River.

There have been many misconceptions about the bases for this protection. Accordingly, Attorney General Lynch directed the preparation of a brief that would, in reasonably short compass, state the nature of the protection and our reasoning in support of it. We have done that, and our “Brief on the Protection of Existing Projects Against the Proposed Central Arizona Project (California Limited to 4.4 Million Acre-Feet Per Annum)” is annexed to my statement. Appended to that brief are relevant extracts from S. 861, and from the U.S. Supreme Court decree and opinion in *Arizona v. California*. I ask that the brief and its appendixes be incorporated into your record as though read in full.

Senator ANDERSON. Is this the copy of it?

Mr. ELY. Yes, Mr. Chairman.

Senator ANDERSON. Without objection, it will be incorporated at the end of your remarks.

Mr. ELY. I would like to summarize it here just briefly.

The protection of existing projects is a sound proposition—legally, equitably, economically, and morally.

Legally, the provision (1) would implement, not amend, the *Arizona v. California* decree, (2) falls expressly within the congressional authority described by the Supreme Court in its *Arizona v. California* opinion, and (3) would relieve the Secretary of the Interior of the burden of making some shortage allocation.

Equitably, the provision is based upon principles of appropriation law that the Colorado River Basin States recognize internally and the rule of equitable apportionment that the U.S. Supreme Court recognizes in interstate controversies.

Economically, the provision recognizes that construction of a new project, such as the central Arizona project, should not be allowed to destroy or substantially impair existing projects serving established economies in Arizona, California, or Nevada (California alone being limited to 4.4 million acre-feet.)

Morally, Arizona's consistent and repeated recognition of California's right to 4.4 million acre-feet annually justifies our reliance on receiving not less than that quantity.

Arizona's legislature has on three recent occasions enacted legislation to protect existing Arizona projects from demands of the proposed central Arizona project. There is no reason why this principle should stop at the State line.

This formula, proposed in S. 861, is simply the second half of the shortage formula that Congress wrote into section 4(a) of the Boulder Canyon Project Act. It required California to bear the first shock of shortages if the supply should drop to 7.5 million acre-feet, but, in return, recognized California's right to appropriate up to 4.4 million. The effect is that California must give up 700,000 acre-feet of existing uses to reduce these to 4.4 million acre-feet, whenever the annual mainstream supply drops to 7.5 million acre-feet and Arizona and Nevada are using their shares, decreed by the U.S. Supreme Court, of 2.8 million and 300,000 acre-feet respectively. California has built projects at a cost exceeding \$600 million to put that water to use, in reliance on that agreement with Congress. The Project Act contemplated that, if we did so, we could keep 4.4 million of the 5.4 million acre-feet of water that those projects were built to use. Arizona has called this agreement between Congress and the Legislature of California a "statutory compact", and that is a good description of it. We have kept that agreement. Last year the House Committee on Interior and Insular Affairs, in H.R. 4671, 89th Congress, directed the Secretary to keep it. We ask this committee to do so as well.

The effect of an amendment protecting 4.4 million (of 5.1 million) acre-feet of California's existing uses, applied to the Secretary's forecast of water supply, would be this: Arizona's central Arizona aqueduct would have a full supply of more than 1,200,000 acre-feet until 1990, or about 25 years from now. Thereafter, if no imported water arrived, the central Arizona aqueduct diversions would have to gradually shrink, dropping to about 676,000 acre-feet, by the year 2030, about 65 years hence. The Secretary reports that the project could readily pay out on this basis, is quite justifiable, and has an excellent

benefit-cost ratio, all predicated on priority protection to 4.4 million acre-feet of California's existing uses. See the Secretary's summary report, dated February 1967, as reproduced in hearings on H.R. 3300 and S. 20, and similar bills before the Subcommittee on Irrigation and Reclamation of the House Committee on Interior and Insular Affairs, 90th Congress, first session, 93, 94, 96, 98 (1967).

On these calculations, the worst that could happen to Arizona is that, almost 65 years from now, she might have an aqueduct carrying 676,000 acre-feet. But this is more than California can hope for, beginning very soon after the central Arizona project starts its diversions, that is, soon after 1975.

Our supply would then drop from 5.1 million acre-feet presently used to 4.4 million, and the metropolitan aqueduct would be reduced from its present use of 1.2 million to 550,000 acre-feet.

California offers Arizona a fair proposal; that our two States share both the hope that imported water will be brought in, and the risk that it will not. If we are disappointed in this, let both States share the burden in the manner I have just described. This is the result required by the bargain which Congress exacted of us in 1928, to obtain construction of Hoover Dam despite Arizona's obduracy in opposing its construction and in rejecting the Colorado River Compact. We ask Congress to keep this 40-year-old statutory compact with California now, just as California has kept her agreement with Congress.

Senator ANDERSON. Could I ask you one question there?

Mr. ELY. Yes, sir.

Senator ANDERSON. Does this refer to the Self-Limitation Act?

Mr. ELY. Yes, sir.

2. TIMELY AND MEANINGFUL IMPORTATION STUDY

An early and realistic investigation of the extent of the water shortages in the Colorado River Basin and of importation works to remedy those shortages constitutes the second important principle that must be incorporated in any legislation to authorize a central Arizona project. Title II of S. 861 would authorize the Secretary of the Interior to do this job by preparing a reconnaissance report of a staged project under the direction of the National Water Commission (S. 20, establishing that Commission, has already passed the Senate) and the guidance of the Federal Water Resources Council.

If he believes that it would be feasible, and after receiving comments thereon from the affected States and Federal agencies, the Secretary is to proceed with a feasibility report on the first stage of an importation project to bring at least 2.5 million acre-feet of water into the Colorado River Basin, but only if this is surplus to the needs of the area of origin.

This 2.5 million is the quantity which must be added to the river to make possible the consumptive use of 7.5 million acre-feet apportioned by the Supreme Court, whenever Upper Basin uses deplete the river's flow at Lee Ferry to the compact minimum of 75 million acre-feet per decade. This is because 1.5 million acre-feet must flow on through to Mexico and another million is evaporated in transit.

In addition, the first stage may also include up to 2 million acre-feet for the Lower Colorado River Basin, up to 2 million acre-feet for the

Upper Basin (directly or by exchange), and up to 2 million for areas en route to the Colorado. Hence, the floor is 2.5 million and the ceiling is 8.5 million.

We do not say that this is the only possible importation program. A thorough reconnaissance study could well be adequate at this stage. But the program must be timely, so it must start along with this legislation; and the program must be meaningful, so it must be a realistic survey of supply and demand throughout the entire West.

Section 201 (b) and (c) of Senator Moss' S. 1409 directs the Secretary to prepare reports on staged plans for importation projects; but it would require that northern California streams be tapped to provide the water for the first stage to bring 2.5 million acre-feet each year into the main Colorado River below Lee Ferry and to provide up to 2 million acre-feet for use en route to the Colorado River. We have no objection to a study of California's waters—in fact, we encourage it, as Mr. Gianelli has said. But S. 1409 assumes the answer—that northern California streams will provide a feasible and dependable surplus supply. For example, the 2.5 million acre-foot importation that terminates the priority for existing projects must be provided (in the language of section 305(b) of S. 861) "without adverse effect upon the satisfaction of the foreseeable water requirements" of the State of origin. If the Secretary correctly finds that this can be done by an importation from northern California, so be it. This would solve many problems. But let's not prejudice the answer.

3. DEVELOPMENT FUND

A third principle, which is related to the need for importations, is the establishment of a development fund. This fund would be fed by revenues from Hoover, Davis, and Parker powerplants after their respective payouts. It would also receive revenues from the proposed Hualapai powerplant at Bridge Canyon, a subject I shall cover later because it involves more than just money for the development fund. Moneys from this fund will be used primarily to underwrite as large a portion as possible of the reimbursable cost of works to import the first 2.5 million acre-feet of surplus water into the Colorado River. It has some other functions that I shall touch on later. Title IV of S. 861 includes the development fund provisions.

4. PROTECTION FOR STATES OF ORIGIN

Another function of the development fund is to help to implement the fourth principle: protection for states of origin. California is itself a potential area of origin.

S. 861 has several provisions to this effect: Section 202(a) requires the Secretary, in preparing any plans for an importation project, to—

Make provision for adequate and equitable protection of the interests of States and areas of origin, including (in the case of works to import water for use in the lower basin of the Colorado River) assistance from the Development fund established by title IV of this act, to the end that water supplies may be available for use therein adequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River system.

Section 202(b) contains a priority for States of origin that is important enough to quote in full:

(b) All requirements, present or future, for water within any state lying wholly or in part within the drainage area of any river basin and from which water is exported by works planned pursuant to this Act shall have a priority of right in perpetuity to the use of the waters of the river basin, for all purposes, as against the uses of the water delivered by means of such exportation works, unless otherwise provided by interstate agreement.

There is other language for protection of areas of origin in the bill. For example, section 203(c) provides that the Secretary can proceed with a feasibility study for the first stage of an importation plan if, and only if, his reconnaissance study shows, among other things, "that a water supply surplus to the needs of the area of origin exists."

5. HUALAPAI PROJECT AT BRIDGE CANYON

The Hualapai Dam, powerplant, and reservoir at Bridge Canyon should be considered as a separate fifth principle. The combined hydro-pumped storage project, and its powerplant with an installed capacity of 5 million kilowatts, has been proposed by the Los Angeles Department of Water and Power. Mr. Goss of that department will testify later. The Hualapai project is important for three reasons:

(1) It has a valuable economic asset, providing the flexibility of instant starting hydroelectric power for peaking and reserve capacity for systems within its service area. To those who may doubt its feasibility, we would propose the use of the section 4(b) device of the Boulder Canyon Project Act: The Secretary can be required to have in hand contracts with responsible entities for repayment of the project before he can begin to build it.

(2) The Hualapai project will, after its payout, pour many hundreds of millions of dollars into the development fund. The Los Angeles Department of Water and Power has estimated that this could reach \$2 billion at the end of 75 years. House hearings, *supra*, p. 7, at 599.

(3) Finally, the 95-mile Hualapai Reservoir will provide an important recreation facility by making this magnificent canyon area accessible to millions of people. The reservoir would encroach on the Grand Canyon National Park only minutely, by raising the water surface a maximum of 89 feet, which gradually reduces to zero, and only along 13 miles of the park's northwesterly boundary. The 145 miles of canyon from Glen Canyon to the Hualapai Reservoir would remain as it is—untouched, except for the regulated streamflow from Glen Canyon Dam, which makes it reasonably accessible to those who wish to navigate it.

In 1967, the Sierra Club estimated that "since Major Powell pioneered the Colorado River in 1869, barely a thousand people have run the majestic Marble and Grand Canyons." The balance then is this: On one hand, we leave 145 miles of river through an untouched canyon area for the next thousand people who wish to "run" its regulated flows. On the other hand, we have 95 miles of Hualapai Reservoir, which is expected to have about twice that thousand people every visitor-day and totaling nearly 500,000 people each year.

6. HOOVER-GLEN CANYON OPERATIONS COMPROMISE

A sixth principle is the balancing the operation of Lake Mead behind Hoover Dam and Lake Powell behind Glen Canyon Dam, so that the benefits of the wet years and the burdens of the droughts are equitable distributed between those Lower and Upper Basin reservoirs. The compromise language worked out by the State and Federal representatives last year is noncontroversial, and is included in all the bills.

Section 601(b) (1) of Senator Allott's S. 1242 adds an additional mandate to the Secretary, that he must not impair the Colorado River compact appointments to either the Upper Basin (7.5 million acre-feet per annum) or the Lower Basin (8.5 million acre-feet per annum). Unfortunately, there is simply not enough water in the Colorado to make this workable, and hence it should be deleted. Senator Allott is to be commended, however, for pointing out in another way the need for importations to meet the longstanding aspirations of both the Upper and Lower Colorado River Basins.

7. RECOGNITION OF THE MEXICAN TREATY BURDEN AS A NATIONAL OBLIGATION

A seventh principle is the recognition of the Mexican Treaty burden as a national obligation. Section 201(d) of S. 861 does this, and provides that when 2.5 million acre-feet of surplus water is imported into the Colorado River, the basin States are then relieved of their obligations under article III(c) of the Colorado River compact to relinquish water to service that treaty burden. Section 401 declares in effect that all costs associated with importation of surplus water to service the Mexican Treaty burden shall be nonreimbursable. If the treaty burden is taken as 1.8 billion acre-feet (1.5 billion delivery at the boundary plus 300,000 associated losses en route); this means that of a 2.5-million-acre-foot importation, the development fund would then have to finance only the remaining 700,000 acre-feet.

8. UPPER BASIN PROJECT AUTHORIZATIONS

An eighth principle involves the authorization of five projects in the State of Colorado. We support these authorizations, which are found in title V of S. 861.

CONCLUSIONS

In conclusion, we reiterate that any bill to authorize a central Arizona project must recognize and implement these eight principles.

We do not seek to delay authorization of the central Arizona project, even though its water demands will require California to cut its present uses from 5.1 to 4.4 million acre-feet per annum. We do ask that the legislation face the grim realities of water deficiency in the Colorado River Basin and do something about it—and do it now. The principles incorporated in S. 861 could do that job.

Mr. Chairman, in addition to the brief of Attorney General Lynch which you have kindly included in the record, may I ask to have in-

cluded also a statement of Raymond R. Rummonds, the chairman of the Colorado River Board of California, to which is annexed the resolution of that board dated March 1, 1967; a statement by Dallas E. Cole, chief engineer of the Colorado River Board of California; and a resolution of the Colorado River Board of California dated April 5, 1967, endorsing the 500 million kilowatt Hualapai powerplant, and also a map of the California developments on the Colorado River.

Senator ANDERSON. We sometimes have trouble with maps, but we will include these matters without objection in the record after the brief you have inserted.

Senator Hayden wishes to make a comment. He is very much interested in this bill.

Senator HAYDEN. Mr. Chairman, I don't have any questions to ask my friend from California, but I do want to make a statement at this time for myself and Senator Fannin on the California priority issue.

S. 1004, unlike some other bills concerning the central Arizona project, offers no guarantee of minimum deliveries to California in times of shortage. It would leave the allocation of shortages to the Secretary's judgment under the circumstances then existing—which is the way the Supreme Court left it.

The California Senators will agree that this has been a troublesome issue. At one point we suggested as a compromise that a 4.4 priority be accorded to California for a period of 25 years—but not in perpetuity. We believed that this would give California assurance of a dependable water supply during the period that our mutual long-term water problems were being worked out. However, our suggestion was not acceptable.

Our unwillingness to agree to a 4.4 million acre-feet California priority in perpetuity is neither an arbitrary nor an unreasonable position. An unconditional priority to California in perpetuity has the potential of placing on Arizona—and the other so-called inland States—the entire burden of augmenting the water supply of the Colorado River in preparation for the years of short supply in the Colorado River Basin. The people of Arizona must look solely to the Colorado River system for their water needs—while the citizens of southern California look not only to the Colorado River and the abundant water in the northern part of their own State—but to the entire Pacific Ocean. It may well be that the people of the thickly populated coastal plain of southern California will find these alternate sources ultimately less expensive and more adequate than a program to augment the Colorado River—in which event they would have little, if any, interest in aiding the inland States with the obviously difficult and expensive task of supplementing the water supply of the Colorado River. If, under these circumstances, California were to be guaranteed annual minimum of 4.4 million acre-feet, the water supply of the central Arizona project would be progressively curtailed to provide a permanent supply of 4.4 million acre-feet for California out of the Colorado River— notwithstanding the fact that the people of the California coastal plain may have solved their water problems by looking to alternate sources. It is our belief this would be inequitable—and would be one of the circumstances to which the Secretary would

give consideration if the allocation is left to him to determine at the time shortages occur.

This is unquestionably the type of thing the Supreme Court had in mind when it refused to accept the special master's recommendation that shortages be prorated under a suggested rigid formula. The Court said:

* * * While pro rata sharing of water shortages seems equitable on its face, more considered judgment may demonstrate quite the contrary. * * * This choice, as we see it, is primarily his, not the Master's or even ours. And the Secretary may or may not conclude that a pro rata division is the best solution.

In further justification of leaving the decision to the Secretary's judgment, under circumstances then existing, the Court said:

It must be remembered that the Secretary's decision may have an effect not only on the irrigation uses but also on other important functions for which Congress brought this great project into being—flood control, improvement of navigation, regulation of flow, and generation and distribution of electric power. Requiring the Secretary to prorate shortages would strip him of the very power of choice which we think Congress, for reasons satisfactory to it, vested in him and which we should not impair or take away from him. * * *

And in its concluding remarks on this issue, the Court said:

None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation. * * *

A 4.4 priority to California—on California terms—actually changes and reverses the decision of the Court. The basic question in the litigation arose from California's assertion that the prior appropriation doctrine should apply to the Colorado River—thus conferring a priority for existing California projects over the central Arizona project yet to be built in Arizona.

The Supreme Court of the United States clearly held that the law of prior appropriation does not apply to the waters of the Colorado River below Lee Ferry. The Court said:

* * * For the same reasons we cannot accept California's contention that in case of shortage each State's share of water should be determined by the judicial doctrine of equitable apportionment or by the law of prior appropriation. These principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress with full power to do so, has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency under a statutory scheme.

This decision came as a result of a directive of the Congress to both Arizona and California to submit their differences about the division of these waters to the highest court—as a prerequisite to further legislation by the Congress.

Now, if the Congress agrees to this California demand and imposes on Arizona the burden of guaranteeing the delivery of 4.4 million acre-feet each year to California from Arizona's own scarce supply—it will have effectively reversed the U.S. Supreme Court on this basic issue of the lawsuit. Further, such action by the Congress would have the effect of amending the Boulder Canyon Project Act—so carefully examined and interpreted by the special master and the Court. The Court has ruled. We suggest that the Congress—and, hopefully, the State of California—should be willing to accept and abide by the

Court's decision. The Congress should unequivocally reject this California proposal to legislate away Arizona's hard-fought, precious victory.

The Congress having selected the Court to be the arbiter of this problem—and the Court having decided it after 12 long years of litigation—it now seems inappropriate for the Congress to consider California's plea that the decision be reversed by congressional edict.

We are willing to rely on the Secretary of the Interior—whoever he may then be—to exercise his good judgment when the years of short supply begin to come along. This may work to Arizona's advantage—or its disadvantage—depending on the circumstances existing in the Southwest at that time.

Adjustments in times of shortage depend on the overall water supply as it exists at that particular date. Establishment of priorities by act of Congress is not suited to making these adjustments as they occur from time to time.

We are firmly convinced that the solution which the Congress reached in enacting the provisions of the Boulder Canyon Project Act—a solution which the Supreme Court affirmed—namely, to leave the adjustment to the judgment of the Secretary—is the only intelligent, statesmanlike way of resolving the problem, “* * * in harmony with the act, the best interests of the basin States, and the welfare of the Nation.”

I thank you, Mr. Chairman.

Mr. ELY. In view of Senator Hayden's remarks, Mr. Chairman, I think the committee may desire to have in the record at this point the language with respect to the decree on the shortages and the language of the Supreme Court on that point.

Senator ANDERSON. We have it in last year's record. We can use it again.

Mr. ELY. I think it would be appropriate here in view of Senator Hayden's comments, with which we take issue.

The Supreme Court's opinion said:

* * * Congress still has broad powers over this navigable international stream. Congress can undoubtedly reduce or enlarge the Secretary's power if it wishes.

The decree that the Court thereupon entered stated as follows, with respect to shortages. It is short, it is controlling, and I think the committee should have the language before it.

Article 2(b) (3) of the Supreme Court's decree says this:

If insufficient main stream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumption use of 7,500,000 acre-feet in the aforesaid three States [i.e. Arizona, California, and Nevada], then the Secretary of the Interior, after providing for satisfaction of present perfected rights in the order of their priority dates without regard to State lines and after consultation with the parties to major delivery contracts and such representatives as the respective States may designate, may apportion the amount remaining available for consumptive use in such manner as is consistent with the Boulder Canyon Project Act as interpreted by the opinion of this Court herein, and with other applicable Federal statutes, but in no event shall more than 4,400,000 acre-feet be apportioned for use in California including all present perfected rights * * *.

We are now considering the “other applicable Federal statute” which would control shortages. The formula that we present to you is that upon which Arizona and California agreed last year, evidenced

by the introduction of the bill by all three of Arizona's Congressmen, 35 of California's, containing identical language on the shortages. It reads exactly as in S. 861. This was the compromise worked out in the February 1965 under the chairmanship of Secretary Udall, by the delegations of Arizona and California and their Governors, that the 4.4 protection should continue until 2.5 million acre-feet of water had been imported into the river.

California has not changed its position from that agreed position of last year.

Senator ANDERSON. Reading from the top of page 2, you say :

The Kuchel, Moss, and Allott bills and their counterpart in the House, H.R. 3300 by Chairman Aspinall, all embody the principles on which the seven Colorado River Basin States agreed last year.

Mr. ELY. Yes.

Senator ANDERSON. Do you have some agreement on that?

Mr. ELY. Yes.

Senator ANDERSON. Was there agreement on that?

Mr. ELY. Yes, I think it is fair to say.

Senator ANDERSON. Was Governor Love agreeable to that decision?

Mr. ELY. Governor Love of Colorado?

Senator ANDERSON. Yes.

Mr. ELY. Yes, I believe so. He testified in favor of this bill, H.R. 3300, as well as the agreed bill last year, H.R. 4671.

Senator ANDERSON. I thought he at one time had some questions about it. I know I had various questions about it. I was not a party to it, but I do not believe the seven States all agreed to it and I just wanted to weigh that notice. I am not objecting to your statement at all, but I did not know if that was actually so.

You again say at the top of the page :

Last year the House Committee on Interior and Insular Affairs, in H.R. 4671, 89th Congress, directed the Secretary to keep it.

Did he do that?

Mr. ELY. Yes, sir; H.R. 4671, 89th Congress, as reported out by the House Insular Affairs Committee, contains identically the same language of shortages that H.R. 3300 and S. 861 do in this Congress.

Senator ANDERSON. I understand that, but did it direct the Secretary to do certain things?

Mr. ELY. Yes; this is the language before you. It directs the Secretary, in the event of shortage, what to do. He shall first satisfy present perfected rights. He shall then, in the event that the water is insufficient to supply 7.5 million acre-feet, curtail deliveries to the central Arizona project in order to enable existing projects to survive to the extent stated.

Senator ANDERSON. I simply question where you said the House committee directed the Secretary to keep it.

Mr. ELY. We think—

Senator ANDERSON. They did not direct it at all. They passed a resolution and the bill never got to the floor.

Mr. ELY. I said the House Committee on Interior and Insular Affairs did this. I am not saying the House of Representatives did. The language before you, in other words, is as reported out by the House committee.

Senator ANDERSON. I do not question that.

I do not think there was any direction to it at that time.

Senator Kuchel?

Senator KUCHEL. First I would like to say to Mr. Gianelli that the statement of the Governor of California is an excellent addition to this record. Governor Reagan has represented in my opinion not only the best interests of the people of California, but the best interests of the people who reside in the Colorado River Basin States, and I want to say both to you and to Mr. Ely that together you have demonstrated to the members of this committee and to the Congress a way by which our hard-pressed neighbors in Arizona can look forward to the construction of the central Arizona project, and look beyond that to the additional waters which they will require to support their economy and their growth in future years.

I want to say to the members of this committee, and particularly to the dean of the Senate, who is held in the highest esteem by all of us, that I very much grieve his position and that of our beloved colleague on the Republican side, Paul Fannin, with respect to this question of protection of existing uses.

I want to try, for the benefit of our committee when we get into trying to create a bill, to display just as courteously as possible why I believe the other side of this argument is the one that should appeal to the members of this committee.

It is true that in the last Congress, the two distinguished Senators from Arizona suggested that they would approve of a reduced guarantee to California for a period of 25 years.

I am going to ask Mr. Ely this question:

You have attended all the hearings on this tragic controversy over the years. You have heard engineers speak here representing the Bureau of Reclamation and State governments. What is your recollection as to the time at which the Lower Basin will be faced with a depleted streamflow at Lee Ferry in the amount of 7.5 million acre-feet?

Mr. ELY. If the virgin flow at Lee Ferry is of the general order of 15 million acre-feet, then I believe the engineers are in general agreement that whenever the Upper Basin depletions rise to a figure between 5 and 5.5 million acre-feet, the quantity available for use by Arizona, California, and Nevada, after giving respect to the Mexican Treaty, and taking into account intervening losses, will drop below the 7.5 million acre-feet apportioned by the Supreme Court.

Senator Kuchel, I should add that there are caveats because of the inclusion or exclusion of deliveries by the Upper Basin at Lee Ferry, of water to supply half of the treaty burden. This is a question in dispute, unresolved, but which would be resolved by this bill. Both basins would be relieved of the treaty burden when the 2.5 million acre-feet is imported.

Senator KUCHEL. What period of time generally will elapse before there will be a problem of depleted flow?

Mr. ELY. I have the figures in mind, but the experts who have developed these figures are present, and I would rather defer to Mr. Cole or Mr. Maughan.

Senator KUCHEL. Will either of you gentlemen state how many years will elapse before there is a depletion?

Senator ANDERSON. Will you identify yourself for the record?

Mr. MAUGHAN. Yes, I am Don Maughan with the California Department of Water Resources. The best estimates indicate that Colorado River augmentation should be accomplished by about 1990.

Senator KUCHEL. I want that fact to be accepted by the committee or I want anyone who disagrees with it to bring forward engineers to say something else, because I say respectfully that if you are going to build a project and have it completed on or about 1975, and you are going to provide for a 25-year guarantee for existing use in my State, you accomplish nothing. The 25 years will come and go with no need for such a guarantee; is that not correct?

Mr. MAUGHAN. Yes; probably so.

Senator KUCHEL. In other words, the problem of insufficient water will arise about 25 years after the central Arizona project is built; is that not correct?

Mr. MAUGHAN. Well, 1990 is only about 15 years after the central Arizona project could be completed, but is about 25 years from now.

Senator KUCHEL. More or less.

Mr. MAUGHAN. More or less.

Senator KUCHEL. Mr. Ely, what was the wording in the bill introduced by Congressman Udall of Arizona last year with respect to this guarantee?

Mr. ELY. Precisely identical with the language contained in your bill, S. 861, Senator Allott's bill, and Senator Moss' bill now before the committee.

Senator KUCHEL. Will you describe it?

Mr. ELY. Yes, sir.

In S. 861 it appears as section 305 (a) at page 20, line 4. It provides in substance that article 2(b) (3) of the decree of the Supreme Court, which is the language I read you a moment ago, shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream water available for release to satisfy the consumptive use of 7.5 million acre-feet in Arizona, California, and Nevada, diversions from the main stream for the central Arizona unit shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed and by other existing Federal reservations in that State of 4.4 million acre-feet of main stream water, and by years of the same character in Nevada.

It goes on to say:

The water users in the State of Nevada shall not be required to bear shortages in any proportion greater than it would have been imposed in the action of this section 305 (a).

It continues that this section would not affect the relative priorities among themselves of water users in Arizona, Nevada, and California, which are to have diversions for the central Arizona unit or amend any provisions of said decree.

This language was accepted by Arizona because California, on her part, was willing to accept the language in section 305(b). This is

the compromise known as the Lynch amendment, because Attorney General Lynch of California proposed it and Arizona accepted it. It says that:

The limitations stated in paragraph (a)—

that is the limitation on Central Arizona that I have just read—

shall cease whenever the President shall proclaim that works have been completed and are in operation, capable in his judgment of delivering annually not less than 2.5 million acre-feet of water into the main stream of the Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado River system, and that such sources are adequate in the President's judgment to supply such quantities without adverse effect upon the satisfaction of foreseeable water requirements of any state from which such water is imported into the Colorado River system.

Senator KUCHEL. What you have just read appears in the legislation which was introduced in the House of Representatives in the last Congress, with the approval of Representatives of the Colorado River Basin States; is that not correct?

Mr. ELY. That is correct.

All three of Arizona's Congressmen introduced bills bearing their name, containing this language, and it appeared in the bill as reported out by the House committee as well as in bills introduced by yourself, by Senator Murphy, and by 35 of the California Congressmen. Those 35 bills, sponsored by Californians, carried authorization for the central Arizona project in recognition of this bargain, this agreement.

Senator KUCHEL. I would like to ask Mr. Gianelli, is it fair to say that the State administration in California favors legislation similar to that which Senator Allott and Senator Moss and I have introduced in this Congress?

Mr. GIANELLI. Yes; that is substantially the case, Senator.

What we have tried to do at our State administration level is indicate some principles which we think should apply to any legislation that is enacted.

There are two things that we feel very strongly about. First, the Colorado River certainly needs augmentation. Until the supplies of the Colorado River are augmented, the real problem in the entire basin is not solved.

Second, California has spent considerable money on water projects in developing its existing economy, and we feel that those projects and the existing economy have to be protected.

The example that I used in my statement is the Metropolitan Water District aqueduct and distribution system. It represents an investment of over one-half billion dollars. It is just unthinkable that we would do anything which would dry up that aqueduct.

Senator KUCHEL. The citizens of California invested that much money in an aqueduct with the full knowledge that the Congress had passed a law saying that the State Legislature of California should limit itself, and with the full knowledge that the State Legislature of California did; is that not true?

Mr. GIANELLI. That is correct, and this was based upon a water supply which was anticipated would be available in the stream. The fact that the water supply is not available in the amounts originally

estimated does not take away from the fact that existing economies certainly should be protected.

Senator KUCHEL. Mr. Gianelli, I agree with you. As you have suggested in your excellent statement, to solve this problem, augmentation of the water supply in the basin is paramount.

Mr. GIANELLI. There is no question about that, Senator.

Senator KUCHEL. The Senate passed, the House passed, and the President will sign in the next few days, a bill which you have recommended, by which the Federal Government will spend \$72.2 million as part of an agreement in which the city of Los Angeles, the Metropolitan Water District of Southern California, and two private utilities will participate at a cost of approximately \$445 million in the construction of an island off the shore of Orange County, nuclear powerplants to manufacture electric, and of highest importance, facilities to change the waters of the sea into 150 million gallons of potable water a day to run into the metropolitan system.

When you translate 150 million gallons a day into 168,000 acre-feet a year, then the members of this committee will see why we are anxious for a breakthrough with respect to waters of the sea; so far what is anticipated is rather miniscule in solving our problem.

Mr. Gianelli, Secretary Udall yesterday, spoke against the position which you and Mr. Ely have taken here today, and spoke at considerable length about what he described rather colorfully as rivers in the sky, a program under which the heavens would open, and with a little prodding by man, would be able to solve this problem.

The Senator from Colorado over the years has offered amendments in our Appropriation Committee to carry on this work. The Senator from California has supported him under the chairmanship of the dean of the Senate from Arizona, and I would hope that we may go along and develop something tangible along those lines, but the fact is we have not done it yet.

That leaves importation, and I want my friends in Arizona to understand what has been testified to here today by the representative of the Governor of California—that California urges this legislation to include a directive to the Secretary of the Interior to study the possibility of utilizing northern California river streams as one potential source along with all other potential sources to solve the problem, not for California but for the Lower Basin; indeed, for the basin as a whole.

Do I state your position correctly?

Mr. GIANELLI. Yes; that is correct, Senator.

However, I would like to elaborate with respect to the north coastal supply. California has made studies of its own with respect to its future water requirements, and we estimate that by about 1990 our State will have to start using a considerable part of the economically exportable supplies from its north coast, in order to meet the requirements within the State. We are certainly concerned over the possibility of those supplies being permanently dedicated to meeting the problems of the Colorado River, then come a time when we need these north coastal supplies to meet our other requirements in the State. We need State of Oregon protection so that these supplies, or equivalent supplies, will be available at no greater cost, as our statewide water requirements grow.

This is why we take the position that we are very willing to have the north coast of California studied, but it must be studied along with other possible sources of augmentation, so that it does not become the sole target of such studies. This is our concern.

Senator KUCHEL. Is that not another reason why the State government of California favors the language which has been written into the bill that I have introduced, the same language I am sure that appears in the other two bills, which in directing the Secretary to study all potential additional water supplies, says that protection be given to the area of origin.

Mr. GIANELLI. That is correct.

Senar KUCHEL. I want that to be very clear, gentlemen.

I see my good friend, Congressman Udall, here, who is one of the fine members of the Congress, and this provision appeared in the bill which my able friend from Arizona introduced last year with the jubilant and enthusiastic approval of all of us.

I think this is most important, because we can have a bill, gentlemen, that will build an aqueduct that is necessary and a reservoir and public works in your State. We can continue the partnership that we found available to us last year, but we can go forward, more importantly, and have this Federal Government determine how best to satisfy the future needs of the people of Arizona in water and every other basin State as well.

That is what I am pleading for, and I do not think, if I may say so with greatest respect, we ought to stumble over what ought to be an immediately acceptable agreement that the equities and the law ought to recognize that present use anywhere ought to have higher stature than future use. The Legislature of the State of Arizona did the wise thing in passing a law that says when the central Arizona project comes into being, prior use in the State of Arizona of Colorado River watershed shall take precedence over newly created uses.

That is all I think we ought to provide in the bill that we have here.

I am honored to sit up here and listen to the representatives of the State of California and I hope that what you have recommended may be given the most earnest and thoughtful consideration by my colleagues in arriving at a constructive bill.

Senator HAYDEN. Would my friend, the Senator from California, be kind enough to inquire of the witness as to how many members of the Committee on Interior and Insular Affairs of the House of Representatives are from California and how many are from Arizona?

Senator KUCHEL. How many are there?

Mr. ELY. I will be glad to answer that.

There are five distinguished Congressmen from California on the House Interior Committee. All five voted for the central Arizona project. All five introduced bills to authorize it. Had they voted against it, the bill would not have had the votes to get out of subcommittee.

That committee also has on its membership the distinguished Congressman from Arizona, Morris Udall, who gave leadership to this entire joint venture. Without his leadership, this unity in the basin would never have been achieved, and one of the tragedies that we face today is that the leadership of Morris Udall in the last Congress,

which five California members on that committee followed, has faltered. We hope it will be renewed.

This year Arizona has an additional member, a fine new Congressman, Mr. Steiger.

Senator KUCHEL. We are going to try to help Mo get out of the stew. I asked consent yesterday that the text of the Arizona statute be placed in the record, and I have it here. I ask consent that it be placed in the record at this point.

(The statute referred to follows:)

Ours is the same principle that the Arizona legislature has twice enacted to protect existing Arizona projects against the central Arizona project. A 1961 Arizona statute appropriating funds to study the central Arizona project under contract with the Bureau of Reclamation subordinates that project's rights to those of all existing contractees and users of main stream water in Arizona:

"[T]he contract with the bureau of reclamation shall provide that the investigations and studies shall be restricted to only that quantity of water which may be available for use in Arizona, after the satisfaction of all existing water delivery contracts between the secretary of the interior and users in Arizona for the delivery of main stream water, and that nothing shall be done thereunder which will impair existing rights in Arizona for the diversion and use of Colorado River water."⁸

Similarly, a 1962 statute amending the authority of the Arizona Interstate Stream Commission embodied the same principle:

"B. The powers and duties herein given the Arizona interstate commission shall be limited and restricted to only that quantity of water which may be available for use in the state of Arizona, after the satisfaction of all existing contracts between the secretary of the interior and users in the state of Arizona for the delivery of water of the main stream of the Colorado river, and shall not extend to any such contracts, any amendments or supplements thereto, or to any federal statute enacted before the effective date of this section pertaining to any federal reclamation project within the state of Arizona constructed and using water of the main stream of the Colorado river before the effective date of this section. Nothing shall be done hereunder which will impair existing rights in the state of Arizona for the diversion and use of Colorado river water."⁹

Senator KUCHEL. I have no more questions.

Senator ANDERSON. Mr. Ely, the reason I questioned you about this matter where you said the seven Colorado Basin States agreed to the principles embodied in the Kuchel, Moss, and Allott bills, did Senator Hayden and Senator Fannin agree to it?

Mr. ELY. No; Arizona's three Congressmen and Arizona's Governor did.

Senator ANDERSON. You would not say a seven-State agreement had been reached if they did not, would you?

Mr. ELY. I ask to be excused from answering that. I do not know where the political balance in Arizona is and that is one of our troubles today.

Senator ANDERSON. You are trying to claim that a seven-State agreement was reached. It never was reached, and Senator Hayden and Senator Fannin did not agree.

Wyoming backed out of it, did they not?

Mr. ELY. Wyoming did not support the bill as reported out of the committee. It did support the bill that the seven States testified in favor of before the committee. Wyoming dissented from the weakening of the importation provisions that the full committee decided to offer as a compromise.

⁸ Arizona laws 1962, ch. 39, sec. 2, at 108.

⁹ Arizona laws 1962, ch. 109, sec. 1B, at 258.

Senator ANDERSON. And you yourself have a firm position on this all the way through?

Mr. ELY. California and her spokesmen, including myself, had a firm position throughout indeed, and do now. We regret the weakening of the—

Senator ANDERSON. I thought you testified before the Rules Committee of the House.

Mr. ELY. No; let me clear this up. The Rules Committee never held hearings.

Chairman Aspinall of the House Interior Committee has the responsibility, the sole responsibility of the decision whether to seek a rule for a bill reported out by this committee. Chairman Aspinall has stated publicly that he, the chairman, made the decision not to take his bill to a hearing in the Rules Committee, and that he did so because of the apprehension that with such a short time remaining before adjournment, a substitute proposed by Congressman Saylor, the ranking Republican on that committee, might well be adopted. That substitute took out of the bill everything that the other States had insisted be placed in it, with the exception of authorization of the central Arizona project.

California's delegation, after mature consideration, supported Chairman Aspinall's decision.

I recommended that they should so support it. I know of no responsible Californian who did not join in that recommendation.

Senator ANDERSON. Senator Allott?

Senator ALLOTT. Thank you, Mr. Chairman.

I have only one or two comments, and by and large, although not completely, I agree with the statements of the California group, particularly as it respects the development of an overall Colorado River Basin policy, and I think it might be wise, since you, Mr. Ely, have referred repeatedly to the bill offered by your Senator, Senator Kuchel, which is substantially the same as the other bills offered by Senator Moss and by Senator Dominick and myself, to point out here that in section 201 (a) (2), the bill provides that they will:

Investigate sources and means of supplying water to meet the current and anticipated water requirements of the Colorado River Basin, including reductions in losses, transportation from sources outside the natural drainage basin of the Colorado River system, desalinization, weather modification and other means.

And then under section 202 (a) that:

In planning works to import water into the Colorado River system from sources outside the natural drainage areas of the system, the Secretary shall make provision for adequate and equitable protection of the interests of the states and areas of origin—

And I want to underline the word "origin"—

including in the case of works to import water for use in the Lower Basin of the Colorado River assistance from the development fund established by Title IV of this Act to the end that water supplies may be available for use there inadequate to satisfy their ultimate requirements at prices to users not adversely affected by the exportation of water to the Colorado River System.

I assume, and I put the interpretation on this, that the studies which are contemplated are to be made with the complete equitable and

moral considerations of any of the States which might be affected by importation.

Mr. ELY. That is our confident expectation. Those of us who have participated in the drafting of that language, I am sure, would all agree with that.

Senator ALLOTT. And in your statement you emphasize that you have no objection, in fact you would welcome the study of California water along with other water as a possible source for the importation of water into the Colorado River Basin.

Mr. ELY. Both Mr. Gianelli and I have so expressed ourselves.

Senator ALLOTT. You were present yesterday, all of you, at the complete hearing I believe; is that correct?

Mr. ELY. Yes.

Senator ALLOTT. Most of the hearing certainly.

Mr. ELY. Yes.

Senator ALLOTT. What is your view with respect to the Colorado projects, the five Colorado projects which are included in the Moss, Kuchel, and Allott bills, with respect to the future development of Colorado?

Is it not true that unless all five projects are authorized, Colorado cannot achieve any significant part of the water development given to it as a combination of the Colorado River compact and the Upper Colorado River compact and the Upper Colorado River Projects Act?

Mr. ELY. We have testified that we support the inclusion of all five of the Colorado projects in the pending legislation. The total quantity required, I am told, is of the order of 370,000 acre-feet. This, added to the quantity required by projects already authorized in Colorado or in advance planning stages, would leave Colorado within the quantity which would be available to her as $51\frac{3}{4}$ percent of the water supply to which the Upper Basin would be curtailed by performance of the compact obligations.

This leaves one caveat, as I mentioned earlier, the effect of the treaty burden upon the Upper Basin. But so far as we are concerned in California, we regard the authorization of the five projects as being equitable. We do not regard it as carrying the State of Colorado to a point where we would be in any real disagreement with you, no matter how the dispute over the treaty burden were resolved.

Senator ALLOTT. I think we will present, in behalf of Colorado testimony, Mr. Ely and the gentleman from California, which indicates that even under the present historical flows, that once the five Colorado projects are authorized, we will still be a considerable amount short of the amount allocated to the State of Colorado.

During the questioning of the Secretary yesterday, I asked him a question to which I did not receive a very satisfactory answer, and I was referring to the summary report of the central Arizona project, particularly to the table on page 21, and which I believe is on page 96 of the House hearings.

Mr. ELY. Yes.

Senator ALLOTT. I do not have the House hearing in front of me:

And if the present bill was passed, would it be fair to say that during the portion of the years between now and the authorization of the additional Colorado

projects, that it would be water which is legally and morally the property of the State of Colorado, which would go into the Central Arizona project and be sold by that project for the purposes of paying for it?

Mr. ELY. It would certainly be water which Colorado would have a right to put to use in accordance with the Colorado River compact, the Upper Basin compact. There might be a difference in choice of words as to who owns it, but in any event, the result is unquestionable that the water to which Colorado has a right in perpetuity, whenever you put it to use, would in fact be used in the interval by the central Arizona project.

Senator ALLOTT. I stand corrected. I did not realize I used the word "owned," but I think we understand each other.

Mr. ELY. Yes, quite so.

I do not mean to quibble over that.

In support of what you say, Senator, you might refer to section 603(a) of your bill, the Kuchel bill and the Moss bill, which says that:

Rights of the upper basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River Compact shall not be reduced or prejudiced by any use of such water in the lower basin.

Senator ALLOTT. But until the additional projects are authorized and constructed, and financed, to the extent that they would put to a beneficial use the Colorado River water, that water would come down the river and flow into the central Arizona project, and the sale of that water would then help to finance the central Arizona project. This is a fact, is it not?

Mr. ELY. That is a fact.

I do not mean to draw from that any conclusion adverse to Arizona's right to do this; because under article III(e) of the Colorado River compact, the two basins have agreed that the Upper Basin shall not withhold water, and the Lower Basin shall not require the delivery of water, not required for beneficial consumptive use. Each of us in effect has a right to use water not currently demanded for consumptive use in the other basin.

Senator ALLOTT. You are entirely correct, of course.

I simply wanted to call attention to the fact of the equities which do exist in favor of Colorado in this situation, and I do not intend and I am not trying in any way to derogate or arrogate the central Arizona project to an unfeasible or any inequitable aspect.

I only want to point out that the failure to authorize the additional Colorado River projects placed them in a position where they may receive benefits to which the State of Colorado might have reasonably and morally and equitably and, I believe, legally assert its ownership or assert its right. I will use that word.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Thank you, Mr. Chairman.

It is certainly a pleasure to have you gentlemen here with us today; I welcome you, my former fellow Arizonan, Mr. Ely, and other representatives of our great neighbor to the west.

In your statement, Mr. Ely, on page 5 you go into some matters that I would like to discuss and ask questions about your reasoning.

First of all, you say that legally the 4.4 priority is a matter that you feel is justified.

Now, did the Supreme Court of the United States, in deciding that Arizona was entitled to 2.8 million acre-feet per year, make it a condition of that entitlement that Arizona give a priority to California of 4.4 million acre-feet per year?

Mr. ELY. No.

The apportionment to Arizona, however, of 2.8 million is if, and I underscore "if," 7.5 million is available.

Senator FANNIN. Would you repeat that?

Mr. ELY. I say the apportionment to Arizona is 2.8 million acre-feet if 7.5 million acre-feet is available under article II (b) (1) of the decree.

Senator FANNIN. Then how about the 4.4 to California?

Mr. ELY. The 4.4 to California apportioned by the Court is a recognition of the quantity, and that is where it is derived, the quantity stated in section of 4(a) of the Boulder Canyon Project Act. This, in substance, required California, by act of her legislature, to limit her use to 4.4 million acre-feet of the first 7.5 million plus one-half of the excess or surplus water not apportioned by the compact. It placed a ceiling upon California's appropriations to that extent—water which has, in fact, been appropriated and put to use up to that ceiling.

The 4.4 million, therefore, is in a different category from waters not put to use either in California or Arizona or Nevada. The shortage formula in article II (b) (3) of the decree recognized this by saying that any formula imposed, in the event of shortage, cannot give California more than 4.4 million, with the plain implication that it can give California up to that quantity.

Senator FANNIN. It can, but in your statements previously you have said "must."

Mr. ELY. I have said that the principle which this committee, this Congress should adopt, indeed must adopt if you are not to break with 100 years of tradition of western water law, is to recognize existing use in any shortage formula.

Senator FANNIN. Did you make this argument to Mr. Rifkin in the Supreme Court case?

Mr. ELY. We did.

Mr. Rifkin disagreed with us and wrote into his recommendation a proration formula, that in the event of shortage California shall get only 44/75. But the U.S. Supreme Court, on the only issue upon which all the Justices were unanimous, rejected the master's proration formula.

Three Justices committed themselves to the principle of protection of existing use of equitable apportionment. Five Justices did not commit themselves, said there is nothing here to decide. Arizona did not get any vote at all for the special master's formula.

Senator FANNIN. But the decision was adverse to your position. You recognize that?

Mr. ELY. On the shortage issue?

Senator FANNIN. That is right.

Mr. ELY. To the contrary. This should be made crystal clear.

The decision of the Supreme Court was adverse to the special master's contention, which was Arizona's contention, that proration should apply. It held on that issue that the Court would decide nothing. It

remitted that issue to the Congress for the Congress to write a fair formula, and that is why we are here.

Three Justices I should say did commit themselves to the principle we ask you to adopt from the western water law. Five Justices said—

We do not commit ourselves until we have a formula before us to pass upon.

Senator FANNIN. To go further, in your statement you say that California is entitled to protection for existing use. The Supreme Court recognizes the principle of prior appropriation and equitable apportionment.

Is it not true that California, through you as their attorney, made this argument to the Supreme Court, and that the Supreme Court rejected it?

Mr. ELY. No, Senator.

The Supreme Court rejected all formulas, said "We have nothing before us to decide," and remitted that question to the Congress.

We asked the Congress to adopt, to have plenary power dealing with this interstate navigable stream as the Supreme Court said, we ask you to adopt the same principle that the courts of the West, the legislatures of the West, have adopted for a hundred years, and that the Supreme Court has not rejected. Article II(B)(3) of the decrees governs shortages. The master proposed an entirely different decree, which the court rejected. The two read as follows:

The Supreme Court said :

"(3) If insufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use of 7,500,000 acre-feet in the aforesaid three States, then the Secretary of the Interior, after providing for satisfaction of present perfected rights in the order of their priority dates without regard to state lines and after consultation with the parties to major delivery contracts and such representatives as the respective States may designate, may apportion the amount remaining available for consumptive use in such manner as is consistent with the Boulder Canyon Project Act as interpreted by the opinion of this Court herein, and with other applicable federal statutes, but in no event shall more than 4,400,000 acre-feet be *apportioned for use in California including all present perfected rights;"

*[376 US 343]

The special master had recommended :

"(3) If insufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use of 7,500,000 acre-feet in the aforesaid three states, then the available annual consumptive use shall be apportioned as follows :

(a) For use in Arizona

2.8

7.5,

(b) For use in California

4.4

7.5,

(c) For use in Nevada

.3

7.5;"

Senator FANNIN. I would say, Mr. Ely, I will just refer to the Supreme Court decision where they say, and I have heard you quote this before:

For the same reasons we cannot accept California's contention that in case of shortage each state's share of water should be determined by the judicial doctrine of equitable apportionment or by the law of prior appropriation. These

principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress with full power to do so, had provided the waters of a navigable stream shall be harnessed and distributed through a government agency under a statutory scheme.

Now I think that Senator Hayden has read into the record an answer to your argument, as I understand it, and I will let it stand on that basis.

Mr. ELY. Might I comment, Senator Fannin. I think the difference between us is a matter of words really, like two knights looking at the opposite side of the same shield. The Supreme Court found that Congress in 1928 had not written into the act any shortage formula. It said Congress wrote nothing with respect to shortages except the requirement that present perfected rights be protected, and that it disagreed with us when we said the Congress had intended to incorporate into the act a shortage formula which was the interstate doctrine of equitable apportionment. It is annexed to Attorney General Lynch's brief, in the record of these hearings.

The Court did not say, I emphasize this, the Court did not say that the principles of equitable apportionment or interstate priorities should not apply here. It said this is for the Congress to decide. It deferred to your judgment in 1967 rather than 1928.

We are now talking about what should go into a 1967 piece of legislation, and not about what was contained in the 1928 law. We say that this committee should adopt the same principle that Arizona's Legislature has adopted, the legislature of every State has adopted in the West, that all the courts of the West have adopted for 100 years. This is the fair and equitable shortage formula which, upon your own volition, exercising plenary power, you too should adopt.

Senator FANNIN. I do not agree with you, Mr. Ely, but I think the record speaks for itself.

Now to go on with the statement that you have made, on page 6 you speak of the projects that would be destroyed or substantially impaired by permitting Arizona to use her own entitlement of water. Now what projects would be affected in the State of Nevada?

Mr. ELY. I missed the last few words.

Senator FANNIN. What Nevada projects would be destroyed or substantially impaired by permitting Arizona to use her own entitlement of water?

You say:

Recognizing the construction of a new project such as the Central Arizona Project should not be allowed to destroy or substantially impair existing projects serving established economies in Arizona, California or Nevada, California alone being limited to 4.4 million acre-feet.

Mr. ELY. I think it should be self-evident that the Congress, in authorizing a southern Nevada project so recently did not anticipate that that project would be dismantled in the future to make possible the construction of a new project in either Arizona or in any other State.

Senator FANNIN. I am just taking the statement as it reads. But is it your position that Nevada cannot make use of her entitlement if it interferes with California's existing uses?

Mr. ELY. Are you speaking of Nevada?

Senator FANNIN. Nevada, yes.

Mr. ELY. No, sir, the shortage formula, as written, specifically leaves Nevada untouched, and this is subject to future consideration.

Senator FANNIN. Is it your position that the Upper Basin cannot make use of their entitlements if they interfere with the California existing uses?

Mr. ELY. Just the reverse. We have agreed in the Colorado River Compact, and for that very purpose, that the Upper Basin could indeed reserve for its own use such water up to the 7.5 million apportioned as might be available to it after meeting the obligations of the compact at Lee Ferry. To this, California immediately agreed in 1923. Arizona did not for 22 years. We recognized that principle of the protection of the Upper Basin, then and now.

Senator FANNIN. Do you feel that Arizona is the only State that should be penalized?

Mr. ELY. To the contrary, California is being penalized by the reduction which we agreed to. Congress required that agreement of California only because Arizona rejected the compact. We bear that burden, to reduce our uses from 5.1 million now used to 4.4 million acre-feet, to reduce our metropolitan aqueduct to half capacity, from 1.2 million to 550,000, to release that water to your new aqueduct. That was the bargain we made in 1928, and we are keeping it.

But when Congress said we could use up to 4.4 million acre-feet, it was like a speed limit. A speed limit of 44 miles an hour doesn't say forty-four seventy-fifths of 44 miles. The right to occupy 44 acres of land doesn't mean forty-four seventy-fifths of 44 acres. A boundary fences in, as well as fences out. We have spent \$600 million to occupy the area within our fence. We admit that we must give up 700,000 acre-feet that is fenced out by that limitation.

Senator FANNIN. You are saying that you are giving up, but you are bringing it down to 4.4 million acre-feet.

Mr. ELY. Indeed we are.

Senator FANNIN. Which is the amount of water that, of course, was allocated to you.

Mr. ELY. No. We were allocated by the Limitation Act 4.4 million acre-feet plus, plus one-half of the excess or surplus. As to that excess or surplus, and as to that only, we agreed to proration. We abide by that. The excess or surplus has disappeared. We lose it all when the central Arizona project commences diversions.

Senator FANNIN. You still are saying that Arizona is the one State that must give up water?

Mr. ELY. Not at all. I just finished saying we are giving up 700,000 acre-feet, which is more than we are asking you to ever give up.

Senator FANNIN. You are asking Arizona to give up water so you can have water.

Mr. ELY. To the contrary, Senator Fannin. The effect of the formula written into the Arizona-California agreement last year, and in which we asked Arizona to return, is that as the supply drops to 7,500,000 acre-feet, California's Metropolitan Water District loses about 700,000 acre-feet of its supply, dropping to 550,000.

This result does not confront your aqueduct until the year 2030, and then you will still have 676,000 acre-feet or the Secretary's figures, more water than the 550,000 we will have for our aqueduct in 1975.

Senator FANNIN. I gather you were quoting from the summary of the Bureau of Reclamation operation of water supply studies when you were talking about the different years of supply—is that right?

Mr. ELY. I don't follow your question, sir. Are you referring to a page of my statement?

Senator FANNIN. No, I am referring to a statement which was made by you regarding water supply in the year 1975.

Mr. ELY. I still don't quite follow your inquiry. Are you referring to page 7 of my statement?

Senator FANNIN. I refer you to page 96 of the House hearings or page 21 of the summary report on the central Arizona project.

Mr. ELY. I have page 96 of the House hearings before me. May I have the question again, sir?

Senator FANNIN. Yes. Did you not utilize these figures in your statement, or did not one of the California witnesses utilize these figures?

Mr. ELY. Yes, sir, using the Secretary of the Interior's forecast of supply, which is that contained on page 96.

(The summary follows:)

Summary of Bureau of Reclamation reservoir operation and water supply studies

[Averages for 60-year period 1906-65, inclusive, in thousands of acre-feet]

Item	Year 1975	Year 1990	Year 2000	Year 2030
Virgin flow, Lee Ferry.....	15,063	15,063	15,063	15,063
Upper basin depletion.....	4,220	5,100	5,430	5,800
Upper basin end-of-year storage:				
Maximum.....	36,125	34,476	33,329	30,386
Minimum.....	15,769	14,280	9,186	6,888
Net storage change.....	0	0	0	0
Lee Ferry regulated delivery.....	9,570	8,770	8,600	8,250
Upper basin spills.....	1,273	1,193	1,033	1,013
Net gain, Lee Ferry to Hoover.....	772	753	732	704
Lake Mead:				
Inflow.....	11,615	10,716	10,365	9,967
Evaporation.....	898	872	835	853
Spills.....	653	269	148	188
Regulated release.....	10,064	9,575	9,382	8,956
Maximum end-of-year storage.....	25,900	25,900	25,900	24,900
Minimum end-of-year storage.....	13,370	13,000	11,800	11,090
Net storage change.....	0	0	0	0
Bill Williams River.....	50	50	50	50
Net losses, Hoover to Mexico (after salvage).....	590	590	590	590
Delivery to Mexico.....	1,500	1,500	1,500	1,500
Available for use in the United States.....	8,024	7,535	7,342	6,916
California ¹	4,762	4,687	4,654	4,564
Nevada.....	100	150	200	(-)300
Arizona ¹	3,612	2,698	2,488	2,052
Other than central Arizona project.....	1,020	1,160	1,203	1,230
Central Arizona project:				
Available.....	2,142	1,538	1,258	822
Limited by 2,500-c.f.s. aqueduct.....	1,650	1,255	1,026	676
System losses ²	165	126	103	68
Supplied from Colorado River.....	1,485	1,129	923	608
Supplied from Gila River.....	50	50	50	50
Project deliveries.....	1,535	1,179	973	658
M. & I.....	82	232	312	312
Irrigation.....	1,453	947	661	346

¹ Figures represent California and Arizona entitlements under the decree in *Arizona v. California* (including surplus in excess of 7,500,000 when available) and 4.4 priority for California. California could use more, however, due to Arizona's inability, through physical limitations, to use its full share.

² System losses assumed to be 10 percent throughout. Refinement of this estimate, particularly in years of less than full capacity aqueduct operation, will be considered in more detailed studies.

³ Although the average yield under year 2030 condition would be 658,000 acre-feet, the assured yield would be about $\frac{1}{2}$ of this figure and would be devoted to M. & I. use.

Senator FANNIN. And in these figures it indicates where California would, in 1975, drop to a figure of 4,762,000 acre-feet, with Arizona having available 2,142,000 acre-feet, but because of the size of the central Arizona project aqueduct, we drop down, by the year 2030, to 676,000.

And then you say that we are not making a sacrifice when in accordance with the figures, California continues to get 4,564,000 in the year 2030.

Mr. ELY. I appreciate the opportunity to respond. Senator Kuchel brought out yesterday in his questions, we do not assert the right of California to 4,564,000 acre-feet in the year 2030 as this table would show, at a time when Arizona is receiving less than 2,800,000 acre-feet and at a time when the total supply is only 6,916,000.

These are arrived at by calculations for which California does not take responsibility. But my testimony said that adopting the Secretary's figures, he still shows you with 676,000 acre-feet for the central Arizona aqueduct in the year 2030. If we were calculating it, we would subtract from the figure shown for California by the Secretary, which is 4,564,000 acre-feet for the year 2030, the excess above 4,400,000, and this excess of 164,000 acre-feet would become available to Arizona. This would raise Arizona to something in excess of 800,000 acre-feet for the central Arizona project, in addition to the 1,200,000 acre-feet shown for other uses in Arizona.

Senator FANNIN. But, of course, that would lower the central Arizona project from the estimated 1,200,000 projected previously when we were considering this matter down to below 331 $\frac{1}{3}$ percent, approximately, using your figures.

Mr. ELY. Let's straighten this out, Senator Fannin. I really do appreciate this opportunity. I mean this. The Secretary originally proposed a 1,800-cubic-foot-per-second aqueduct for central Arizona.

Last year, when Arizona agreed with us to the 4.4 million protection for California, cutting this protection off when 2.5 million is imported, it was pointed out to us that in order for Arizona to abide by that 4.4 million protection for California, and at the same time get an average of 1,200,000 acre-feet for Arizona, which is what the bill then provided, Arizona would need not a 1,800-cubic-foot-per-second aqueduct, but a 2,500-cubic-foot-per-second aqueduct. We were asked if California would agree to that. We met in Phoenix to discuss that.

We pointed out that it meant an additional burden upon the development fund of about \$60 million to increase the size of your aqueduct from 1,800 to 2,500 cubic feet per second. But we said we would agree to it for the very purpose of giving Arizona, upon the Secretary's figures, the average that she said she contended for, the average, I repeat, of 1,200,000 acre-feet for the period shown here, 1975 to 2030. That is the effect, as Mr. Dominy testified yesterday, of the Secretary's tabulation.

Arizona would get an average of 1,200,000 acre-feet for the period 1975 to 2030. You would start with much more than 1,200,000. You would start with 1,650,000 in 1975, not 1,200,000, and you would dwindle, on the Secretary's figures, to 676,000 in the year 2030. But you would have an average of 1,200,000. That is the very justification for the larger aqueduct.

Now what I am saying is that we believe the Secretary has been too generous in his calculation, too generous to California, by the year 2030, to the extent of 164,000 acre-feet, and if this water were made available to Arizona, you would have more, an average greater than the 1,200,000 average which is what you asked for last year, for the period 1975 to 2030.

The consequence, however, is that California's metropolitan aqueduct would be reduced to 550,000 acre-feet, in consequence of our being reduced to 4,400,000, not in the year 2030, but about the year 1975, or at best between 1975 and 1980.

Senator FANNIN. Depending on the distribution of the 4.4 million acre-feet in California.

Mr. ELY. Depending on what, sir?

Senator FANNIN. Depending upon the distribution of water in California.

Mr. ELY. Of the 3,850,000 feet which is senior to Metropolitan, about 3,100,000 acre-feet is in present perfected rights protected by the decree. The balance represents the Coachella County Water District, constructed pursuant to the authority of the Boulder Canyon Water Act.

Senator FANNIN. Mr. Ely, as you know, the bill that Senator Hayden has introduced and I also cosponsored does provide for 3,000 cubic feet per second.

Mr. ELY. Yes.

Senator FANNIN. Would California support a 3,000-cubic-foot-per-second aqueduct?

Mr. ELY. If so, would you support our 4.4, sir?

Senator FANNIN. I am asking you if you thought it advisable to go to 2,500. According to the testimony yesterday it was indicated that it would be highly advisable to go to a 3,000-cubic-foot-per-second aqueduct.

Mr. ELY. We made a bargain with you last year, a 2,500-second-foot aqueduct in return for 4.4 million protection for California, and we stayed with it. Now if the present inquiry is whether we would rise to 3,000, would Arizona stay with her 4.4 production for California? I would have to refer this question, I must say, to my clients in California before I answer you, but I would like to know just what I am answering, whether you are proposing a new bargain.

Senator FANNIN. Mr. Ely, you know that there is not an agreement with California on the 4.4 matter.

Mr. ELY. Agreement by whom?

Senator FANNIN. By Arizona I mean.

Mr. ELY. As I say, this is a delicate subject. I don't know who speaks for Arizona. Her Governor agreed with us, her three Congressmen did.

Senator FANNIN. I don't think that you can show that the Governor, any of the Governors of Arizona, conceded that you have the 4.4 priority.

Mr. ELY. Governor Goddard testified for H.R. 4671 which contains it.

Senator FANNIN. He did not concede or did not acknowledge, in fact I am sure that he would oppose any contention that you have a 4.4 priority.

Mr. ELY. There is no question that the three Arizona Congressmen introduced bills in the 89th Congress containing it. They were H.R. 4671 by Mr. Udall, H.R. 4676 by Mr. Rhodes, and H.R. 4677 by Mr. Senner.

Senator FANNIN. I understand that the bills were introduced and I think that has been clearly covered.

Mr. ELY. I am sorry that Senator Kuchel is not here. He has a memorandum from Senator Hayden on this subject.

Senator FANNIN. I am sure my senior colleague can speak for himself.

Mr. ELY. I think that memorandum should speak for itself. The two Senators can produce it.

Senator FANNIN. I have several more questions.

Mr. ELY. Has this been placed in the record? The two Senators can speak for themselves on this, but there is in existence a memorandum from Senator Hayden to Senator Kuchel on this very subject.

Senator FANNIN. To continue on with your testimony, Mr. Ely, on pages 6, 7, and 8 of your written statement you refer to a statutory compact for California to receive 4.4 million acre-feet of water. Is this compact the one you referred to when you say that the California Limitation Act limiting California in perpetuity to 4.4 million acre-feet constituted a grant of that much water to California?

Mr. ELY. Who said it was a grant?

Senator FANNIN. I am asking you.

Mr. ELY. I do not know who said so. I said it is a confirmation of appropriations up to 4.4 million. May I say with respect to this Kuchel-Hayden memorandum, it is in the Congressional Record, February 8, 1965, at page 2138, and since it is public, I think it would be important and proper that it be in the record of this committee.

The conclusion stated at the end of Senator Hayden's memorandum, which relates to this 4.4 language, with the 2.5 million cutoff, is:

In other words, I am prepared—although reluctantly—to accept your proposal when the legislative process has reached the point where I can plainly see that my acceptance of it will result in the authorization of the central Arizona project. I shall do so because authorization of the central Arizona project and additional developments in California are of such vital importance that our presently differing views regarding the manner in which protection for California shall be spelled out must not be allowed to delay enactment of the necessary legislation.

The language to which he refers is that which resulted from conferences between staffs of the two States and, as Senator Hayden properly says, in which Mr. Weinberg participated on behalf of the Secretary of the Interior.

May I ask that the entire memorandum be placed in the record at this point?

Senator ANDERSON. Yes. I do think that Senator Hayden said when you can produce the central Arizona project you will have nothing to worry about.

Mr. ELY. We are doing our best to produce it in bills sponsored by California's delegation. We are testifying here in support of it, but we can't cast the votes necessary to pass it.

Senator ANDERSON. You opposed it in the Rules Committee.

Mr. ELY. No, sir; it never came before the Rules Committee.

Senator ANDERSON. It never did?

Mr. ELY. That is correct. The reason was that Chairman Aspinall of the House Interior Committee decided not to press it for a hearing and we supported it.

(The memorandum referred to follows:)

MEMORANDUM FOR SENATOR KUCHEL

U. S. SENATE,
COMMITTEE ON APPROPRIATIONS,
February 1, 1965.

On January 29, I advised you that I could not accept the amendment to S. 75, which you had proposed, even as modified at the staff meeting of January 28. I offered you a compromise amendment which you rejected.

I have since been informed that at the staff meeting in question Mr. Ely expressed confidence that substantially all of the Members of the House of Representatives from California will be prepared to introduce bills and to press for passage of legislation along the lines of the most recent draft submitted by Mr. Weinberg of the Department of the Interior to the group in attendance at the staff meeting. I assume that such bills would include the amendment which you have proposed as modified by Messrs. Ely and Weinberg at the staff meeting on January 28.

In order to avoid further delays in the enactment of legislation providing for water resources development in both of our States, I propose to press for passage by the Senate of S. 75 in substantially its present form. It is my hope that the Congressmen from California will follow the course which Mr. Ely has indicated they are prepared to take. I assure you that if a bill along those lines is passed by the House, I shall press for its prompt passage by the Senate notwithstanding that it contains the language of your proposed amendment as modified at the January staff meeting by Messrs. Ely and Weinberg.

In other words, I am prepared—although reluctantly—to accept your proposal when the legislative process has reached the point where I can plainly see that my acceptance of it will result in the authorization of the central Arizona project. I shall do so because authorization of the central Arizona project and additional developments in California are of such vital importance that our presently differing views regarding the manner in which protection for California shall be spelled out must not be allowed to delay enactment of the necessary legislation.

It is my hope that both Houses can now proceed simultaneously to consider legislation authorizing a Lower Colorado River Basin project.

CARL HAYDEN.

Senator ANDERSON. I think we will have to examine into how these things go, because time after time we have heard this agreement. Now, you did say that the Kuchel, Moss, Allott bills all abided by the principle on which the seven Colorado River Basin States agreed last year.

Mr. ELY. That is correct.

Senator ANDERSON. That is, in my opinion, completely false to say the seven States agreed last year. They did not agree.

Mr. ELY. If you mean by agreements—

Senator ANDERSON. They did not agree, Mr. Ely.

Mr. ELY. Do you mean agreements by all members of the delegation? Of course, you are correct.

Senator ANDERSON. They did not agree. There was a press conference that very evening and the statement was made announcing this joint opposition to the agreement. Governor Love adopted it for Colorado. He is going to testify. I think he is a very fine man and a very fine executive.

Mr. ELY. He will testify in support of the Allott bill and—

Senator ANDERSON. We are talking about this agreement now.

Mr. ELY. Senator, Governor Love testified in support of H.R. 4671 and in support of H.R. 3300 of this Congress.

Senator ANDERSON. Wyoming did not agree, New Mexico did not agree, Arizona did not agree, and you say the seven States all agreed, and that is that sort of thing that causes trouble in these hearings.

Mr. ELY. Mr. Chairman, the seven States, the representatives of the Governors of the seven States did agree upon the text of the language introduced in the House committee hearings, a revision of H.R. 4671.

Senator ANDERSON. To report back—

Mr. ELY. By the time the House committee reported the bill out, H.R. 4671, Wyoming had expressed her discontent with it because it weakened the importation program, and she is entitled to her opinion about that. We reluctantly went along with that weakening of the importation program ourselves.

Senator FANNIN. Mr. Chairman, the California interests have offered a brief to be inserted in the record that is, as I see it, asking this committee to reverse the Supreme Court decision. It is 20 pages long, and I would like to ask of the chairman, if it will be permissible for Senator Hayden and I to answer this, to have 10 days after the hearings have ended to answer this brief.

Senator ANDERSON. Without objection that may be done.

(The material referred to starts on p. 88.)

Senator FANNIN. In reference to this, not in reference to the brief, but a discussion regarding what you are asking, Mr. Ely, of this committee, did not this Congress by resolution in the House in 1951 direct Arizona to go to the Supreme Court to get her water entitlement settled before asking Congress to enact the central Arizona project bill?

Mr. ELY. That is substantially correct; yes, sir.

Senator FANNIN. And did not Arizona thereupon go to the Supreme Court as the Congress directed, and obtain a determination of Arizona's entitlement after 12 years of litigation in *Arizona v. California*?

Mr. ELY. I think I have already answered that. I will not labor it except to say upon the shortage issue she did not obtain a determination. The Court transferred that problem back to Congress.

Senator FANNIN. On this, we disagree. The Court transferred it to the Secretary, although Congress can, of course, increase or decrease that authority.

Mr. ELY. Yes.

Senator FANNIN. Do you consider it equitable to ask this committee to reverse the decision which the Congress asked the Supreme Court to make?

Mr. ELY. I think the question begs itself, Senator Fannin. We are not asking the Congress to reverse the Supreme Court but to do as the Court told Congress it could do to implement article II(b) (3) of the decree as to the shortages, by writing your own shortage formula.

Senator FANNIN. Is it not true that the Court held that the Congress had given the Secretary the power to allocate shortages and the Court upheld the wisdom of the action of the Congress?

Mr. ELY. The Court also said that the Congress had the power to reduce or enlarge the Secretary's power and that is what we are asking you to do. The Secretary has not exercised any power by writing any shortage formula. The decree that the Court entered, after the opinion,

says in so many words that the Secretary shall abide by all applicable Federal statutes. We are asking you to write the applicable Federal statute for the shortage.

Senator FANNIN. Mr. Ely, you referred to the Governors' letters I think in your earlier testimony. In making your contentions, you referred to the Governors' letters?

Mr. ELY. I referred to a letter from Governor Warren to Governor Osborn of Arizona, dated March 3, 1947, offering arbitration; is that what you mean?

Senator FANNIN. I am sure if you would examine the letters, in none of the letters you referred to did Arizona recognize or state that California has a 4.4 priority in times of shortage. I want to be sure to make that clear, because I wanted to offer you—

Mr. ELY. The letters should speak for themselves. I should like to offer them for the record. They were published in 1947 in the hearings of the Subcommittee on Public Lands of the U.S. Senate, captioned, I may say, "Bridge Canyon Project on S. 1175." They appear at pages 485 through 488, and the letter from Governor Warren, to which I referred, says that—

The negotiations of the past have failed to bring about agreement between Arizona and California but I am of the opinion that there must be some fair base upon which their respective rights can be determined. The only methods that occur to me are (1) negotiation of a compact, (2) arbitration, and (3) judicial determination.

I would, therefore, like to suggest that we three Governors of the affected States endeavor first to enter into a compact which will resolve our differences and finally determine our respective rights.

In the event you believe for any reason that this cannot be done, I suggest that we submit all our differences to arbitration, agreeing to be bound by the results thereof.

If this is not feasible, I propose that we join in requesting Congress to authorize a suit to determine our rights in the Supreme Court of the United States, which suit could, if agreeable to the States, be submitted on an agreed statement of facts.

To this, Governor Osborn replied on March 12, 1947, saying, among other things—I intend to put the full letter in the record—

Arizona recognizes the right of California to use the quantity of water to which California, by the statutory agreement, is forever limited.

It goes on to say that "Arizona does not claim the right to the use of any water to which California is entitled."

In a subsequent letter dated May 23, 1947, Governor Osborn said—

California has unconditionally and irrevocably limited herself forever to the quantity of water set out in the California Self-Limitation Act. Arizona has by contract recognized the right of California to the quantity of water set out in that act and Arizona does not intend to and will not attempt to utilize water to which California is entitled. Arizona respects her commitments.

This correspondence followed 1930 testimony by Senator Hayden in which he said that—

What will happen is that the waters of the Colorado River will be impounded in the Boulder Canyon Reservoir and made available for use; large quantities of water will be taken out of the Colorado River into the great all-American canal; over 1 million acre-feet will be further taken out of the river by a pumping plant, and taken over into the coastal plain of California in the vicinity of Los Angeles; they will be put to beneficial use; and once having acquired the prior right to its use, no other State can obtain the use of those waters.

Governor Osborn proposed that Arizona become a party to the Colorado River Compact in 1944. He made this statement to the Arizona Legislature at the time of the ratification of the compact:

Now, of course, we would like to take from California some of that 4,400,000 acre-feet of water, but neither unrecognized filings against it nor wishful thinking on our part can accomplish that * * *. The Federal Government, having expended tens of millions of dollars of the people's money to provide irrigation and power facilities for the use of this water in one State will not wipe out that investment and divert that water to another State. Arizona cannot compel that any more than we can turn back the pages of history. The time is long since past when Arizona could obtain the water which California has already put to beneficial use.

Mr. Chairman, may I place in the record the full text of the correspondence?

Senator ANDERSON. That may be placed in the record.

(The correspondence referred to follows:)

STATE OF CALIFORNIA,
GOVERNOR'S OFFICE,
Sacramento, March 3, 1947.

HON. SIDNEY R. OSBORN,
*Governor of Arizona,
Phoenix, Ariz.*

HON. VAIL N. PITTMAN,
*Governor of Nevada,
Carson City, Nev.*

MY DEAR GOVERNORS: We have just completed our review of the comprehensive plan for the Colorado River system as presented by the Bureau of Reclamation, and I am more than ever impressed by the staggering size and complexity of the proposal.

It is quite apparent, and it is admitted in the comprehensive plan, that the 134 projects inventoried will, if constructed, use more water than is available in the river system. This fact will undoubtedly emphasize the differences of opinion concerning the water to be made available to each State. It is therefore of the utmost importance to the lower-basin States that we reconcile our differences as soon as possible.

The negotiations of the past have failed to bring about agreement between Arizona and California but I am of the opinion that there must be some fair basis upon which their respective rights can be determined. The only methods that occur to me are (1) negotiation of a compact, (2) arbitration, and (3) judicial determination.

I would therefore like to suggest that we three Governors of the affected States endeavor first to enter into a compact which will resolve our differences and finally determine our respective rights.

In the event you believe for any reasons that this cannot be done, I suggest that we submit all our differences to arbitration, agreeing to be bound by the results thereof.

If this is not feasible, I propose that we join in requesting Congress to authorize a suit to determine our rights in the Supreme Court of the United States, which suit could, if agreeable to the States, be submitted on an agreed statement of facts.

I believe that either method could produce the desired results. If you agree with me, I suggest that the three of us meet at some time and place mutually agreeable for the purpose of further exploring the subject. If we can place our three States in position to maintain a common front in urging the speedy and orderly development of the Colorado River system, we will have rendered a great service to our people.

Hoping that I may have your reaction to this proposal and with best wishes, I am,

Sincerely,

EARL WARREN, *Governor.*

EXECUTIVE OFFICE, STATEHOUSE,

Phoenix, Ariz., March 12, 1947.

HON. EARL WARREN,
Governor, State of California,
Sacramento, Calif.

MY DEAR GOVERNOR WARREN: I have your letter of March 3, addressed to Governor Vail Pittman and myself, concerning the Report of the Bureau of Reclamation on the Development of the Water Resources of the Colorado River Basin.

I presume from your letter that you have completed and sent to the Bureau your comments on the above-mentioned report. I, too, have furnished the Bureau with my comments and am enclosing a copy to you herewith. It will be appreciated if you will furnish me with a copy of your report.

Ever since I have been Governor of Arizona I have endeavored to cooperate with all other States in the Colorado River Basin in all matters of common interest. Arizona has at all times been represented on the Committee of Fourteen and Sixteen, whose name has now been changed to the Colorado River Basin States Committee. Arizona is now represented on the Colorado River Basin States Committee, which committee as presently constituted and as heretofore constituted, has been very helpful in all matters affecting the interests of the respective States in the Colorado River. Arizona is now cooperating in plans for the utilization of Colorado River water in the respective States within the allocation of water available to them.

I will be pleased to meet with you, or with you and Governor Pittman, or with the governors of other interested States, to discuss all matters of common interest to our respective States.

All seven of the Colorado River Basin States—Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming—five of which States are still represented on the Colorado River Basin States Committee, are parties to the Colorado River compact which apportions the water of the Colorado River system as between the upper basin and the lower basin and to Mexico. The compact contains provisions which make utilization of water over and above the apportionment made by the compact of interest to all of the States of the basin.

Portions of Utah and New Mexico are in the lower basin and are entitled to share in the apportionment made to the lower basin and in the use of any available water which is unapportioned by the Colorado River compact.

California, in consideration of the passage by the Congress of the Boulder Canyon Project Act and as a condition precedent to the taking effect of that act and the construction of Boulder Dam, Imperial Dam, and the All-American Canal, by chapter 16, California Statutes 1929, entered into a statutory agreement with the United States and for the benefit of each of the Colorado River Basin States, irrevocably and unconditionally limiting California's claim to water of the Colorado River to 4,400,000 acre-feet per annum of the apportioned water, plus not more than half of the water unapportioned by the Colorado River compact. The quantity of surplus water, that is, water unapportioned by the compact, varies from year to year and is subject to further apportionment by agreement between all of the compact States after 1963.

Arizona recognizes the right of California to use the quantity of water to which California, by the statutory agreement, is forever limited.

Arizona recognizes the right of Nevada to use 300,000 acre-feet of apportioned water per annum, plus one twenty-fifth of available unapportioned water, subject to further apportionment of the unapportioned water by agreement between the compact States after 1963.

Arizona has a contract with the United States for delivery for use in Arizona from the main stream of the Colorado River, subject to its availability for use in Arizona, under the Colorado River compact and the Boulder Canyon Project Act, of so much water as is necessary to permit the beneficial consumptive use in Arizona of main stream water to a maximum of 2,800,000 acre-feet of the apportioned water, plus one-half of the available surplus, less such part of the one-twenty-fifth thereof as Nevada may use, the quantity of which surplus, of course, varies from year to year, and which surplus is subject to further apportionment by agreement between all of the compact States after 1963.

Arizona does not claim the right to the use of any water to which California is entitled, nor the right to the use of any water to which Nevada is entitled,

and I am sure that Nevada does not claim the right to the use of any water to which California is entitled, nor the right to the use of any water to which Arizona is entitled. It therefore appears that California and Nevada are now in a position to join Arizona in urging the speedy consideration and passage of S. 433 now pending in the United States Senate and H.R. 1598, its companion bill, now pending in the House of Representatives, which are authorization bills to authorize the construction of the central Arizona project, and H.R. 1597 which is an authorization bill to relocate the boundaries of the Gila project heretofore authorized.

I am certain that the passage of these bills and the construction of the works which they seek to authorize will be of great and incalculable benefit, not only to Arizona, but to California and Nevada and to the United States as a whole.

They are vitally necessary to the welfare and to the economy of the whole southwest region. They do not in any way interfere with the full use in California and in Nevada of the water to which California and Nevada are respectively entitled.

If either California or Nevada are interested in the promotion and construction of projects for the utilization of water to which they are respectively entitled, I would like to know it in order that I may render such aid as seems appropriate.

It is difficult for me to understand what, if anything further, need be done to place either California or Nevada or Arizona in position to support the utilization in our respective State of our respective shares of the water of the Colorado River, which shares have already been determined by the Colorado River compact, the Boulder Canyon Project Act, the California Limitation Act, the water-delivery contracts of the California agencies, the Nevada water-delivery contracts, and the Arizona water-delivery contract.

However, I will be glad to meet and discuss with you and the governors of the other Colorado River Basin States, jointly or severally, any matters of common interest, and if at such conference or conferences it should develop that there are any substantial differences, we can consider and perhaps resolve such differences and if it should develop that anything further is necessary, we can consider the proper course to pursue.

During your incumbency we in Arizona have not had the pleasure of a visit from you. We would like to see you over in our State and I will greatly appreciate it if you can arrange to come to Phoenix as soon as possible, either alone or with Governor Pittman, or with such other governors of the Basin States as you may desire to have present, in order that any matters which you may desire to further discuss can be gone into fully and thoroughly.

With all good wishes, I am

Sincerely,

SIDNEY P. OSBORN, *Governor.*

EXECUTIVE OFFICE, STATE HOUSE,
Phoenix, Ariz., May 23, 1947.

HON. EARL WARREN
*Governor of California,
Sacramento, Calif.*

MY DEAR GOVERNOR WARREN : I have received your letter of May 16 and appreciate your personnal good wishes.

In my letter to you of March 12 and in my letter to William E. Warne, Acting Commissioner of the Bureau of Reclamation, of November 22, 1946, a copy of which I sent to you, I clearly stated the facts and the reasoning which in my opinion lead to the inescapable conclusion that the quantities of apportioned water available for use in Arizona, California, and Nevada, respectively, from the Colorado River, are already determined.

If you do not agree with such facts and reasoning and my conclusions, it is regrettable that you do not specify wherein you disagree.

On page 8 of the Views and Recommendations of the State of California on Proposed Report of the Secretary of the Interior entitled "The Colorado River" there purports to be a list of relevant statutes, decisions, and instruments affecting the Colorado River, but no mention is there made of the California Self-Limitation Act, chapter 16, California Statutes, 1929.

I discussed the California Self-Limitation Act as well as the other relevant compact, statutes, contracts, and reports in my letters, but in your letters to me you make no exception to any statements in my letters, nor do you set forth any statement of any facts, reasoning, or conclusions as to what claim to water of the Colorado River you intend to assert for California nor the basis for such claim.

California has unconditionally and irrevocably limited herself forever to the quantity of water set out in the California Self-Limitation Act. Arizona has by contract recognized the right of California to the quantity of water set out in that act and Arizona does not intend to and will not attempt to utilize water to which California is entitled.

Arizona respects her commitments.

Any aspiration entertained in California to use water in excess of that limitation appears to be illegitimate. If California would be content with the use of the quantity of the water to which she has by solemn statutory agreement unconditionally and irrevocably limited herself forever all occasion for any feeling that any further compact, any arbitration or litigation is advisable would disappear.

I am sure if you will review my letters and the compact, statutes, contracts and reports therein mentioned you will recognize that the only thing required for cooperation between our great States in developing the use of the waters of the Colorado to which they are respectively entitled for their mutual benefit and for the benefit of the Southwest and the Nation, is for your great State to respect the agreements your State has already made.

I request that you again review my letters and if in your opinion, there is any error in the facts, reasoning, or conclusions stated in my letters, I will appreciate your advising me concerning the same.

With all good wishes, I am

Sincerely,

SIDNEY P. OSBORN, *Governor.*

STATE OF CALIFORNIA,
GOVERNOR'S OFFICE,
Sacramento, May 16, 1947.

HON. SIDNEY P. OSBORN,
Governor of Arizona, Phoenix, Ariz.

DEAR GOVERNOR OSBORN: I did not bother you during the time you were ill in our State concerning my suggestions for settling the differences of opinion of Arizona and California regarding their respective rights to the use of the water of the Colorado River. However, now that you have recovered sufficiently to return to your home, I would like to discuss your letter of March 12, 1947, and the accompanying copy of your letter to William E. Warne, Acting Commissioner of the Bureau of Reclamation, dated November 22, 1946.

I gather from these two letters that you believe it is unnecessary to try to write a compact between the lower basin States or to have our respective claims arbitrated, because you consider the existing statutes, contracts, etc., have so settled the rights of Arizona, California, and Nevada in the Colorado River that there are no substantial differences between the States. It may well be that the suggestions of a compact and arbitration are not feasible at this late date, but I am of the opinion that there are such basic divergencies of interpretation of the statutes and documents mentioned above, particularly between Arizona and California, that without an authoritative determination as to which State is right, it is impossible for anyone to know what quantity of water either State is entitled to. If our States are to plan for their futures, they must know with certainty how much water is eventually to be made available to them, because everyone recognizes that there is not enough water in the river to fully serve the legitimate aspirations of both our States.

It seems to me that a suit in the Supreme Court of the United States, to which the lower basin States and the United States are parties, is essential to supply the necessary answer. This would of course require a jurisdictional act of Congress, authorizing the United States to be made a party to such suit. Governor Pittman of Nevada has expressed a similar opinion in a letter to me dated March 6, a copy of which is enclosed. I am sure that such a procedure will eventually redound to the benefit of both of our States.

With best wishes for the continued improvement of your health, I am

Sincerely,

EARL WARREN, *Governor.*

Senator FANNIN. I have just one more statement. Mr. Ely, to further develop what the Governors have said, certainly they have said from a full stream California could use up to 4.4 million acre-feet, and Arizona can use up to 2.8. In time of shortage however, "there is no right of California either legally, equitably, economically, or morally to claim a priority, either against Arizona or Nevada or Colorado or New Mexico or Utah or Wyoming."

Mr. ELY. I respect your opinion as I know you respect mine. I think I have fully stated mine. We disagree. I do not accept the premise that we are asking the upper basin for Nevada to accept any shortage. To the contrary, what we do say is that we ask Arizona to adhere to the bargain we made with you last year that we support your project if you recognize the rights of our existing projects up to 4.4 million acre-feet. We have not attacked your project. We have not brought before this committee any of the manifest infirmities in the project. We hope not to.

We would rather reestablish our alliance with Arizona than to get involved in open warfare with you. The cement of this alliance is the recognition of our existing investments of \$600 million, just as we recognize your larger aqueduct, 2,500 second-feet to give you the average of 1,200,000 acre-feet which you said you wanted.

Senator FANNIN. Mr. Chairman, Mr. Ely, and gentlemen from California, we certainly want to be good neighbors.

Mr. ELY. Yes.

Senator FANNIN. We have been good neighbors, but we, of course, must protect our rights in this regard, and we feel that when you consider the moral point of view, then California should be guaranteeing Arizona 2.8 million acre-feet of water.

Mr. GIANELLI. Senator, I want to make a comment on behalf of our administration in Sacramento. Our Governor has indicated in correspondence his desire to work out regional water problems with the Governors of the 10 other western States.

We are looking forward to meeting with the various State representatives to discuss some of the things we have been talking about today.

Senator FANNIN. Thank you very kindly.

Senator ANDERSON. Mr. Ely, the inserts you made will be printed at this point in the record.

(The data referred to follows:)

BRIEF ON THE PROTECTION OF EXISTING PROJECTS AGAINST THE PROPOSED CENTRAL ARIZONA PROJECT (CALIFORNIA LIMITED TO 4.4 MILLION ACRE-Feet PER ANNUM)

Any bill that authorizes a Central Arizona Project (hereinafter "CAP") must contain a provision that protects existing projects against shortages caused by the water demands for the new CAP. California's protection, however, is limited to 4.4 million acre-feet per annum.

The purpose of this memorandum is to demonstrate that such protection is sound—legally, equitably, economically, and morally.

THE PROTECTION-OF-EXISTING-PROJECTS LANGUAGE

The language that we support appears as section 305 (a), (b), and (c) of Senator Kuchel's bill, S. 861.

That language provides essentially as follows (the full text is attached hereto as appendix A, pp. 13-15 *infra*):

(a) In the implementation of Article II(B)(3) of the Supreme Court decree in *Arizona v. California*, the Secretary shall meet shortages in the following

manner: Whenever there is less than 7.5 million acre-feet available for consumptive use in Arizona, California, and Nevada, the CAP diversions shall be limited to assure sufficient water for existing projects in California for 4.4 million acre-feet per annum (California is limited to 4.4 million out of the first 7.5 million acre-feet per annum of consumptive use) and for existing projects in Arizona and Nevada. (By "existing projects" we mean what the bill refers to as "[1] holders of present perfected rights, * * * [2] other users * * * served under existing contracts with the United States by diversion works heretofore constructed and * * * [3] other existing Federal reservations * * *" (Bracketed numbers added.)) However, the relative priorities of those senior existing projects are not determined, nor is any provision of the decree amended.

(b) The foregoing provision ceases wherever the President proclaims (1) that works have been completed and are in operation that in his judgment are capable of delivering at least 2.5 million acre-feet each year into the main Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado and (2) that such sources are adequate in his judgment to supply the 2.5 million acre-feet each year without any adverse effect upon the foreseeable water requirements of any state from which such water is exported and delivered into the Colorado River.

(c) To the extent that such imported water is used to make available the 2.8 million acre-feet allocated to Arizona, 4.4 million to California, and 300,000 to Nevada under article II(B) (1) of the *Arizona v. California* decree, the Secretary must make such water available to users of main stream water in those states at the same costs and on the same terms as main Colorado River water. In doing so, he must take into account, among other things, (1) the nonreimbursable allocation of imported water to be used to service the Mexican Treaty burden (a provision that is found in section 401 of S. 861) and (2) such assistance as may be available from the development fund established elsewhere in the bill (a provision found in title IV of S. 861).

THE SCOPE OF THE PROTECTION

At the beginning, it is important to recognize that this protection for existing projects extends not just to California projects, but also to all existing projects in Arizona and Nevada as well. In fact, that protection will cover all such existing projects in Arizona and Nevada; but this is regrettably not so in California.

California's existing projects are now using about 5.1 million acre-feet per annum, and their capacity is about 5.4 million acre-feet per annum. But that protection for California is limited to 4.4 million acre-feet per annum. Thus, it would leave California 700,000 acre-feet short of water for our existing uses and 1 million acre-feet short of water for the capacity of the works of our existing projects. This burden we must bear—but no more.

1. The legal bases

The protection-of-existing-projects provision (1) would implement, not amend, the *Arizona v. California* decree, (2) falls expressly within the congressional authority described by the Court in its opinion in *Arizona v. California*, and (3) would relieve the Secretary of the burden of making some shortage allocation (perhaps to his delight as well). The reason follow.

The major allocations of main Colorado River water among Arizona, California, and Nevada in the *Arizona v. California* decree are set forth in article II(B) (1), (2), and (3) (376 U.S. 340, 341, 342 (1964)). (The full text of this article is attached hereto as appendix B, pp. 16-17 *infra*.)

Article II(B) (1) provides that in any year when there is 7.5 million acre-feet of main Colorado River water available for consumptive use in Arizona, California, and Nevada, it shall be divided as follows: 2.8 million to Arizona, 4.4 million to California, and 300,000 to Nevada.

Article II(B) (2) provides that in any year when there is more than 7.5 million acre-feet available, that excess or surplus is divided as follows: one half to Arizona and one half to California. (Arizona's half is subject to a four per cent reduction in favor of Nevada.)

What then is the allocation whenever there is less than 7.5 million acre-feet?

The Special Master proposed this proration formula: 28/75 to Arizona, 44/75 to California, and 3/75 to Nevada. The Supreme Court, however, unanimously rejected that proration formula.

Instead, the Court held that the Secretary of the Interior has authority, under guidelines in the Boulder Canyon Project Act, to make an appropriate allocation of shortages, subject to review by the Court; that the Secretary had not made any such allocation; and that the Congress could establish a shortage formula to guide the Secretary. (The full text of the Court's decision on this issue (*Arizona v. California*, 373 U.S. 546, 592-94) is attached hereto as appendix C, pp. 18-20 *infra*.)

The Court clearly held that proration is not mandatory (e.g., 373 U.S. at 593) : "While pro rata sharing of water shortages seems equitable on its face, more considered judgment may demonstrate quite the contrary. Certainly we should not bind the Secretary to this formula * * *. [T]he Secretary may or may not conclude that a pro rata division is the best solution."

The Court further held that priority (the rule that would have been applied by the three dissenting Justices (373 U.S. at 603-30)) may be adopted by the Secretary as the rule governing the allocation of shortages (373 U.S. at 594) :

"None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony, with the Act, the best interests of the Basin States, and the welfare of the Nation."

Finally, and most significantly in this context, the Court held (373 U.S. at 594) :

"Congress still has broad powers over this navigable international stream. Congress can undoubtedly reduce or enlarge the Secretary's power if it wishes." (Emphasis added.)

This holding is implemented by article II (B) (3) of the decree, which provides as follows (376 U.S. 340, 342-43 (1964)) :

If insufficient main stream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use of 7,500,000 acre feet in the aforesaid three states [of Arizona, California, and Nevada], then the Secretary of the Interior, after providing for satisfaction of present perfected rights in the order of their priority dates without regard to state lines and after consultation with the parties to major delivery contracts and such representatives as the respective states may designate, may apportion the amount remaining available for consumption use in such manner as is consistent with the Boulder Canyon Project Act as interpreted by the opinion of this Court herein, and with other applicable federal statutes, but in no event shall more than 4,400,000 acre feet be apportioned for use in California, including all present perfected rights * * *." (Bracketed words and emphasis added.)

The pending legislation is simply one of the "other applicable federal statutes" (art. II (B) (3), 376 U.S. at 342) by which "Congress [will] * * * reduce * * * the Secretary's power" (373 U.S. at 594) by requiring him to protect existing projects as against the proposed CAP, California being limited to 4.4 million acre-feet.

2. The equitable bases

The protection of existing projects is equitable because it is based upon principles that the Colorado River basin states and the United States all recognize.

The protection of existing projects is based upon the United States Supreme Court doctrine of equitable apportionment of waters in interstate litigation. As first enunciated, the rule provided that "the doctrine of appropriation, which each [state] recognizes and enforces within her borders" should also apply without regard to state lines in interstate water litigation between appropriation states. *Wyoming v. Colorado*, 259 U.S. 419, 467, 470 (1922). See also *Arizona v. California*, 373 U.S. 546, 555-56 (1963). Strict appropriation will be departed from, however, to protect established uses under junior appropriations serving an existing economy. *Nebraska v. Wyoming*, 325 U.S. 589, 618 (1945).

A *fortiori*, equitable apportionment of interstate waters will protect established uses serving existing economies under senior appropriations. That is all that we seek here for existing projects in Arizona, California, and Nevada. As we have noted earlier, California's protection is limited to 4.4 million acre-feet, although our existing projects are now using 5.1 million and could use 5.4 million.

This protection of existing projects operating under senior rights also follows the appropriation law that each of these states recognizes internally: "First in time, first in right." Arizona and Nevada are strict appropriation states, and the appropriation law is a significant element of California water law. See *Arizona v. California*, 373 U.S. 546, 555 n. 14 (1963).

3. *The economic bases*

Economically, there can be no justification for depriving an existing project in Arizona, California, or Nevada of water (California being limited to 4.4 million acre-feet) in order to provide a supply for the new proposed CAP. You should not destroy existing projects serving established economies in order to build a new project.

There will undoubtedly be less than 7.5 million acre-feet of water available for consumptive use in Arizona, California, and Nevada. This means that, under the Supreme Court decree, California will be required at the very best to cut back her current uses by 700,000 acre-feet—from their current level of 5.1 million to the 4.4 million. This 4.4 million acre-feet, under the California schedule of priorities, will provide only 550,000 acre-feet for the Colorado River Aqueduct of The Metropolitan Water District—less than a half supply. The protection-of-existing-projects provision would insure California only that this burden will not be increased.

4. *The moral bases*

Morally, Arizona's consistent and repeated recognition of California's right to 4.4 million acre-feet justifies California's reliance on receiving no less than that quantity.

In 1930, Senator Hayden stated that the use of water by California projects would establish prior rights that could not be taken away (Hearings on H.R. 12902 Before a Subcommittee of the Senate Appropriations Committee, 71st Cong., 2d Sess. 171 (1930) *):

"What will happen is that the waters of the Colorado River will be impounded in the Boulder Canyon Reservoir and made available for use; large quantities of water will be taken out of the Colorado River into the great all-American canal; over 1,000,000 acre-feet will be further taken out of the river by a pumping plant, and taken over into the coastal plain of California in the vicinity of Los Angeles; they will be put to beneficial use; and, once having acquired a prior right to its use, no other State can obtain the use of those waters."

In 1943, Arizona's Governor Osborne proposed that Arizona become a party to the Colorado River Compact and sign a water delivery contract with the United States that was approved by its legislature. At that time, Governor Osborne echoed Senator Hayden's view in these words (Ariz. Senate Journal, 16th Legis., 1st Spec. Sess. 1944, at 16):

"Now, of course, we would like to take from California some of that 4,400,000 acre feet of water, but neither unrecognized flings against it, nor wishful thinking on our part can accomplish that * * *. The Federal Government, having expended tens of millions of dollars of the people's money to provide irrigation and power facilities for the use of this water in one state, will not wipe out that investment and divert that water to another state. Arizona cannot compel that any more than we can turn back the pages of history. The time has long since passed when Arizona could obtain the water which California has already put to beneficial use."

CONCLUSION

On two separate occasions—in 1961 and again in 1962—Arizona's legislature has enacted legislation to protect existing Arizona projects against the proposed CAP. Ariz. Laws 1961, ch. 39, § 2, at 108; Ariz. Rev. Stat. § 45-412B (1966 Supp.) as added by Ariz. Laws, ch. 100, at 258. We simply ask that the principle that Arizona seeks to apply intrastate in Arizona should also apply interstate to protect our existing projects up to 4.4 million acre-feet per annum as against the CAP. There is no reason why this principle should stop at the state line.

The cut-off date for terminating the priority of existing projects—when 2.5 million acre-feet per annum is being imported into the main Colorado River—is a logical one:

Under Article III(d) of the Colorado River Compact, the upper states may not deplete the flow to the lower states at Lee Ferry below 75 million acre-feet every 10 years, reckoned in continuing progressive series. This averages 7.5 million acre-feet annually. Of the 7.5 million, a guaranteed 1.5 million acre-feet would be delivered to Mexico under our treaty with her (59 Stat. 1219 (1945)), and about 1

*Congress enacted the Boulder Canyon Project Act in 1928. However, § 4(b) provided that no moneys should be appropriated until certain contracts had been executed. This Hayden statement was in hearings on this first appropriation bill, in which the California contracts were under attack.

million acre-feet would be lost to evaporation and other losses in transit (about 300,000 acre-feet of which is attributable to servicing the Mexican Water Treaty). Hence, of the 7.5 million, 2.5 million is not available for consumptive use in the United States (being delivered to Mexico or lost), and only 5 million is available for consumptive use.

An importation of 2.5 million acre-feet added to that 5 million acre-feet assures the 7.5 million acre-feet to supply 2.8 million to Arizona, 4.4 million to California, and 300,000 to Nevada. The priority provision, which applies only when there is less than the 7.5 million, is not likely to be needed after that importation.

Thus, the protection-of-existing-projects provision must be included in any legislation to authorize a CAP. If the committee desires any further information or explanation on this subject, we will be pleased to supply it.

Respectfully submitted.

THOMAS C. LYNCH,
Attorney General of the State of California.
By NORTHCUTT ELY,
Special Assistant Attorney General.
BURTON J. GINDLER,
Deputy Attorney General.

APPENDIX A

SECTION 305 (A), (B), & (C) OF S. 861, 90TH CONG., 1ST SESS.

SEC. 305. (a) Article II (B) (3) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340) shall be so administered that in any year in which, as determined by the Secretary, there is insufficient main stream Colorado River water available for release to satisfy annual consumptive use of seven million five hundred thousand acre-feet in Arizona, California, and Nevada, diversions from the main stream for the Central Arizona unit shall be so limited as to assure the availability of water in quantities sufficient to provide for the aggregate annual consumptive use by holders of present perfected rights, by other users in the State of California served under existing contracts with the United States by diversion works heretofore constructed and by other existing Federal reservations in that State, of four million four hundred thousand acre-feet of main stream water, and by users of the same character in Arizona and Nevada. Water users in the State of Nevada shall not be required to bear shortages in any proportion greater than would have been imposed in the absence of this section 305 (a). This section shall not affect the relative priorities, among themselves, of water users in Arizona, Nevada, and California which are senior to diversions for the Central Arizona unit, or amend any provisions of said decree.

(b) The limitation stated in paragraph (a) shall cease whenever the President shall proclaim that works have been completed and are in operation, capable in his judgment of delivering annually not less than two million five hundred thousand acre-feet of water into the main stream of the Colorado River below Lee Ferry from sources outside the natural drainage area of the Colorado River system; and that such sources are adequate, in the President's judgment, to supply such quantities without adverse effect upon the satisfaction of the foreseeable water requirements of any State from which such water is imported into the Colorado River system. Such imported water shall be made available for use in accordance with subsection (c) of this section.

(c) To the extent that the flow of the main stream of the Colorado River is augmented by such importations in order to make sufficient water available for release, as determined by the Secretary pursuant to article II (B) (1) of the decree of the Supreme Court of the United States in Arizona against California (376 U.S. 340), to satisfy annual consumptive use of two million eight hundred thousand acre-feet in Arizona, four million four hundred thousand acre-feet in California, and three hundred thousand acre-feet in Nevada, respectively, the Secretary shall make such additional water available to users of main stream water in those States at the same costs and on the same terms as would be applicable if main stream water were available for release in the quantities required to supply such consumptive use, taking into account, among other things, (1) the nonreimbursable allocation to the replenishment of the deficiencies occasioned by satisfaction of the Mexican Treaty burden provided for in section 401, and (2) such assistance as may be available from the development fund established by title IV of this Act.

APPENDIX B

ARTICLE II (B) (1), (2), AND (3) OF DECREE IN ARIZONA V. CALIFORNIA, 376 U.S. 340, 341, 342-43 (1964)

II. The United States, its officers, attorneys, agents and employees be and they are hereby severally enjoined:

* * * * *

(B) From releasing water controlled by the United States for irrigation and domestic use in the States of Arizona, California and Nevada, except as follows:

(1) If sufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy 7,500,000 acre-feet of annual consumptive use in the aforesaid three states, then of such 7,500,000 acre feet of consumptive use, there shall be apportioned 2,800,000 acre feet for use in Arizona, 4,400,000 acre feet for use in California, and 300,000 acre feet for use in Nevada.

(2) If sufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use in the aforesaid states in excess of 7,500,000 acre feet, such excess consumptive use is surplus, and 50% thereof shall be apportioned for use in Arizona and 50% for use in California; provided, however, that if the United States so contracts with Nevada, then 46% of such surplus shall be apportioned for use in Arizona and 4% for use in Nevada;

(3) If insufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use of 7,500,000 acre feet in the aforesaid three states, then the Secretary of the Interior, after providing for satisfaction of present perfected rights in the order of their priority dates without regard to state lines and after consultation with the parties to major delivery contracts and such representatives as the respective states may designate, may apportion the amount remaining available for consumptive use in such manner as is consistent with the Boulder Canyon Project Act as interpreted by the opinion of this Court herein, and with other applicable federal statutes, but in no event shall more than 4,400,000 acre feet be apportioned for use in California including all present perfected rights.

APPENDIX C

EXTRACT FROM OPINION IN ARIZONA V. CALIFORNIA, 373 U.S. 546, 592-594 (1963).

III. Apportionment and contracts in time of shortage

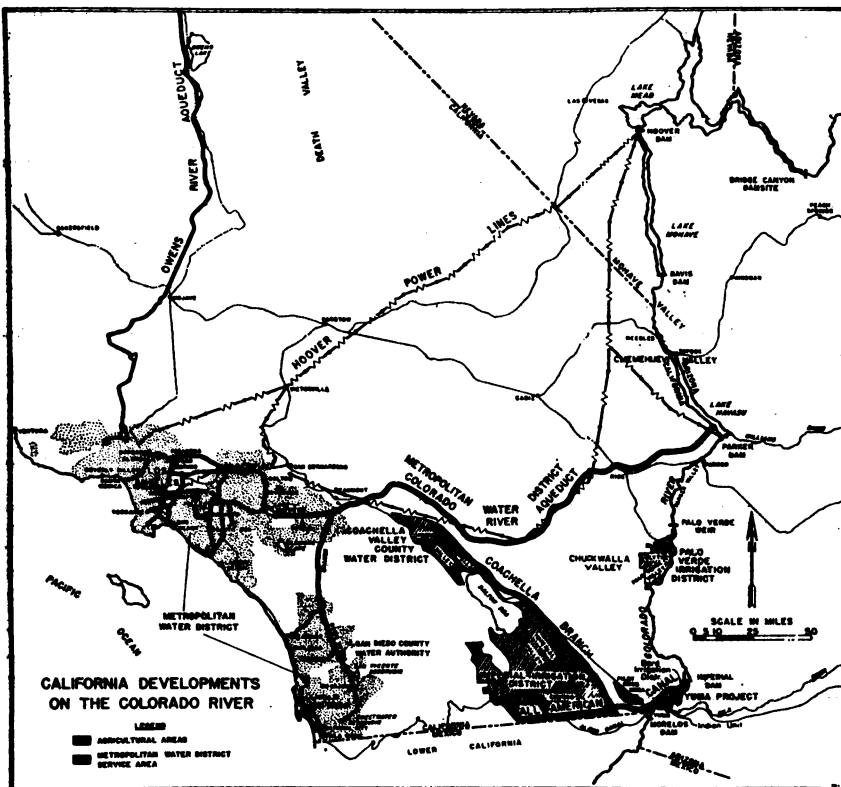
We have agreed with the Master that the Secretary's contracts with Arizona for 2,800,000 acre-feet of water and with Nevada for 300,000, together with the limitation of California to 4,400,000 acre-feet, effect a valid apportionment of the first 7,500,000 acre-feet of mainstream water in the Lower Basin. There remains the question of what shall be done in time of shortage. The Master, while declining to make any findings as to what future supply might be expected, nevertheless decided that the Project Act and the Secretary's contracts require the Secretary in case of shortage to divide the burden among the three States in this proportion: California $\frac{4.4}{7.5}$; Arizona $\frac{2.8}{7.5}$; Nevada $\frac{.3}{7.5}$. While pro rata sharing of water shortages seems equitable on its face,²⁸ more considered judgment may demonstrate quite the contrary. Certainly we should not bind the Secretary to this formula. We have held that the Secretary is vested with considerable control over the apportionment of Colorado River waters. And neither the Project Act nor the water contracts require the use of any particular formula for apportioning shortages. While the Secretary must follow the standards set out in the Act, he nevertheless is free to choose among the recognized methods of apportionment or to devise reasonable methods of his own. This choice, as we see it, is primarily his, not the Master's or even ours. And the Secretary may or may not conclude that pro rata division is the best solution.

It must be remembered that the Secretary's decision may have an effect not only on irrigation uses but also on other important functions for which Congress

²⁸ Proration of shortage is the method agreed upon by the United States and Mexico to adjust Mexico's share of Colorado River water should there be insufficient water to supply each country's apportionment.

brought this great project into being—flood control, improvement of navigation, regulation of flow, and generation and distribution of electric power. Requiring the Secretary to prorate shortages would strip him of the very power of choice which we think Congress, for reasons satisfactory to it, vested in him and which we should not impair or take away from him. For the same reasons we cannot accept California's contention that in case of shortage each State's share of water should be determined by the judicial doctrine of equitable apportionment or by the law of prior appropriation. These principles, while they may provide some guidance, are not binding upon the Secretary where, as here, Congress, with full power to do so, has provided that the waters of a navigable stream shall be harnessed, conserved, stored, and distributed through a government agency under a statutory scheme.

None of this is to say that in case of shortage, the Secretary cannot adopt a method of proration or that he may not lay stress upon priority of use, local laws and customs, or any other factors that might be helpful in reaching an informed judgment in harmony with the Act, the best interests of the Basin States, and the welfare of the Nation. It will be time enough for the courts to intervene when and if the Secretary, in making apportionments or contracts, deviates from the standards Congress has set for him to follow, including his obligation to respect "present perfected rights" as of the date the Act was passed. At this time the Secretary has made no decision at all based on an actual or anticipated shortage of water, and so there is no action of his in this respect for us to review. Finally, as the Master pointed out, Congress still has broad powers over this navigable international stream. Congress can undoubtedly reduce or enlarge the Secretary's power if it wishes. Unless and until it does, we leave in the hands of the Secretary, where Congress placed it, full power to control, manage, and operate the Government's Colorado River works and to make contracts for the sale and delivery of water on such terms as are not prohibited by the Project Act.



STATEMENT OF DALLAS E. COLE, CHIEF ENGINEER, COLORADO RIVER BOARD OF CALIFORNIA

CALIFORNIA'S STAKE IN THE COLORADO RIVER

The State of California depends on the Colorado River for much of its sustenance. About half of the present population of the State is in whole or in part dependent upon the Colorado River for its water supply for irrigation, domestic, municipal and industrial purposes. Eighty percent of the water supply of Southern California and twenty percent of the total water use in the State of California is from the Colorado River. Hydroelectric plants on the river furnish a substantial supply of power at low cost.

The metropolitan areas of Southern California situated on the coastal plain and foothills in Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties, with a present population in excess of 10,000,000 inhabitants and assessed valuation in excess of 20 billion dollars, are dependent upon the Colorado River as a source of supplemental water supply for domestic, industrial, and municipal purposes. They are using more than 1,100,000 acre-feet a year through the Colorado River Aqueduct built by The Metropolitan Water District of Southern California. Without the supply made available since 1941 from the Colorado River, the great development that has taken place in Southern California would not have been possible. Southern California has become the space and electronics capital of the United States; continued development of these new technologies is of utmost importance to the future of the Southwest and to the national welfare.

Colorado River water is the only supply available to serve 700,000 acres of land being irrigated in the Palo Verde, Imperial, and Coachella Valleys of California. Irrigation of these lands requires about 4,000,000 acre-feet annually.

Imperial Irrigation District has over 505,000 acres under irrigation which every year produces crops valued at more than \$200 million, including values added by cattle feeding. Principal crops are vegetables, melons, lettuce, sugar beets, alfalfa, cotton, and barley. Because of the large quantity and high quality of the winter and early spring vegetables and fruits, Imperial Valley is known as "America's Winter Garden."

Coachella Valley County Water District is currently irrigating 60,000 acres of a potential 161,000 acres north and west of the Salton Sea. Crops valued at \$56 million a year are grown, including dates, grapefruit, grapes, vegetables, alfalfa, cotton, grain, and values added by livestock feeding operations.

Palo Verde Irrigation District is located around the City of Blythe and has 90,000 acres under cultivation. Principal crops are lettuce, cantaloupes, watermelons, alfalfa and cotton, which are valued in excess of \$36 million annually, including values added by cattle feeding.

The Reservation Division of the Yuma Federal Reclamation Project was one of the first projects authorized under the Reclamation Act. About 11,000 acres are now under irrigation in California producing crops valued at \$3.4 million each year.

The day is rapidly approaching when the demands upon the waters of the Colorado River System will exceed the average supply. Water shortage on the Colorado affects the entire Southwest, which as a whole is already short, and existing partly on overdrafts. Curtailment of uses by existing California projects on the Colorado probably will commence as soon as the Central Arizona project is built. In order to prevent curtailment of existing uses and to assure future development of the Southwest to its full potential, additional water from other sources will be needed.

Experience has shown that a span of 25 or more years is generally required to accomplish the necessary investigations, formulation of plans, negotiations, authorization, financing, design, and construction of a major water project. In order to anticipate the need for new sources of water for the Pacific Southwest, it is imperative to initiate as soon as possible the studies that will lead to the provision of water supplies adequate to meet future needs. In order to evaluate properly all possibilities and to develop the maximum benefits for all areas, including areas of surplus water, the problem should be studied as one of regional scope; and the solution should be one of integrated regional water resource development, taking into account all legitimate uses for water in the region.

STATEMENT OF RAYMOND R. RUMMONDS, CHAIRMAN, COLORADO RIVER BOARD OF CALIFORNIA

My name is Raymond R. Rummonds. I am chairman of the Colorado River Board of California. This is an agency of the State created by the legislature, charged with responsibility for the protection of California's interests in the waters of the Colorado River. By law, the chairman of the board is California's Colorado River commissioner, responsible for interstate negotiations involving the river, subject to the constitutional control of such matters by the Governor.

The six board members are appointed by the Governor from nominations submitted by six agencies owning Colorado River water rights: Imperial Irrigation District, Coachella Valley County Water District, Palo Verde Irrigation District, the city of Los Angeles, the Metropolitan Water District of Southern California, the San Diego County Water Authority.

On March 1, the Colorado River Board unanimously adopted a resolution, a copy of which is appended thereto. It supports enactment of legislation containing the principles of S. 861.

RESOLUTION, COLORADO RIVER BOARD OF CALIFORNIA**I**

The Colorado River Board of California recommends enactment of S. 861, 90th Congress, introduced by Senator Kuchel of California and Senator Moss of Utah, and counterpart bills in the House, as introduced by Congressman Hosmer (HR 6271) and others. These bills agree in principle with those introduced by Chairman Aspinall of the House Committee on Interior and Insular Affairs and Chairman Johnson of that Committee's Subcommittee on Irrigation and Reclamation.

The foregoing bills all embody the following features, which the Colorado River Board has repeatedly endorsed, and which were contained in the bill reported out by the House Committee in the 89th Congress:

1. Recognition of the necessity for meaningful steps to augment the inadequate flows of the Colorado River.

2. Adequate protection for the states and areas of origin of water exported to the Colorado, including full protection of the priorities of those areas in perpetuity.

3. Recognition of the Mexican Treaty burden as a national obligation, and that an appropriate share of the cost of importing water should be allocated to the performance of that Treaty. Whenever importations are accomplished to the extent of 2.5 million acre feet annually, both basins should be relieved of the danger of curtailment of their own uses to perform the Nation's Treaty obligations to Mexico.

4. Balancing of the operation of Lake Mead and Lake Powell, so that the benefits of wet years and the burdens of drought shall be equitably distributed between Upper Basin and Lower Basin reservoirs. We recommend the language of the Kuchel-Moss-Hosmer bills in this respect.

5. Authorization for construction of the five projects in Colorado.

6. Reimbursements of the Upper Colorado River Basin fund for payments out of that fund to compensate reduction of the power operations at Hoover Dam occasioned by filling of Lake Powell.

7. Authorization for construction of Bridge Canyon (Hualapai) Dam and Power Plant, and creation of a basin account to help finance the Central Arizona Project and importation works, fed by revenues from Hualapai Dam and by revenues from Hoover, Davis and Parker Dams after they have paid out.

8. Authorization for the construction of the Central Arizona Project, as part of the regional plan, but on the condition that if the water supply of the Colorado River is insufficient to satisfy the requirements of the projects already in existence or heretofore authorized by Congress for construction in Arizona, California and Nevada, then shortages shall be borne as provided in those bills. The effect is that California must bear the first burden of shortage, sacrificing nearly one million acre feet of constructed capacity whenever the supply shrinks to 7.5 million acre feet annually; but that the Central Arizona Project shall bear the next share of the shortage if the supply shrinks below 7.5 million acre feet before imported water arrives. To this end the priorities of existing and authorized projects will be protected

as against the proposed Central Arizona Project, but only until works have been constructed to import at least 2.5 million acre feet annually. The protection to existing and authorized projects in Arizona and Nevada would be unrestricted in quantities, but the protection to California's existing projects would be restricted to 4.4 million acre feet annually, to give effect to a limitation to which California agreed at the time of enactment of the Boulder Canyon Project Act.

II

The Colorado River Board of California recommends against enactment of the bill recommended by the Secretary of the Interior in his report on the Aspinall bill. The Secretary's proposal fails to protect the interests of any state other than Arizona. It abandons the regional solutions proposed by the Secretary in the last Congress, and which the seven states accepted in the bill (H.R. 4671) reported out of committee in the 89th Congress. California followed and supported the Secretary's leadership then, and regrets his abandonment of it now. California has not changed her position. We hope that unity among the seven states can be reestablished under the leadership of Chairman Aspinall within the framework of the principles the seven states agreed upon last year which this resolution restates.

RESOLUTION, COLORADO RIVER BOARD OF CALIFORNIA

The Colorado River Board supports such amendment of the pending Colorado River bills now before the Congress of the United States as may be necessary to permit the full exploration and development of the hydro-pumped storage peaking plant for Hualapai Dam and Reservoir at Bridge Canyon, with an installed capacity of 5 million kilowatts. This project was proposed by the Department of Water and Power of the City of Los Angeles on March 17, 1967, in Hearings Before the Subcommittee on Irrigation and Reclamation of the House Interior and Insular Affairs Committee. The Board endorses the principles of the Department's proposal, which will help to optimize hydroelectric power development as well as to improve the recreational potential of the area and will expedite passage of the pending legislation.

Senator ANDERSON. We will resume at 2:30 this afternoon.

(Whereupon, at 12:45 p.m., the subcommittee recessed until 2:30 p.m. of the same day.)

AFTERNOON SESSION

Senator ANDERSON. Joe L. Budd. Go ahead, Mr. Budd.

STATEMENT OF JOE L. BUDD, ASSISTANT COMMISSIONER, UPPER COLORADO RIVER COMMISSION

Mr. BUDD. Mr. Chairman, I certainly appreciate the courtesy you have extended me by allowing me to testify at this time.

Senator ANDERSON. Senator Hansen is a fine member of this committee, and this is the first request he has made.

Mr. BUDD. I hope he doesn't regret it.

My name is Joseph L. Budd, assistant Colorado River commissioner for the State of Wyoming. I have spent my entire life in the cattle ranching business at Big Piney, Wyo., which is located on the upper reaches of the Green River.

I was a member of a group from Wyoming who urged Governor Hunt to call a meeting of the Governors of all the other Upper Basin States to attempt to divide the waters among the Upper Basin States. As a result of this meeting, the Upper Colorado River Compact Commission was formed.

I was appointed as one of the assistants to the Wyoming commissioner, L. C. Bishop. The first meeting of the commission was in July of 1946. The members of the commission worked hard for over 2 years to reach an equitable division of the waters among the Upper Basin States.

The compact provided for the creation of the present Upper Colorado River Compact Commission. I have served continuously as assistant to the commissioner since that time. This has not been a profitable service for me. The pay scale of ranchers on our Wyoming boards certainly is not lucrative. I have, however, spent this time gladly and willingly because I recognized that the whole future growth and development of southwestern Wyoming was dependent on the retention and use of our share of the Colorado River water.

This is an arid country. Irrigation is necessary for the production of any crop that is harvested. Water is essential for the growth of anything other than range grasses.

In spite of this, some of the finest ranches in the West are located in this area, and at Eden Valley, Wyo., we have, under the reclamation project established in 1921, developed some very productive farms. It was pleasing to me that several sons of the owners of the original Eden project farms are among those who applied for and are now operating some of the farms on the new Eden unit. Some of these young men are college graduates who could have chosen to go elsewhere. I am aware that the Eden project has its problem, but most of them have been caused by manmade mistakes, and were not caused by Mother Nature—and are not insurmountable.

All of Wyoming's share of the water of the Colorado will be needed to develop the thousands of acres of arid land that are adaptable to irrigation. Not only is the land available within the basin, but Wyoming has a very critical shortage in the fertile and productive North Platte River Basin. Water has allowed for this diversion from Wyoming's share in the upper Colorado River compact. There is a desperate need for this water there, and I am sure that this diversion will be made someday if Wyoming does not lose her rightful share of this water.

This area is richly endowed with minerals. It has a vast deposit of iron ore which is now being mined by Geneva Steel Co. It has one of the Nation's most extensive coal deposits; the Nation's largest deposit of pure trona which, it is said, can supply the whole Nation's needs for over 50 years.

Wyoming's portion of the tremendous oil shale deposit which the committee has been studying lies in this basin. It contains a major producing oil and gas field, which already furnishes the major portion of gas to the Pacific Northwest and is still in the early stages of development. Other minerals, such as phosphate, are available for future development and, as an added bonus, we have hundreds of square miles of smog-free air and sunshine unlimited. The industrial needs for water in the not-too-distant future will be substantial.

I have spent considerable time telling of my background. I didn't do this to imply that I am an expert, because I am not. I did this because I think it would be valuable to the committee to know some of the background of the Colorado River development.

In noticing the members of the committee, I am noticing the wording of that sentence, so I think it should be changed a little bit. I recognized that on the committee are members who certainly have considerable background regarding the development of the Colorado River.

Some of the West's most dedicated and intelligent men were responsible for the harmonious development of the great river basin. Senators Milliken, Johnson, Anderson, Watkins, O'Mahoney, and Barrett, Judge Stone, L. C. Bishop, Fred Wilson, are a few of those great people. As you know, very few of them are living today.

These men were dedicated to one thing—the development of the Colorado River Basin under the terms of the Upper Colorado River compact. The representatives of these States supported each other without reservation throughout the years without concern of which State came first. They were dedicated to the development of this whole inland empire. Wyoming has supported every other Upper Basin State project throughout the years, without reservation.

I do not mean to offend any of the representatives of the other Upper Basin States. They are fine and honorable men, but I feel that due to the temptations of receiving certain immediate benefits for their own States, they have overlooked what I feel are some very important obligations. They are offering support to bills that could very well terminate the future development of this great area because of concessions that they might receive in this bill, or in return for their support of the bill.

These bills, without authorization of water importation, are giving away water that is not theirs, or yours, to give. A major portion of the water available for the central Arizona project is water that rightfully belongs to the sovereign States of Wyoming and Utah and which, without importation of additional water, we can never expect to use.

This water is Wyoming's water and Utah's water, as a result of solemn interstate agreements and the ratification of the Upper Colorado River Basin compact, which was ratified by all of the State legislatures and signed by the respective Governors of those States. It was also ratified by the U.S. Senate and signed by President Harry Truman.

Wyoming has used only 300,000 acre-feet of its estimated 800,000 acre-foot share. Utah finds itself in a similar position. Colorado, according to figures furnished by the Colorado River Commission, will have utilized her entire share of the river if all of the projects included in H.R. 3300 are constructed, and perhaps even more than her share as estimated.

It is my strong belief that if a bill is to be passed that does not authorize the importation of enough water to supply the needs of the central Arizona projects, then certainly Colorado and New Mexico should also forego some of their development so they can furnish their proportionate share of the deficit, as is agreed in the Colorado River compact of 1922. If they are willing to gamble our future on a promise of a study of an importation project, then they should be willing to gamble with some of their own.

In view of the Nation's budget problems, I think it is essential that any bill passed include the construction of both the Hualapai and

Marble Canyon Reservoirs to full capacity so that at least we will be able to pay for the importation facilities.

Just one brief comment on the Mexican Treaty obligation. Wyoming's position that this is a national obligation has been questioned. I think that the committee should know that this treaty was agreed to under very unusual circumstances. The States were called together by the Secretary of State to form a treaty with Mexico during the crucial period of World War II.

The States were urged to agree to a treaty to improve relations with Mexico and insure here friendship during those crucial years. The States were informed that the treaty was essential to the security of our Nation. It was presented as a patriotic duty for the signatory States to agree. I am sure that the terms would have been changed considerably if this treaty had been negotiated without the pressures caused by the serious situation with which our Nation was confronted.

Mr. Chairman and members of the committee, it has not been pleasant for me to take this position, or to make some of the statements which may have offended some of the representatives of our sister States. I have experienced many years of enjoyable association with these fine men. I do this only because I feel it is the only position I can conscientiously take to justify the trust that the people of my area have placed in me. To do otherwise, in my estimation, would be a betrayal of the future citizens of the Green River Basin. I hope that my friends from the other States will stop to consider what their position would be if they found their States confronted with the same situation.

I want the committee to know that I wholeheartedly support the central Arizona projects. It will be a great national asset when finally consummated. I am aware of the critical water problems of Arizona, and I hope they can be alleviated. I always have and still do support the ambitions of the States of Colorado, New Mexico, and Utah—and if water is made available, or assured, that will allow Wyoming to realize the destiny that is rightfully hers, I would take great pleasure in helping in any way I can to aid them in achieving their ambitions. The Nation's future will be greatly enhanced by the full development of this great inland area.

Gentlemen, I appreciate the privilege of appearing before your committee. I hope my remarks will be helpful in your deliberations.

Senator ANDERSON. I think I should say that some people wouldn't quite agree with you. You say at the bottom of page 3, "They are offering support to bills that could very well terminate the future development of this great area."

Do you list those bills, classify those bills?

Mr. BUDD. Sir, it is my belief that, if importation is not authorized, we are risking the future development of the area, so while there is a difference in the degree and difference in the bills, I feel that there are dangers in each bill that has been introduced.

Senator ANDERSON. You say:

A major portion of the water available for the central Arizona project is water that rightfully belongs to the sovereign States of Wyoming and Utah.

Do you believe that?

Mr. BUDD. Do I believe that?

Senator ANDERSON. Yes.

Mr. BUDD. Yes. In my judgment, when they were allocated to those States by compact, the water that is produced in those particular

States, then I do believe that those States do rightfully own that water. I mention those two States because those are two who are furthest behind in development. They have utilized a smaller percent of their water than do New Mexico and Colorado.

Senator ANDERSON. I just think the central Arizona project does not rob any water from other States. I hope you will consider this somewhat carefully before you much such a statement.

Mr. BUDD. I am basing this on the contention that there would not be sufficient water available for the central Arizona project, if it was not for the Wyoming and Utah water that is now flowing downstream.

Senator ANDERSON. I hope you will check again on the compact. I think the Supreme Court fixed the obligations and duties and the compact did also.

Senator JACKSON.

Senator JACKSON. Not right now, thank you.

Senator ANDERSON. Senator Kuchel.

Senator KUCHEL. I simply want to say, Mr. Budd, that I think you have very clearly, and quite courageously, pointed up many of the problems that are going to be completely unsolved until more water is imported into the system. It is when every State that relies on the Colorado River will have an opportunity to use its entitlement freely, and to build for the people who are going to live in those States in the years to come.

I quite agree with you. This committee, Mr. Budd, with representatives from the basin States participating, could fashion the finest piece of reclamation legislation this country has even known, and bring in supplemental water which would permit your State, and the others, to build. I think your statement is very helpful, and I thank you.

Mr. BUDD. I thank you, Senator.

Senator ANDERSON. Senator Hayden.

Senator HAYDEN. No questions.

Senator ANDERSON. Senator Moss.

Senator MOSS. No questions. I do wish to commend you for a very forthright statement. Your assertions are a little bit shocking in some places, but I think rightfully so. I concur with the Senator from California that it would indicate how great the need is to write a bill here that will solve our problems out beyond just the immediate building of the central Arizona project.

Mr. BUDD. I thank you, and I wish to apologize for my bluntness. We don't get practice in finesse out in the country. I am sure that some of the things I say would not be as shocking if I had the fine mannerisms of many of the Members of the Senate.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Mr. Budd, I am glad to see you here again, and I recognize you as a forthright and honest man. I think we can talk the same language. I am used to speaking bluntly, too.

I agree with that portion of your statement in which you say that the importation features, or augmentation, are very important to this bill. But I must disagree with that portion of your statement on page 4, the first paragraph, in which you say:

These bills, without authorization of water importation, are giving away water that is not theirs, or yours, to give. A major portion of the water available for

the Central Arizona Project is water that rightfully belongs to the sovereign States of Wyoming and Utah and which, without importation of additional water, we can never expect to use.

Now you are aware, of course, of the studies I referred to yesterday in my statement by Leeds, Hill & Jewett, and the subsequent study by Tipton & Kalmbach, which prepared a report, "Water Supplies of the Colorado River Available for Use by the States of the Upper Division and for Use From the Main Stem of States of Arizona, California, Nevada, and the River Basin."

Now, this shows that if we delivered the 75 million acre-feet over a 10-year period, there would not be available to the upper States the 7.5 million average which was originally contemplated in the Colorado River compact. I am sure you are in accord with that, are you not?

Mr. BUDD. I believe so.

Senator ALLOTT. And it shows that instead of the 7.5 million acre-feet, that there would only be an average of 6.3 million acre-feet of water available in the Upper Basin, and if you subtract the 50,000 acre-feet which goes to Arizona for use in the San Juan Basin, about which there was some testimony yesterday, that would make 6.25 million acre-feet of water available in the Upper Basin, rather than the 7.5 million contemplated by the original compact.

Mr. BUDD. Senator, there seems to be quite a few different sets of figures presented, and I certainly can't get into an argument over figures. I am basing my testimony on figures that were presented to the Colorado River Commission this winter regarding Colorado's use of water, and according to those figures—

Senator ALLOTT. The Colorado River Commission, or the Upper Colorado River Commission?

Mr. BUDD. The Upper Colorado River Commission; pardon me.

Senator ALLOTT. That is fine.

Mr. BUDD. Wyoming is prepared, I believe—our State engineer—to submit figures that will bear out, at least in part, my testimony. I think your questions would probably bear more fruit there.

Senator ALLOTT. I think I have an obligation to you, Mr. Budd. I have known you casually for a long time, and I don't think you should find yourself on the horns of a statement which you can't really, I am afraid, justify.

Now, as I figure it, Colorado's share of the 6.25 million acre-feet available for distribution would be 3,234,375 acre-feet, which is 51.75 percent of the 6.25 figure.

You will have to trust my arithmetic on that, if you are willing to do it, and including reservoir evaporation, as contrasted with 3,855,375 if there were 7.5 million feet of water, acre-feet of water, in the river. Now I want to take the report of the Upper Colorado River Commission, dated March 11, 1966. This was addressed to Mr. Floyd A. Bishop, State engineer, State Capitol Building, Cheyenne, Wyo.

That report on page 1, item 1, shows Colorado, present depletions, and I won't bother to read them all off now. They will be in the record later. Present depletions show 1,786,000 acre-feet on Colorado. Are you acquainted with that figure?

Mr. BUDD. I couldn't say that I am acquainted with that particular figure. I understand what the Senator is developing.

Senator ALLOTT. You have seen this document?

Mr. BUDD. What is the document?

Senator ALLOTT. This is a document attached to a letter addressed to Mr. Floyd A. Bishop, State engineer, State Capitol Building, Cheyenne, Wyo.

Mr. BUDD. No, sir; I have not seen it.

Senator ALLOTT. The exact name, well, they just attach it to the letter to your State engineer.

Now, the next item, item 2, is "Authorized Federal projects," which includes the Savery-Pot Hook Park in Wyoming; is that right?

Mr. BUDD. Yes, Senator.

Senator ALLOTT. You will recall that the Senator from Colorado strongly, and I mean strongly, supported that?

Mr. BUDD. Yes, sir.

Senator ALLOTT. Bostwick Park, silt, main stream—those add up to another 482,000, which brings the total of present depletions and authorized projects to 2,268,000, to make it real easy, 2.26 million. That figure includes I might say, the main stream reservoir evaporation at Glen Canyon. So that brings the total present depletion, including authorized Federal projects and the main stream evaporation, up to a total of 2.268.

Then we go over to page 2, and there is an estimate of probable future depletion. Item 4 is the proposed authorization under H.R. 4671 of the five projects we are discussing here in this bill, and the total of those five projects is 378,000.

So, if we add that amount to the present depletions and the presently authorized projects, we come up with a total of 2.646 million, even if all the projects in the Kuchel bill, the Moss bill, and the Allott bill are authorized, we come up with a total of 2.646 million, as compared with an amount which Colorado would be entitled to under these two reports, one of which was authorized by the Upper Colorado River Compact Commission, of 3,234,000 feet.

In other words, something in the neighborhood of 600,000 feet, even under the adjusted figures for the relatively poor flow that we have had in the last few years.

I am at a complete loss, Mr. Budd, to understand why you say with all of that, that the central Arizona project takes water which belongs only to Wyoming and Utah, when, without these projects, there is at least 1 million acre-feet that belongs to Colorado.

Mr. BUDD. Senator, I wish I was capable of sitting here and following that many figures. I will have to admit that I am not. I will, however, say that it bothers me, too, Senator, for instance, the different figures that were used as to the flow of the Colorado River yesterday.

I think maybe this is one of the problems in deciding the share of the respective States, in that it has been stated the river is an erratic stream, and we are all aware that there are considerable differences in figures.

I mentioned that I got my information from a report given to the Upper Colorado River Commission last winter when there was discussion among the States as to what position these five Colorado projects would put Colorado in.

Those figures indicated that this might use over the Colorado share, according to the commission's study. I was interested this morning in the answer of Mr. Ely, why, when he answered that, in my understanding, the projects would be within the share of Colorado, and I don't contest that, but they would probably use Colorado's entire share.

Now, the point I am trying to make——

Senator ALLOTT. I don't think Mr. Ely made—or did he make the statement that he would use Colorado's entire share? If he did, I didn't hear him.

Mr. ELY. I intended to say it would be within Colorado's share. I misspoke, if I said more than that.

Mr. BUDD. The contention I make, I would like to see Colorado be able to use her entire share, but if we are going to gamble on importation for development of the Upper Basin States then I think that Colorado should leave some of her development undone, and take some of the chances with the rest of us. It has not been Wyoming's position to question two of your five projects. Wyoming has agreed to those.

But the three projects that have been added most recently are the ones that we feel should not be included in the bill until we get more assurance that we are going to have importation. Besides that, we think we are going to need all the horses that we have to get importation into the basin. We would like to have Colorado just as anxious for it as Wyoming and Utah would be.

Senator ALLOTT. Is there any question in your mind, Mr. Budd, about my position about importation?

Mr. BUDD. No, sir; I am pleased with it. I don't have faith in the promises of the reconnaissance study. I appreciate the Senator's action, the amendment that you put to the bill that you mentioned yesterday, asking that the National Water Study Commission be directed to study this as a matter of first importance. This was rejected by the committee.

I have been exposed some to groups discussing national water problems, and certainly everyone in this room knows that one of the major problems that a national commission will have to address itself to is stream pollution, the problems of the East. I am very fearful that our study of importation might not receive the consideration of the commission in the early days of its investigation and study.

Senator ALLOTT. If you do not have access to the study made and the tables compiled by the Upper Colorado River Compact Commission, Mr. Budd, I would be very happy to supply you with a copy of it.

You say, also, on page 4, "I hope my friends from other States will stop to consider what their position would be if their States were confronted with the same situation."

I hope you will consider that Colorado is exactly in this situation, and for the sake of you and your State engineer, and also for my very fine and good friend, who is a member of this committee, your Senator, Senator Hansen, I would like to state unequivocally and frankly that we do not seek in Colorado one drop of water that belongs to anyone else, and particularly to those of us in the upper basin States who are sharing the short end of what has turned out to be an improvident

compact made many years ago, in respect to the fact that we agreed to a flat delivery at a given point in the river, instead of dividing it between the upper and lower basin States.

I want you to further understand, and this is the position of Colorado, and it is my personal position, that we will do anything we can to help Wyoming, or help Utah, or help New Mexico, and also to help Colorado develop the projects which will allot to the States and permit them to put to beneficial use the water to which we think we have a right under the various compacts, and under the legislation which has been passed under the Upper Colorado River Project Act.

Mr. BUDD. Senator, I would be the first to say that we certainly appreciate the leadership that Colorado has displayed in this program. You mentioned that Wyoming's and Colorado's positions are the same. The place they are different is that Wyoming has barely started to use the water that has been apportioned to it under the Colorado River Compact. We have consumptive use, according to these figures provided me, of somewhere in the neighborhood of 300,000 acre-feet.

Senator ALLOTT. Mr. Budd, just one final question. This really isn't a question, but I think we ought to clear the record.

We now have feasibility reports on all of these five projects proposed for authorization here, and we have had them for over a year. Does Wyoming have at this time any projects upon which feasibility reports have been submitted, which it would like to have included in this legislation?

Mr. BUDD. We once—I don't know whether we still do—but certainly, we have feasibility reports on Seedskaadee, which has been held up because of the additional study that was made, the farm that was developed to further check the productivity of the area and the soilability, even though the project had been submitted not only to soil studies by the Interior Department, but also by the Department of Agriculture. It was submitted to more thorough study, I think, than nearly any other project, but still the funds were withheld for the canal structures, and at this time it isn't indicated that there is any consideration of doing anything about this.

Senator ALLOTT. Just for the record, I think, perhaps, I ought to read in on the basis of the 6.3 million acre-feet availability, the shares of the various States would be: Arizona, 50,000; Colorado, 3,234,375; New Mexico, 703,125; Utah, 1,437,500; Wyoming, 875,000. But under the figures, Mr. Budd, that I have given to you, it is hard—really difficult—for me to understand how you could say that this construction takes water that belongs only to Wyoming and Utah.

This is what concerns me more than anything else.

Senator ANDERSON. Senator Jordan.

Senator JORDAN. No questions.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Mr. Budd, may I say that I agree with the last paragraph in your statement that you want the committee to know that you wholeheartedly support the project. It will be a great national asset when finally consummated.

I feel as the distinguished chairman feels, that your statement that "A major portion of the water available for the central Arizona project is water that rightfully belongs to the sovereign States of Wyoming

and Utah and which, without importation of additional water, we can never expect to use," is an improper statement, because I judge that you have followed the compact all these years. You realize that this is not in accordance with the compact.

Mr. BUDD. Senator, it is probably not fair to the committee that I am testifying first. Wyoming, I think, will produce figures that will pretty much substantiate my position.

Senator FANNIN. I can't see how that is possible, but thank you.

Senator ANDERSON. Senator Hansen.

Senator HANSEN. Mr. Chairman, if I could say so, and I am certain I don't need to speak for Mr. Budd, but I think that there is in his statement, and in the statement given earlier this morning by Mr. Ely, an important observation that bears repeating.

I now read from Mr. Ely's statement this morning, on page 3 of that statement:

If the Central Arizona Project is to be authorized, the legislation must also undertake a number of steps in the interests of all the Colorado River Basin States, to initiate a realistic solution for the inevitable water shortage that will follow.

With that, I agree; and I am sure with that, Mr. Budd also agrees. Then, I would read also, if I may, from Mr. Ely's statement this morning on page 5, wherein he speaks first of "the protection of existing projects is a sound proposition legally, equitably, economically, and morally."

And on the bottom of that page, under "Economically," he makes this observation:

Economically, the provision recognizes that construction of a new project such as the new Central Arizona Project, should not be allowed to destroy or substantially impair existing projects serving established economies in Arizona, California, or Nevada.

And then in parentheses, he says—

California alone being limited to 4.4 million acre-feet.

I think the point Mr. Budd is trying to make is that it would not make sense at all for the Congress of the United States to authorize projects, and it just happens that at this particular time we are discussing the central Arizona project, it would not make sense for the Congress, once having authorized this project, and expecting that it has been built, then to consider further the authorization and the actual building and construction of projects in Wyoming which would do to central Arizona and to Colorado precisely what I think Mr. Ely was trying to point out this project could do to some other project already built.

Our concern certainly is not to detract in any way from the full development of this great basin area, and we do share genuinely the concern of Arizona in getting on with that job. I think we would get on with the job more quickly if we could agree as to the way in which we could take steps which would lead to a study that could be followed, a feasibility study that would look forward to the importation of water in the amounts so as to make valid all of the projects which I think should be authorized.

Thank you, Mr. Chairman.

If I may, Mr. Chairman, let me thank you, sir, for your courtesy in letting Mr. Budd appear. He does have to catch a plane.

Senator ANDERSON. Thank you, Mr. Budd, for coming.

Mr. BUDD. Thank you.

Senator ANDERSON. Mr. Bingham.

**STATEMENT OF HON. CALVIN L. RAMPTON, GOVERNOR OF THE
STATE OF UTAH; PRESENTED BY JAY R. BINGHAM, EXECUTIVE
DIRECTOR, UTAH WATER AND POWER BOARD, SALT LAKE CITY,
UTAH**

Mr. BINGHAM. Thank you, Mr. Chairman.

My name is Jay R. Bingham. I am executive director of the Utah Water and Power Board, Salt Lake City, Utah.

I am presenting this statement on behalf of Gov. Calvin L. Rampton, who is unable to attend these hearings. The Governor concurs with this statement and appreciates the opportunity to present testimony on the pending bills which are of such vital importance to the State of Utah.

At all levels of government we are engaged in a never-ending struggle to meet the demands of a growing nation. We in the West, and particularly Utah, the second driest State in the Nation, have been compelled to make frugal use of our limited water supply. Two-thirds of our irrigated land is inadequately supplied with water and more than 1 million acres of arable land lies idle and unproductive. To maintain our present rate of development we have had to reach our ever greater distances for additional water.

The State of Utah has a special interest in the legislation pending before this committee. More than 40,000 square miles, or nearly one-half of the area of the State, is in the drainage basin of the Colorado. We have the second largest drainage area of any State contributing to the Colorado River. Furthermore, Utah has interests in the lower, as well as the upper basin, by reason of a 3,600-square-mile area within the lower basin.

More importantly, Utah looks to its compact entitlement in the Colorado River to provide water needed for the Ute Indian unit of the central Utah project and other projects now being planned. Needless to say, we will scrutinize carefully any proposal which may use water from the Colorado and, particularly, any proposal which would use even temporarily "our" water.

In Utah, there is concern about the bills pending before this committee to authorize a Lower Colorado River Basin project or a central Arizona project. The construction and operation of another large water-consuming project on the Colorado River is possible only by making use of presently unused water apportioned to the Upper Colorado River Basin by the Colorado River compact of 1922 and, subsequently, to the individual States of the Upper Basin by the Upper Colorado River Basin compact of 1948.

When the Colorado River compact of 1922 was negotiated, a consumptive use of 7.5 million acre-feet of water was apportioned to the Upper Basin. Utah's share of this apportionment would be 1,714,000 acre-feet. Studies made since 1922 have indicated that on the basis of

more reliable and longer periods of streamflow records, the compact apportionment of 7.5 million acre-feet of consumptive use to the Upper Basin cannot be attained.

In 1953, the firm of Leeds, Hill, & Hewett made a study of the water resources available to the State of Colorado. This report shows that in contrast to the 7.5 million acre-feet believed by the Colorado River compact negotiators to be available, there is only 6.2 million acre-feet of water that can be consumptively used in the Upper Basin.

Utah and her sister States, Colorado, New Mexico, and Wyoming, are members of the Upper Colorado River Commission. In 1965, the internationally known firm of Tipton & Kalmbach, Inc., of Denver, Colo., prepared a report for the commission, entitled, "Water Supplies of the Colorado River Available for Use by the States of the Upper Division and for Use From the Main Stem by the States of Arizona, California, and Nevada in the Lower Basin."

This report shows that based upon past flows of the Colorado River, with all presently existing or authorized storage reservoirs, and meeting the compact requirement to deliver 75 million acre-feet in each 10-year period to the Lower Basin, there are only 6.3 million acre-feet of water per annum available for consumptive use in the Upper Basin. When Upper Basin reservoir evaporation is deducted, the net consumptive use possible in the Upper Basin amounts to only 5.6 million acre-feet.

Utah's share of 6.3 million acre-feet, which includes mainstream reservoir evaporation, would be 1,438,000 acre-feet. Furthermore, in the event that deliveries to the Lower Basin exceed 7.5 million acre-feet per year the amount available to the Upper Basin and to Utah is correspondingly reduced. The attached chart from the Tipton report graphically shows the marked decline in the flow of the river since the signing of the Colorado River compact in 1922.

The shortages indicated by these studies is caused by Mother Nature's water deficient river, coupled with the compact requirement to deliver 75 million acre-feet in 10 years to the Lower Basin. Major shortages in water supply for a Lower Colorado River Basin could occur sometime about 1990 to 2000, 25 to 35 years from today, or 15 to 25 years after the central Arizona project would begin to operate. Practically all water studies that have been made by other entities interested in the Colorado River confirm this finding.

We in Utah are fully aware of the Lower Basin's water needs. Arizona's plight is probably more serious and immediate than that of any other State in the basin. California is currently using 700,000 acre-feet more than confirmed to her by the U.S. Supreme Court from the first 7.5 million acre-feet of lower basin main stem water. Importations of water are being made into southern California not only for the purpose of replacing the 700,000 acre-feet that she must give up to others on the Colorado River, but also for the purpose of supplying her rapidly increasing municipal and industrial requirements. Nevada is running short of water in the Las Vegas area. By year 2000, Nevada will use all of the 300,000 acre-feet confirmed by the Supreme Court.

In summary, there is not enough water in the river from that available within compact apportionments for all potential uses in either

the Upper or the Lower Basin. Any large, new project, such as the central Arizona project, can exist only on presently unused compact apportioned water belonging to the Upper Basin—and can exist for only as long as water is not withdrawn by the Upper Basin States for their future uses. Thus, both the Upper Basin and the Lower Basin are in a precarious position so far as future water development is concerned.

The future water supply situation for the State of Utah is further complicated by the fact that there is a great imbalance in the relative total amounts of water resource development that has been accomplished within the Upper Basin States. For instance, present and probable future depletions of Colorado River water in the State of New Mexico may slightly exceed New Mexico's compact apportionment of physically available Upper Basin water. In Colorado present depletions, coupled with uses by authorized projects under construction and probably future depletions plus the water to be consumptively used by the five projects to be authorized in the pending legislation, approach the compact apportionment of available water for the State of Colorado.

On the other hand, Wyoming's present depletions, plus committed uses of water, amount to only about 54 percent of her compact apportionment.

Utah's present depletions and committed uses total only about 60 percent of our compact apportionment. The colored chart pictorially illustrates this imbalance. Therefore, it is easy to conclude that a large share of the water that will be temporarily used in the Lower Basin by the central Arizona project will have to come from unused water belonging to the States of Utah and Wyoming.

Our apprehension in Utah stems from the fact that in the future when we need this water for our own uses, we may be standing alone in attempts to withdraw it from a going downstream economy for the establishment of new upstream developments. Therefore, Utah's support of this legislation must be dependent upon the inclusion of certain protective measures that will give some assurance that our future water resources development will not be jeopardized.

It is our desire to take a constructive approach with regard to the pending bills to authorize a Colorado River Basin project—namely, S. 861, S. 1242, and S. 1409—provided certain safeguards are included in the legislation to protect Utah's entitlement from the Colorado River. We are opposed to the concept in S. 1004 and S. 1013 to provide pumping power for the central Arizona project from a thermal generating plant because, among other things, it does not contribute to a solution of a pressing regional problem.

Because the fundamental regional problem revolves around an uncertain future water supply, it is our belief that there should be included in the bill a "legislative commitment" for a study of an importation of water from sources outside the Colorado River Basin. Utah can support this legislation only if there is such a commitment.

As we have emphasized above, we are fearful of being put in the position of prematurely losing part of our remaining water supply and, therefore, being precluded from opportunity for further development. This is why we are so concerned about the study of an importation of water.

In view of the imminent critical water shortage in the Colorado River, Utah will support any feasible means of augmenting the water supply. At the moment, the most promising means of augmentation is the importation of water from areas of surplus.

As part of an importation study and in conformity with the recommendations made in the Secretary of the Interior's Southwest water plan, it appears to be logical to look to the northern coastal streams of the State of California as one source of water.

Senator Moss in S. 1409 has suggested this possibility. As outlined in the three Colorado River Basin project bills before the committee, initial studies of an import should provide that the first 2.5 million acre-feet be designated for satisfaction of the Mexican Water Treaty burden and to alleviate loss in the Lower Basin.

We strongly recommend that a high Hualapai Dam be authorized by this legislation. The authorization of this storage and power generating unit is in the national interest to provide revenues for a development fund for repayment of other features of the project and for providing a sound approach for future augmentation of the river.

Recently, the Department of Water and Power of the City of Los Angeles proposed that a pump-storage peaking generating plant be constructed in conjunction with Hualapai Dam, and that public and private utilities in the marketing area finance the costs of the generating facilities and transmission lines.

We recognize that there may not be sufficient time in order to research and compile the requisite economic power market and other feasibility data to authorize this pump-storage, peaking-power facility at this time. Therefore, we heartily endorse the proposal to authorize the high Hualapai Dam in this legislation and to direct the Secretary of the Interior to continue engineering and economic studies and negotiations with non-Federal entities with respect to constructing and operating the hydroelectric generating and transmission facilities and to report back to the Congress on the results of his negotiations.

Utah supports the principle that there should be language in this legislation which would provide equitable criteria for the coordinated long-range operation of Colorado River storage reservoirs. This provision is included in the pending legislation. We regard it as extremely important because it constitutes a legislative recognition of our rights under the Colorado River compact and the Colorado River Storage Project Act.

Without it, Utah could not support any legislation that would include authorization of a central Arizona project. These reservoir operating principles have been agreed to by all of the States and the Department of the Interior. Therefore, we urge that they be retained in the legislation when enacted.

The pending bills to authorize a Colorado River Basin project include an apportionment of water shortages in the Lower Basin that would require the central Arizona project to bear all shortages if water available in the main stream falls below 7.5 million acre-feet and at the same time gives a priority to the delivery of 4.4 million acre-feet of water per year to California.

We view this highly controversial arrangement as an Arizona-California problem. We interpret this grant of priority by Arizona to California as in no way acting as an obligation against the Upper Basin States.

Yet there is some disagreement on this point because such a priority might mean that in the operation of the central Arizona project, in times of lean water supply, will have to be more dependent upon the use of Upper Basin water than it might be without the priority. Since the language granting this priority to California is meant to be a waiver by the State of Arizona only, the wording should make it unmistakably clear that the benefits to the remaining States from the Boulder Canyon Project Act and the California Self-Limitation Act are not modified or repealed by this legislation. We strongly endorse the language of S. 1242 and S. 1409 that we believe is essential to accomplish this purpose.

Utah supports a provision in the legislation that would provide reimbursement to the Upper Colorado River Basin fund for expenditures that have been made to pay for diminutions in power generation at Hoover Dam attributed to the filling of Upper Basin reservoirs.

It is Utah's position that the Dixie project, which is actually in the Lower Basin, should be integrated into the Colorado River Basin project and particularly in the development fund that can be established by this legislation. In order to make the Dixie project financially feasible, all separable and joint costs allocated to recreation and fish and wildlife enhancement should be made nonreimbursable.

The provision in section 401 of S. 1409 by Senator Moss should definitely be included. It is consistent with the original authorizing legislation for the Dixie project and has been relied upon by local interests.

Utah urges the priority of planning for certain Upper Basin projects. In this regard, Utah desires that the Ute Indian unit of the central In this regard, Utah desires that the Ute Indian unit of the central Utah project be given a priority of planning such that the planning report on this unit will be completed by 1972. A proviso to this effect is included in section 501 of S. 1409.

The State of Utah, of course, has a vital interest in the proceedings of this Commission and in the waters of the Colorado River.

I would point out to the committee that nearly one-half of the area of the State of Utah is tributary to the Upper Colorado, and likewise Utah is one of those States that has areas lying in both the Upper and the Lower Basin.

The State of Utah is, again, concerned over matters that have already been discussed before this committee, the fact that the waters apportioned by the compact of 1922 are not available for us.

Mr. Chairman, I think it would be of interest to the committee—I have here reproduced in large scale a graph prepared during the preparation of the Tipton-Kalmbach report. I would simply state that this graph for 1905 to 1964, a 10-year moving average, and you will note that the trace of that moving average shows in the blue area prior

to 1930, a period when the supply of the river was greater than it is at present, with the decline you see in the yellow-shaded portion, in more recent years where the river has been deficient so far as its ability to meet the compact commitment.

I would say in defense of those who sat and deliberated on the compact, that it happened so far as that chart is considered, that deliberations took place when that reached its peak and they thought they were dividing a safe supply of the river. The long-term trend is charted on the chart as a dashed red line. A smaller reproduction of that appears attached to my statement.

The State of Utah, perhaps in an oversimplified summary, takes the position that it would like to be constructive. It would like to be helpful to its neighbors. We are sympathetic to the position that the State of Arizona finds itself in.

We feel in the interests of the future development of the State of Utah and its rights to develop its compact entitlement, that there are certain safeguards or provisions that should be a part of this legislation. We feel in using the words of our Governor, that there should be a legislative commitment for imports.

We feel, further, that the upgrading criteria, which has been developed over a period of time, provides a further guarantee to the interests of the State of Utah that the operation of Lake Powell and the releases from that structure there will be such that we will be better able to come before this committee in the future to get more favorable observation on this project.

Again, quickly, we would feel that the best interests of the entire basin would be served by the construction of a Hualapai Dam. We are not competent to, at this point, comment with any specific detail on the so-called Goss recommendation, but we would submit that this should be studied, and would recommend this to you.

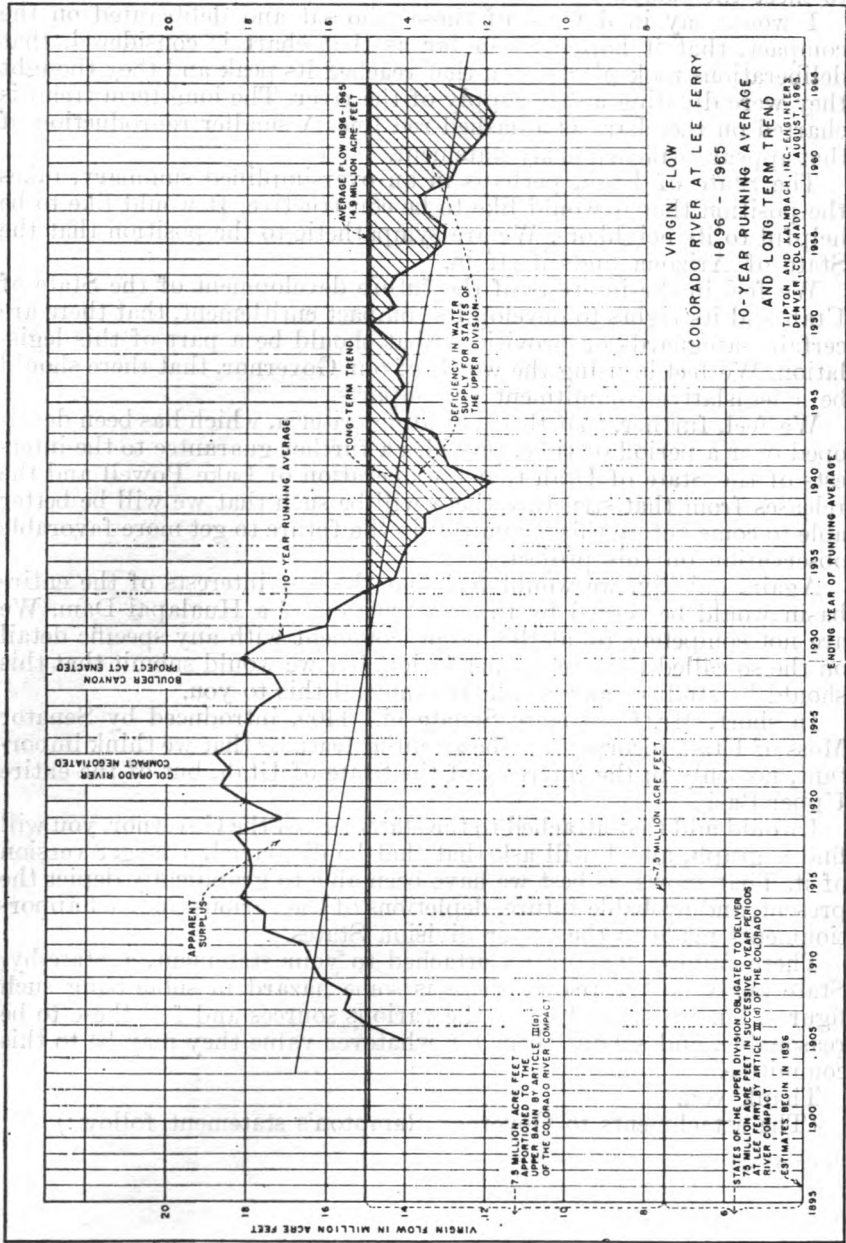
In short, Mr. Chairman, Senate bill 1409, introduced by Senator Moss of Utah, incorporates the essential features that we think important, not only in the interests of the State of Utah, but of the entire Upper Basin.

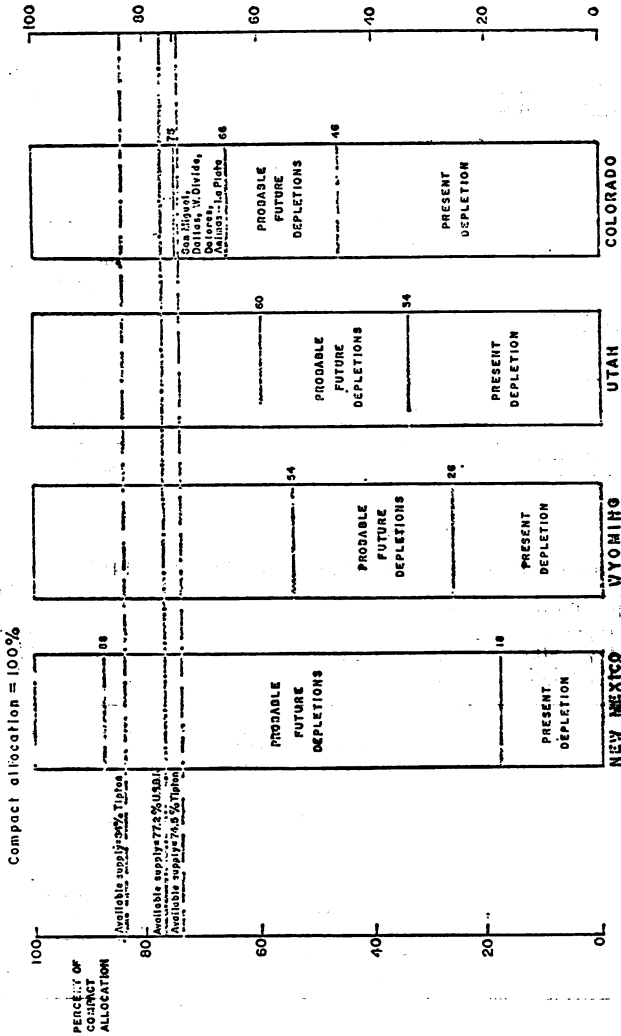
I would add that attached to the statement of the Governor, you will find a graph, and I will ask that that be displayed, a larger version of it. That shows, as best we have been able to graphically depict the present, and probable future, depletions of the various compact apportionments made to the upper division States.

There follows that graph attached to your statement, a State-by-State analysis. We realize there is some hazard in submitting such figures, but we have checked the various sources and feel these to be reasonable, and submit them for whatever value they may be to this committee.

Thank you.

(The attachments to Governor Rampton's statement follow:)





UPPER BASIN STATES
COLORADO RIVER SYSTEM WATER
PRESENT & PROBABLE FUTURE DEPLETIONS

April 1967

STATE-BY-STATE ANALYSIS OF COMPACT APPORTIONMENTS TO UPPER DIVISION STATES

Colorado River system water compact allocations—Present and probable future depletions

[Units 1,000 acre-feet]

NEW MEXICO

Allocation (Upper Colorado River Basin compact): $(7,500 - 50) \times 11.25\% =$ *Percent*
838..... 100.0

Probable water supply:

$(6,300^1 - 50) \times 11.25\% = 703$ 83.9
 $(5,800^2 - 50) \times 11.25\% = 647$ 77.2
 $(5,600^3 - 50) \times 11.25\% = 624$ 74.5

	At site depletion	Salvage	Depletion at Lee Ferry	Accum- ulated total	Percentage
Present depletion.....	145	-6	139		
Main stem evaporation.....			11	150	17.9
Probable future depletions:					
Utah construction.....	25				
Navajo Reservoir contracts.....	100				
Town of Farmington.....	5				
San Juan-Chama.....	110				
Navajo Indian irrigation.....	250				
Navajo Indian Hogback.....	10				
Animas-La Plata.....	34				
Total.....	534	-21	513		
Navajo Reservoir evaporation.....			10		
Main stem evaporation.....			63	736	87.8

WYOMING

Allocation (Upper Colorado River Basin compact): $(7,500 - 50) \times 14\% =$ *Percent*
1,043..... 100

Probable water supply (Tipton report):

$(6,300^1 - 50) \times 14\% = 875$ 83.9
 $(5,800^2 - 50) \times 14\% = 805$ 77.2
 $(5,600^3 - 50) \times 14\% = 777$ 74.5

	At site depletion	Salvage	Depletion at Lee Ferry	Accum- ulated	Percent- age
Present depletions.....	267	-11	256		
Main stem evaporation.....			14	270	25.9
Probable future depletions:					
Seedskadee.....	165				
Lyman.....	10				
Westvaco industrial.....	41				
Savory-Pot Hook.....	12				
Total.....	228	-9	219		
Main stem evaporation.....			78	567	54.4

Colorado River system water compact allocations—Present and probable future depletions—Continued

UTAH

Allocation (Upper Colorado River Basin compact):	Percent
$(7,500-50) \times 23\% = 1,714$	100
Probable water supply:	
$(6,300^1-50) \times 23\% = 1,438$	83.9
$(5,800^2-50) \times 23\% = 1,322$	77.2
$(5,600^3-50) \times 23\% = 1,277$	74.5

	Con- sumer use	Evapo- ration	At site deple- tion	Salvage	Deple- tion at Lee Ferry	Accum- ulated total	Percent- age
Present depletion:							
In basin.....	449	6	455				
Export.....	108	16	124				
Total.....			579	-23	556		
Main stem evaporation.....		23			23	579	33.8
Probable future depletions:							
Bonneville.....	148	18	166				
Upalco.....	18	2	20				
Jensen.....	9	1	10				
Uintah.....	18	2	20				
Emery County.....	14	3	17				
Kaiparowits.....	102	0	102				
Total.....				-13	322		
Main stem evaporation.....		129			129	1,030	60.1
Ute Indian.....			400	-15	385	1,415	82.6
San Juan and Grand Counties.....			100	-4	96	1,511	88.2
Price River.....			20		20	1,531	89.3
Gray Canyon.....			170	-7	163	1,694	98.8
Juniper.....			100	-4	96	1,790	104.4

Colorado River system water compact allocations—Present and probable future depletions—Continued

COLORADO

Allocation (Upper Colorado River Basin compact): $(7,500 - 50) \times 51.75\% =$	<i>Percent</i>
3,855-----	100
Probable water supply (Tipton report):	
$(6,300^1 - 50) \times 51.75\% = 3,234$ -----	83.9
$(5,800^2 - 50) \times 51.75\% = 2,976$ -----	77.2
$(5,600^3 - 50) \times 51.75\% = 2,872$ -----	74.5

	At site depletion	Salvage	Depletion at Lee Ferry	Accum- ulated total	Percentage
Present depletion-----	1,786	-61	1,725 52		
Main stem evaporation-----				1,777	46.1
Probable future depletion:					
Savory-Pot Hook-----	26				
Hayden steam plant-----	12				
Fruitland Mesa-----	28				
Bostwick Park-----	4				
Homestake Creek diversion-----	74				
Pueblo-Eagle River-----	3				
Fryingpan-Arkansas-----	70				
Ruedi Reservoir-----	6				
Silt-----	6				
Colorado Springs-Blue River-----					
Denver-Blue River-----					
Denver-Williams Fork-----					
Denver-Moffat Tunnel-----	215				
Denver-Eagle and Piney River-----					
Englewood-Moffat Tunnel-----	10				
Independence Pass Tunnel-----	14				
M. & I. Green Mountain-----	12				
Total-----	486	-19	467 290	2,534	
Mainstem evaporation-----				2,534	65.7
Seeking authorization:					
Animas-La Plata-----	112				
Dolores-----	74				
Dallas Creek-----	37				
West divide-----	76				
San Miguel-----	85				
Total-----	384	-15	369	2,903	75.3

¹ 7,500 annual delivery at Lee Ferry—Tipton.

² 8,250 annual delivery at Lee Ferry—U. S. Bureau of Reclamation.

³ 8,250 annual delivery at Lee Ferry—Tipton.

Senator ANDERSON. You did state that you would like to see the Hualapai Dam constructed?

Mr. BINGHAM. Yes, sir.

Senator ANDERSON. We appreciate very much the fact that you have presented a very good paper and a very good study.

Thank you.

Senator JACKSON.

Senator JACKSON. I have no questions. Thank you very much.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. I think I have none, thank you.

Senator ANDERSON. Senator Jordan.

Senator JORDAN. No questions.

Senator ANDERSON. Senator Hansen.

Senator HANSEN. I have none, thank you, Mr. Chairman.

Thank you for a good statement.

Mr. BINGHAM. I thank you, Senator.

Senator ANDERSON. Senator Moss.

Senator Moss. I will try to be very brief. I did have the opportunity of reading your statement in full, Mr. Bingham, and therefore I probably dredged up two or three points that I would like to underline that the rest of the committee have not had time to see yet because of your brief oral presentation.

I was interested, for instance, in your characterizing Utah as the second dryest State in the Nation. Am I right in saying that Arizona must be the dryest State?

Mr. BINGHAM. No; I think you will find the State of Nevada is the dryest. Arizona is third. That is a distinction we are not particularly proud of, but that, I think, is the order.

Senator Moss. You are saying Utah is even dryer than Arizona, then?

Mr. BINGHAM. That is a fact.

Senator Moss. For that reason, we think that we must look very carefully at whatever water we have in our State. Now Utah, you said, had about 40,000 square miles in the drainage basin of the Colorado, the Upper Basin of the Colorado River. How much of our State is this in percentage?

Mr. BINGHAM. It computes about 48 percent of the area of the State in the drainage basin.

Senator Moss. We also have some in the Lower Basin. About how much is that?

Mr. BINGHAM. That would include the Lower Basin area. The Lower Basin area by itself would be 3,600 square miles, or about 4½ percent.

Senator Moss. In the Lower Basin?

Mr. BINGHAM. In the Lower Basin.

Senator Moss. And how much apportionment do we get of the waters of the Upper Basin, the 7.5 million acre-feet that was decreed for the Upper Basin?

Mr. BINGHAM. 23 percent.

Senator Moss. So if you take 23 percent of 7.5 million acre-feet, approximately how much water is this that we are entitled to?

Mr. BINGHAM. The arithmetic, of course, is as Senator Allott has already commented. You would subtract first the 50,000 acre-foot allocation to Arizona, applying the 23 percent to the remainder. Utah's portion would be 1,714,000 acre-feet.

Mr. Moss. And how much do we contribute to the virgin flow of the Colorado?

Mr. BINGHAM. The State of Utah contributes, approximately, 2.4 million acre-feet to the virgin flow of the river.

Senator Moss. So if we could get our maximum entitlement, we still would be contributing water to go on downstream out of our State. In other words, we are not holding within Utah all that we contribute to the river.

Mr. BINGHAM. That is correct.

Senator Moss. Is it Utah's position that assurances and the safeguards that she is asking on this legislation is only to assure her that she can develop her share that she has been allotted of the waters of the river?

Mr. BINGHAM. That is correct, Senator.

Senator MOSS. Thank you, Mr. Bingham.

Senator ANDERSON. Thank you again.

If we have problems, we will communicate with you. Thank you for a fine presentation.

Mr. BINGHAM. Thank you, sir.

Senator ANDERSON. Mr. Goss.

STATEMENT OF FLOYD L. GOSS, CHIEF ELECTRICAL ENGINEER AND ASSISTANT MANAGER, LOS ANGELES DEPARTMENT OF WATER AND POWER, ACCOMPANIED BY WILLIAM A. MYERS, CHAIRMAN, WATER AND POWER COMMISSION, CITY OF LOS ANGELES, LOS ANGELES, CALIF.; MYRON B. HOLBURT, PRINCIPAL HYDRAULIC ENGINEER, COLORADO RIVER BOARD, STATE OF CALIFORNIA; AND PETER G. LOWERY, SENIOR ELECTRICAL ENGINEER, LOS ANGELES DEPARTMENT OF WATER AND POWER

Mr. Goss. Mr. Chairman, my name is Floyd Goss. I am chief electrical engineer and assistant manager of the Los Angeles Department of Water and Power.

I have with me today on my left Mr. Pete Lowery, who is the senior electrical engineer in charge of the resource development for the power system of the Los Angeles Department of Water and Power.

On my right is Mr. Myron Holburt, who is the principal hydraulic engineer for California's Colorado River Board.

I had expected to have with me also Mr. Gilmore Tillman, the chief assistant city attorney for water and power. However, he is very seriously ill, and was unable to be here, which he greatly regrets, and so do I.

I appreciate the opportunity to present this statement on behalf of the city of Los Angeles and its department of water and power in connection with the Hualapai power project as it relates to the Colorado River Basin project.

I shall endeavor to make these points:

First. The department of water and power recommends the immediate authorization and construction of Hualapai Dam and powerplant.

Second. We recommend increasing the generating capacity of the Hualapai powerplant from the 1,500,000 kilowatts originally proposed for the project to 5 million kilowatts as a combined hydro-pumped storage peaking plant.

Third. We believe that the peaking power from a 5-million-kilowatt plant, if the units were to be operated as integral parts of the power systems it serves, can be absorbed by the market within 6 years after the plant goes into service, commencing, say, in 1976.

Fourth. Hualapai peaking power is more attractive to us than peaking power generated by nuclear or fossil-fuel thermal plants, both from the standpoint of lower cost and greater flexibility. It is assumed that the Hualapai units serving us would be fully integrated into our system for peaking and spinning reserve, and operated as a part of that system, just as our present units are.

Fifth. The financing and operation of the larger Hualapai powerplant can be accomplished in several ways. This can be done as at Hoover Dam, where both the powerplant and dam were financed by the United States, and the generating units are operated under Federal agency contracts by the utilities responsible for repayment of their cost.

Alternatively, each utility having an entitlement in the project could prepay its share of the capital costs of a larger Hualapai peaking-pumped storage plant.

The department of water and power is willing to subscribe for a share of this power on either basis. In either event, we would provide our own transmission lines. If arrangements were made for prepayment by the utilities, the Federal capital required for the 5-million-kilowatt plant would be several hundred million dollars less than the Federal capital required for the proposed 1.5-million-kilowatt plant and transmission lines. The larger plant would, in addition, provide a substantially greater contribution to the development fund than the smaller plant.

Sixth. An early decision to proceed with the project is imperative, because transmission lines to be constructed or reconstructed within a short distance of Bridge Canyon, and now in advanced planning stages, must be designed for larger capacities than are presently contemplated, so that Hualapai power can be delivered to load centers at the lowest cost and within maximum value.

As evidenced by its filing of an application, project No. 2272, as amended September 1960, with the Federal Power Commission for the construction of the Bridge Canyon power project, the Department of Water and Power of the City of Los Angeles has been interested in a project at this site for many years.

Expiration of the moratorium for an FPC license at the Hualapai site caused the Department to review its position on this project commencing in January of 1967. During this review, it became apparent to us that the best use of this site to meet future power demands would be as a combined hydro-peaking-pumped-storage project with a greatly enlarged capacity of the powerplant. We are very familiar with the advantages of this type of project, having recently completed a 2-year engineering study culminating in a contract with the State of California for a similar project at Castaic, Calif.

We had discussed the peaking-pumped-storage concept informally with representatives of the Colorado River Board and the Department of Water Resources of the State of California, but the first public expression of our interest in this project was made before the Subcommittee on Irrigation and Reclamation of the House of Representatives in March of 1967.

On April 5, 1967, the Colorado River Board of California passed a resolution supporting the enlarged project.

Since our presentation before the congressional subcommittee, we have met on several occasions with representatives of the U.S. Bureau of Reclamation and with representatives of Pacific Southwest electric utilities and water agencies. Considerable discussion was held concerning this complex project and potential problems which might

arise. However, no information has been presented in these meetings that would negate any of the conclusions contained in our proposal. We are, today, more convinced than ever that Hualapai can be an outstanding project of tremendous benefit to the entire nation.

COMBINED HYDRO-PEAKING-PUMPED-STORAGE DEVELOPMENT

Preliminary engineering studies which we have made indicate that the Hualapai site should be developed as a combination hydro-peaking-pumped storage project rather than a conventional peaking plant as originally proposed.

Under the new concept, low-cost energy from thermal plants would be used to pump water back into the reservoir during off-peak periods. This water would be released, together with the water required for downstream use, during the hours of peak demand. The total Hualapai generating capacity usable in this way would be 5 million kilowatts, rather than the 1.5 million kilowatts planned under the old concept, which did not include the use of pumped storage.

Sites such as Hualapai, which permit the development of both a high-head regulated streamflow powerplant, and augmentation by pumped storage, are extremely rare. The Hualapai site is ideally suited to such an installation. The full value of the resource could be obtained only by complete integration of such a plant into the systems of the utilities which absorb the power. So integrated, it could be operated with great flexibility generating from zero to full load.

For example, the units might at times be operated for spinning reserve, available against emergencies in the system as instant insurance against blackouts. But when needed, the full capacity of 5 million kilowatts might be generating power on peaks. At times, only part of the plant might be at work, while at other times it could be fully employed in pumping water back into the reservoir for later use.

TRANSMISSION

There are already a number of high-voltage transmission lines in the vicinity of the site of the Hualapai project, some of them extending to the southern California area. Additional lines are either under construction or planned in connection with the development of large coal-fired plants in the Four Corners area and elsewhere on the Colorado River.

The incremental cost of a present increase in the planned capacity of these lines to enable them to transmit Hualapai power to load centers, including Los Angeles, is drastically lower than the cost of building new lines later for the sole purpose of transmitting Hualapai power. Time is therefore of the essence in making the decision to build this dam and powerplant now, as contrasted with deferring that decision

POWER MARKET

We believe that substantially all of the 5 million kilowatts of peaking capacity which we propose can be absorbed within a period of 6 years, commencing in 1976, when the plant is assumed to go into operation.

The market area for this power can be considered to be generally the area within a circle with a radius of 250 miles and centered at the Hualapai site, plus southern California.

The utilities serving this power market area have already made commitments for generating capacity and associated transmission facilities to satisfy their requirements through 1973. Some commitments have been made for the period 1974-75, although most capacity additions for this period are at this time only in an advanced stage of planning.

We believe that the utilities serving this market area have not yet made substantial commitments to construct the capacity which must be added to their systems to serve the growth of load from 1976 through 1980. There is thus a present opportunity for Hualapai power to supply that need, provided the decision is made now.

It is estimated that the combined loads of these utilities will be about 28 million kilowatts in 1975, and 40 million kilowatts in 1980, a total increase of 12 million kilowatts. With the addition of required reserves, these utilities will need to add about 14 million kilowatts of capacity during this 5-year period.

Computer studies of expansion plans for our own system indicate that about 30 percent of the added capacity will be peaking capacity, which we believe to be a typical pattern of system development for other utilities in the market area.

On this basis, the peaking requirement of the Hualapai power market area in the 5-year period following 1975 will be 4.2 million kilowatts. The remaining 800,000 kilowatts of the proposed 5 million-kilowatt capacity of the project—or any portion of that quantity not reserved for pumping—could be absorbed very soon thereafter.

After consideration of our requirements and those of other utilities in the service area, we believe that a reasonable share of the 5 million-kilowatt plant would be in the order of 1 million kilowatts for the Department of Water and Power. However, if additional capacity is made available for purchase, we would be willing to contract for substantially more than this amount.

COST TO GOVERNMENT AND EFFECT ON DEVELOPMENT FUND

The total Federal investment in the dam, a 1.5 million-kilowatt powerplant, and the transmission lines, as originally proposed, was \$540 million. The total Federal investment in the dam and the 5 million-kilowatt powerplant which we proposed could be as much as \$729 million or as low as \$254 million, or less than half the Federal investment originally proposed for a project less than a third as large.

The reduced Federal investment of \$254 million would be the consequence of prepayment by the utilities of the capital cost of the units serving them, and non-Federal financing of the transmission lines. Other utilities may prefer Federal investment in the powerplant; however, the Department of Water and Power would prefer to make its own investment in this fashion, prepaying the cost of the units integrated into its system.

The estimated capital cost of the dam and powerplant proposed for the 1.5-million-kilowatt installation was \$234 per kilowatt. This capi-

tal cost estimate is reduced to \$146 per kilowatt for the 5-million-kilowatt plant which we propose. Based on the Federal cost of money, the annual cost of capacity at the bus bar furnished by the larger plant is estimated to be cheaper by about \$3.50 per kilowatt-year than the cost of capacity at the bus bar supplied by the smaller plant.

If capacity at the bus bar were to be sold for \$4.60 per kilowatt-year, the contribution to the development fund from the Hualapai powerplant would be approximately \$1.1 billion at the end of 75 years. If capacity were to be sold for as much as \$7 per kilowatt-year, the contribution to the development fund from the Hualapai powerplant would be \$2.1 billion at the end of 75 years. The contribution from the smaller plant was estimated to be \$0.85 billion.

The quantity of energy generated by the flow of the stream would be essentially the same for either size of powerplant. Additional energy, however, would be generated on peak by the use of pumped-back water in the larger plant. This water would be pumped by low-cost off-peak thermal-generated energy supplied by the participating utilities rather than by the United States.

CONSERVATION OF NATURAL RESOURCES

Statements have been made that steam peaking units and even nuclear peaking units are economically more attractive than peaking power from Hualapai. So far as we know, no manufacturer has offered to either design or to build nuclear peaking units.

From our knowledge of the high annual capital cost associated with nuclear units, we seriously question their attractiveness for this use.

Conventional fossil fuel-burning peaking units are notoriously inefficient; hence they waste valuable, irreplaceable natural resources. It is also a waste of a valuable natural resource to delay construction of the Hualapai project beyond that date when there is a need for the capacity and energy from this project within the area where it can logically be marketed.

CONCLUSIONS

From our studies which are discussed briefly above, we have concluded—

- (1) A 5-million-kilowatt hydro peaking-pumped storage development of the Hualapai site is feasible and will provide substantially increased benefits as compared to the 1.5-million-kilowatt plant originally planned for the site.

- (2) The utilities in the area can provide a market for Hualapai power.

- (3) Since only incremental additions to existing and planned transmission capacity will be necessary, economic transmission from the project can be provided.

- (4) Authorization of the project at this time is necessary to permit planning for integration of Hualapai capacity with other capacity to be installed in the 6-year period following 1975.

There is included with the statement a chart showing the investment in the Hualapai project under the alternatives suggested in my statement, and the investment in the smaller plant. I have also included

with the statement, Mr. Chairman, a general description or conceptual description of the 5-million-kilowatt Hualapai combined hydro peaking and pump storage project, including consideration of the transmission power market and the effect on the development fund.

I will not read this additional material, but will ask permission to submit it with my statement.

Senator ANDERSON. Without objection, that will be done.

(The attachment follows, together with the supplemental statement of Mr. Goss:)

PROPOSED 5,000-MEGWATT HUALAPAI COMBINED HYDRO PEAKING-PUMPED STORAGE PROJECT INCLUDING CONSIDERATION OF TRANSMISSION POWER MARKET, AND EFFECT ON DEVELOPMENT FUND

GENERAL DESCRIPTION

Proposed Hualapai Power Project

Recent development of the highly efficient reversible pump turbine and the reversible electric drive unit which functions both as a motor and, in reverse, as a generator, makes possible the expansion of a potential hydroelectric development to a much greater generating capacity. At Hualapai, our preliminary studies indicate that through the use of reversible pump turbines, an installation of 5,000 Mw would produce much greater benefits than the original proposed 1,500-Mw project utilizing conventional hydraulic turbines.

Basically, such a hydroelectric power storage project functions to convert off-peak electric energy which would generally be available to each of the participating utilities, into potential energy, i.e., the energy of water pumped to a higher elevation by the reversible unit. This stored potential energy is then available during on-peak load periods to drive the turbines, developing on-peak energy which is of much greater value than the off-peak energy which was utilized for pumping. During off-peak periods, any water which had been utilized, in excess of stream flow, would be restored by pumping.

Project Design

The Hualapai Dam and Reservoir are proposed to be the same as those designed by the Bureau of Reclamation as indicated in the Pacific Southwest Water Plan, Bridge Supplement, Modified, dated January, 1964.

Figure 1 indicates the proposed power plant layout which is also based on the Bureau of Reclamation design referred to above; however, two underground power plants are indicated instead of one. Our preliminary design sketch indicates six units, each of 425 Mw capacity for each plant. Actual number and sizes of units installed, as well as staging thereof, would be determined by the participants.

Figure 2 indicates a single generating unit and its associated water ways. This preliminary layout indicates a downstream surge chamber. Final design studies may indicate that this will not be necessary, depending on machine characteristics and length of the tailrace discharge conduit.

The tailbay, which is commonly called the lower forebay for a pumped storage project, would be created by excavation of a tailrace discharge channel downstream from the plant to the site of a weir. It is planned to excavate all of the loose material, sand, gravel, and boulders from the river channel, and, in addition, to excavate, by blasting, a channel of adequate width to handle the design generation flow of 95,000 cubic-feet per second.

Due to the extremely flat slope of the river channel downstream from the Hualapai Dam site, it is possible to create a pumping forebay of any desired volume.

This weir will be located at a suitable distance downstream, and constructed to such an elevation as to provide a storage of approximately 40,000 acre-feet. It will be a reinforced concrete structure designed as a full over-flow spillway having a capability of passing 500,000 cfs, which is the design flood flow. In the lower portion of the tailbay weir will be a number of slide-gates which can be opened to permit passage of the re-regulated flow to Lake Mead.

When it is desired to accumulate water in the tailbay for pumping during the forthcoming off-peak period, these slide-gates will be closed by remote control from the power plant. Under these conditions, water from the turbine discharge will accumulate in the tailbay, and be available for pump-back at the close of the generation period.

Project Operation

The operation of this project has been analyzed on a daily and weekly basis in terms of its effect on the water surface elevation in Hualapai Reservoir. Figure 3 indicates the variation in the elevation of the water surface of Hualapai Reservoir during a normal weekly operating cycle. The variation on weekdays is indicated at 2.7 feet. However, on Saturdays and Sundays, the variation is approximately 1.8 feet. The large surface area of the Hualapai Reservoir permits the operation of this pumped-storage cycle on a weekly basis with these small variations in the elevation of the water.

When a generating unit of any participant is not in service for either pumping or generation, this unit would probably be utilized as spinning reserve. Under this condition, it is running as a motor, synchronized to the system, and immediately available to pick up load. Compressed air is introduced into the runner space, forcing the water level down to a lower elevation, so that the turbine runner turns in air, not water. Due to the large storage capacity of Hualapai Reservoir, in a large-scale emergency involving a number of the participants, and perhaps extending over a period of many hours, the entire project generating capacity would be available until the cause of the emergency was rectified.

Advantages of the Hualapai Site

The Hualapai site is unique in that it combines all of the following:

1. The geologic structure of the canyon permits the construction of a relatively inexpensive arch dam of sufficient height to develop hydroelectric power in a very economic manner.

2. Due to the very shallow slope of the river channel downstream from the Hualapai Dam site, it is possible to create a pumping forebay of any desired volume. Also, sufficient storage can be obtained to provide a re-regulating function.

3. The proximity of the upper forebay (Hualapai Reservoir) to the lower pumping forebay, represents a tremendous economic advantage for this location. This proximity results in a minimum expense for water ways, and also minimal friction-head losses which, in many projects, would be a significant economic factor.

4. The flow of the Colorado River being regulated upstream at Glen Canyon is an ideal circumstance. This permits the operation of a large project of 5,000 Mw for an appreciable period without pumping; in contrast, pumped-storage projects generally have to pump all of the water which they utilize at an overall cycle efficiency of approximately 70 percent.

The combination of these attributes at one location is a rare circumstance. This is especially true, considering the magnitude of the flow involved. Few locations in the entire United States would provide the setting for the development of such a large peaking power plant.

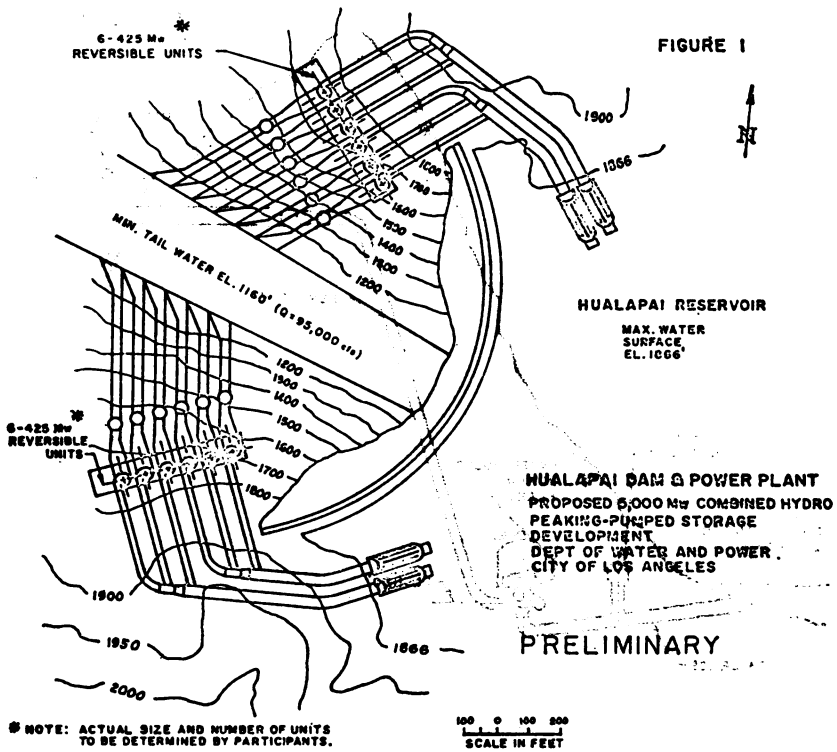
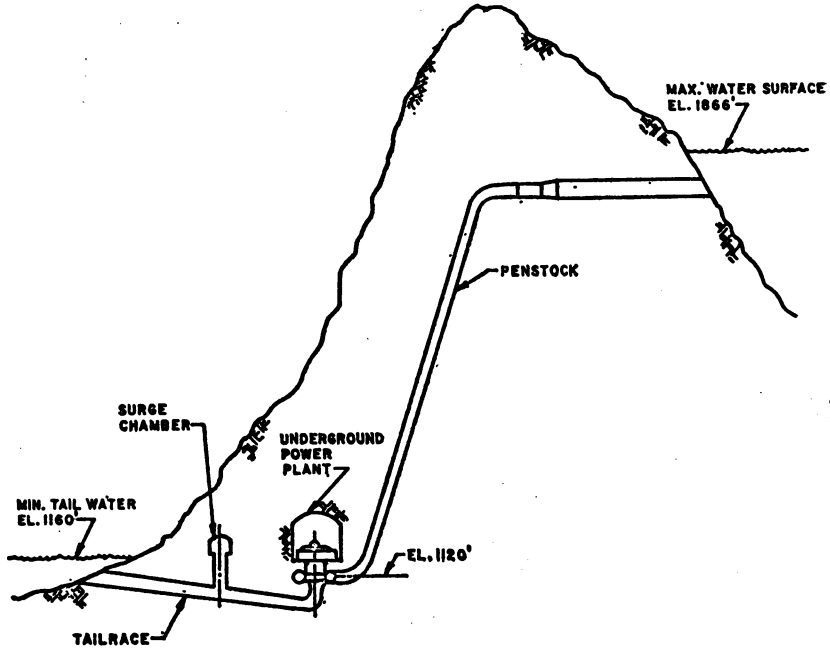


FIGURE 2

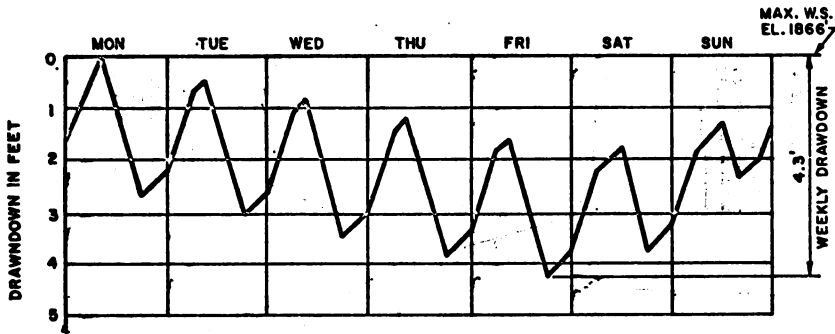


PRELIMINARY

HUALAPAI POWER PLANT
 PROPOSED 5,000 MW COMBINED
 HYDRO-PEAKING PUMPED
 STORAGE DEVELOPMENT
 DEPT OF WATER AND POWER
 CITY OF LOS ANGELES

FIGURE 3

**HUALAPAI RESERVOIR
NORMAL WEEKLY OPERATING CYCLE**



NORMAL DRAWDOWN: DAILY = 2.7'
 SAT. & SUN. = 1.8'
 WEEKLY = 4.3'

NOTE:
 UNDER ASSUMED CONDITIONS OF INFLOW,
 ALLOCATION OF CAPACITY TO SPINNING
 RESERVE AND GENERATION PATTERN.

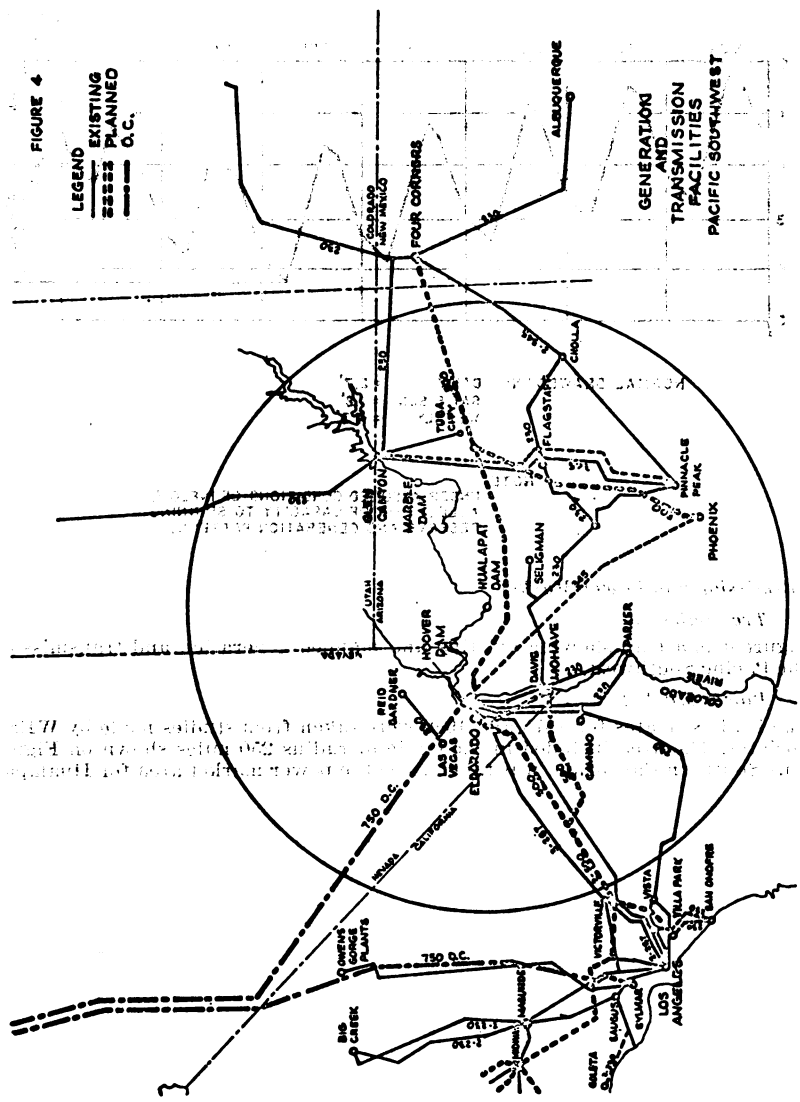
Transmission and Power Market

Transmission

Figure 4 is a map showing existing and planned generation and transmission in the Pacific Southwest.

Power Market

The load estimates for 1975 and 1980 were taken from studies made by WEST Associates. The area included in the circle of radius 250 miles shown on Figure 4, plus Southern California, was taken to be the power market area for Hualapai.



Cost to Government and Effect on Development Fund

The total federal investment for the Hualapai Unit as presented in the House Interior and Insular Affairs Committee report on H.R. 4671 (89th Congress) was \$529 million. The Paria River silt detention dam originally included in the Marble Canyon Unit was estimated to cost \$11 million. The breakdown by major components is shown in the following Table:

Federal investment in 1,500,000-kw Hualapai project as estimated by the U.S. Bureau of Reclamation

[In millions of dollars]

Hualapai Dam and Reservoir.....	168
Powerplant	140
Transmission system.....	188
Construction camp and other facilities.....	21
Coconino Dam and Reservoir.....	12
Subtotal	529
Paria Dam and Reservoir.....	11
Total	540

Non-federal financing of the transmission lines would reduce the federal investment by \$188 million. The federal investment could be further reduced by non-federal financing of the power plant. The reversible units required for the 5,000,000-kw peaking pumped-storage project would cost more per kilowatt than conventional units required for a 1,500,000-kw plant. However, the unit costs of the larger plant would be lower for such items as the powerhouse, larger units, intake structures, penstocks and tailrace facilities. For the purposes of this preliminary study we used the same unit cost for the complete power plant as estimated by the U.S. Bureau of Reclamation. The 40,000 acre-foot afterbay is estimated to cost \$50 million. Depending upon the extent of federal investment in the larger-size power plant, the total federal investment would range from \$254 million to \$728 million as shown in the following Table:

Federal Investment in Proposed 5,000,000-Kw Hualapai Project

[In millions of dollars]

Hualapai Dam and Reservoir.....	168
Construction camp and other facilities.....	13
Coconino Dam and Reservoir.....	12
Paria Dam and Reservoir.....	11
Hualapai afterbay.....	50
Minimum Federal investment.....	254
Powerplant	466
Construction camp.....	8
Maximum Federal investment.....	728

The federal investment in a 1,500,000-kw Hualapai Project exclusive of transmission lines is \$352 million, or \$234 per kilowatt. The estimated \$728 million cost for the 5,000,000-kw Hualapai Project results in a unit cost of \$146 per kw. Use of the current federal interest rate of 3.225 percent and the maximum payout period of 50 years gives an annual capital cost of capacity at the bus bar of \$9.36 per kw-yr. for the smaller project, and \$5.85 per kw-yr. for the larger project, a difference of \$3.51 per kw-yr.

A detailed year-by-year financial analysis was made of the proposed project using procedures similar to those used by the United States Bureau of Reclamation. Except for the capacity charge, the assumptions were the same as those used by the Bureau of Reclamation in its 1966 study of the Colorado River Basin Project:

- (1) Pumping power delivered to pumps at 2.5 mills per kilowatt-hour for irrigation, and \$10 per kilowatt-year and 3 mills per kilowatt-hour for municipal and industrial pumping.

(2) Commercial energy equivalent to 3 mills per kwh delivered to the load center.

(3) Central Arizona unit municipal and industrial water delivered at canal side for \$50 per acre-foot and irrigation water delivered for \$10 per acre-foot.

Under the proposed plan, it is estimated that capacity at the bus bar would be sold at no less than \$4.60 per kw-yr., and no more than \$7 per kw-yr. The contributions to the Development Fund under the above conditions are shown in the following Table, together with the amounts estimated by the U.S. Bureau of Reclamation for the \$1,500 Mw plant.

Estimated contribution to development fund by project year 1975

[Millions of dollars]

	From Hualapai powerplant	From total Colorado River Basin project
5,000-megawatt plant; capacity, at \$7 per kilowatt-year.....	\$2, 093	\$3, 063
5,000-megawatt plant; capacity, at \$4.60 per kilowatt-year.....	1, 125	2, 096
1,500-megawatt plant.....	845	1, 840

The above values are conservative since they do not include contributions to the Development Fund from the additional energy produced from additional head made available by the afterbay excavation.

Senator Anderson. This is quite a project. What surveys of the market have been made?

Mr. Goss. I used the survey made by WEST Associates, which is a combination of the electric utilities, both public and private in the States of Colorado, part of Texas, New Mexico, Utah, Arizona, Nevada, and southern California.

It is an organization that was formed for the purpose of planning the future development of electric-generating resources and transmission lines in the Southwest. They performed the study, and I used that as a basis of determination of the market.

Senator ANDERSON. I think I am familiar with WEST. What about the utilities? Have they been asked about this?

Mr. Goss. Judging by their interest, Mr. Chairman, in attending a meeting that was scheduled for Los Angeles—we have had two meetings there on the project with representatives from utilities and water agencies, from all of the States of the basin except Utah and Wyoming, and judging by their enthusiastic attendance at the meeting—their interest in the project—I would say that the utilities in the area are very interested in the project.

Senator ANDERSON. Are they willing to commit themselves to this sort of thing?

Mr. Goss. I have commitments from, of course, the department of water and power, that is one, and three, the cities of Glendale, Burbank, and Pasadena; also the Colorado River Commission of Nevada, Mr. Pat Head has indicated his interest in participating in the project. I have no other commitments as such, except statements made to me that if the costs prove out and the problems of preference, the operation of the preference law, can be satisfactorily resolved, other utilities have indicated their interest with these reservations.

Senator ANDERSON. Are they public utilities?

Mr. Goss. Those indicating that interest are primarily privately owned utilities.

Senator ANDERSON. That is a very interesting statement.

Senator JACKSON.

Senator JACKSON. How much of the 5,100,000 kilowatts of installed capacity at Huapalai Dam site would be peaking power only?

Mr. Goss. It would all be peaking power only, Senator.

Senator JACKSON. One hundred percent?

Mr. Goss. Yes.

Senator JACKSON. Would this peaking power be directly usable for pumping on the central Arizona project?

Mr. Goss. If it were used strictly as peaking power, it would not. I proposed in the discussion that is submitted with my statement, that the greatest benefit both to the central Arizona project and to the use of the capacity by the participating utilities, would result from an exchange of energy from this project for energy for pumping furnished at pumping sites by the utilities in the area, which is similar to the arrangement we have with the State of California.

Senator JACKSON. But the fact is that they would not be able to use the power from Hualapai for pumping on the central Arizona project?

Mr. Goss. Yes, they could use it. Then, of course, it would not all be peaking.

Senator JACKSON. It would cut into your peaking capacity.

Mr. Goss. It would reduce the amount of peaking capacity; yes, sir.

Senator JACKSON. What percentage of the time would the 5,100,000—

Mr. Goss. Mr. Holburt reminds me that in one of the studies we performed, we deducted the amount of capacity that we thought was needed for pumping.

Senator JACKSON. What percentage of the time would the 5,100,000 kilowatts peaking capacity be used; that is, what would be its load factor, so to speak?

Mr. Goss. We made a number of studies, Senator, and the beauty of the pumped storage operation, of course, one of the great virtues of it is its great flexibility, depending on the system requirements of the participating utilities. We made a study of what we considered to be a normal operation of the project. If you will excuse me a moment, I have that here. We figured the normal operating cycle, 20 percent of the capacity would be assigned for spinning reserve by the various systems, and during the weekdays the generating machinery would operate from 9 a.m. to 6 p.m.; on Saturday, from noon to 6 p.m.; and on Sunday, from noon to 4 p.m., with a total of about 55 hours, which is about 30 percent capacity factor.

Senator JACKSON. What load factor is ordinarily required for pumping on the central Arizona project?

Mr. Goss. I am not aware of exactly what load factor is required.

Senator JACKSON. I think it is nearly 100 percent, if you check.

Mr. Goss. It is about 90 percent, Mr. Holburt says.

Senator JACKSON. Well, that is getting pretty close.

Mr. Goss. Yes.

Senator JACKSON. You answered certain questions that Senator Anderson raised about who was going to buy this. Would you elaborate on that?

Mr. Goss. Yes.

Senator JACKSON. You are talking about a lot of peaking capacity here. I will come to the Bonneville problem in a minute. As you know, none of that has yet been committed and they don't expect to have the line fully loaded until 1985; so tell me what commitments you really have, what utilities, specifically?

Mr. Goss. The only utility I can speak for as a commitment is the Los Angeles Department of Water and Power. I have no other definite commitments for any amount of power. I don't feel it is my place to do that.

I feel that this is a matter that is between the Government and the individual utilities, and I propose in this bill that the Secretary be required to carry on the negotiation and obtain agreements, and contracts, with the participating utilities, which will repay the cost of this project.

Senator JACKSON. Yes, but it is a very important consideration, isn't it, to know who your customers will be when you talk about building this size facility? With either a publicly owned or investor-owned utility, you have to sell your bonds on the basis of probable customers.

I am putting it to you on a businesslike basis. What real opportunity is there to dispose of this 5,100,000 kilowatts of peaking capacity?

Mr. Goss. Senator Jackson, I am very happy you do put it that way, because that is exactly the way I think this project should be developed. Before any money is spent on this project, the Secretary should have in hand contracts and agreements for participation which will repay the cost of the project, and I think it can be developed at a cost, from our studies it shows it can be developed at a cost, that will be attractive to utilities.

I think the problems relating to the preference can be solved as they were solved with Hoover Dam and have been solved with other Federal projects without violating the preference law. This should be done before any money is spent on the project.

Senator JACKSON. Mr. Goss, you are an able engineer and I am not questioning that. My only point here is that the Bureau has been looking at all sorts of alternatives. They did not, however, come up with this.

This is a relatively new idea, and I raise the question, whether it has been properly thought through. That is why I am asking these questions, and I have several more to ask.

Mr. Goss. Senator Jackson, if I may, I would like to qualify this proposal a little bit. The Department, in the first place, has been interested in this particular site on the Colorado River for a great many years. The Bureau of Reclamation has been interested in this site for many, many years.

A great deal of geological work has been done on this reach of the river, beginning 'way back in the early twenties. All of that was available to us.

In addition, we made a detailed study of both a low dam and a high dam at this site in 1960, and we had this study analyzed by a firm of consulting engineers at that time in connection with our application to the Federal Power Commission to build the project.

Now, the consideration of pumped storage—as I say, we have been interested in pumped storage because we were running out of peaking capacity on our system, and we are going to install principally nuclear and some coal-burning units. We needed this kind of capacity to go with them so that we can operate our system efficiently and reliably.

So we have been studying pumped storage over quite a number of years. During the last 2 years we have been actively studying this, together with the State, in connection with the development of the Castaic pumped storage project on the California aqueduct.

So when we started looking at this from the standpoint of development of a pumped storage project, we had all of this experience as a background.

We, furthermore, had the cost of the dam as estimated by the Bureau of Reclamation and as reconsidered by them in 1963. We had our own cost of the dam estimated by us in 1960. We had the cost of a high dam estimated by the private consulting engineering firm we retained for that purpose, so we had a considerable background of knowledge to start out with.

We had a knowledge of the other utility systems through our association with WEST and of the load growth of the market area. We had a knowledge of the cost of the developing facilities in this area and in the Southwest, and I think we had a sufficient knowledge upon which to judge the feasibility of this project, and we consider it to be a feasible project.

Senator JACKSON. When did you actually start on the development of this plan?

Mr. Goss. As a pumped storage project?

Senator JACKSON. Yes.

Mr. Goss. Right after the first of this year, in January.

Senator JACKSON. The first of this year?

Mr. Goss. Yes, sir.

Senator JACKSON. How far away is the Hualapai site from the Los Angeles area?

Mr. Goss. It is approximately 345 miles.

Senator JACKSON. You are talking about transmitting a lot of peaking power when you talk about 5,100,000 kilowatts. Would it be economical to build transmission lines that far to carry peaking capacity with such a low-load factor?

Mr. Goss. It would probably not be economical if a single line was built for that one single purpose, and that is precisely why this project needs to be authorized now, not at a later date, because right at this moment the department of water and power, for example, in order to participate in a large coal-burning plant on the Colorado River below Davis Dam—is planning to increase the capacity of the three 287,000-volt lines between Hoover Dam and Los Angeles.

Now, we can add additional capacity to those three lines by raising the voltage and changing the conductor at a very low incremental cost. The same is true of other transmission lines that are existing and are being presently planned. You can add additional capacity at a low incremental cost that makes this feasible for Los Angeles.

Ordinarily, that would be too great a distance for peaking power, if you just built one single line for that single purpose. But since we

already have a substantial system of transmission either constructed or in the present condition of being planned, by the incremental cost of increasing the capacity above that necessary for other purposes, makes it feasible for southern California.

Senator JACKSON. The line would only be used probably an hour or so a day, wouldn't it, if used for peaking purposes?

Mr. Goss. No.

According to this schedule, which I consider to be a normal one, the lines would be in use for 9 or 10 hours a day during the week.

Senator JACKSON. You are talking about bringing in the other load, but I am talking about——

Mr. Goss. No; I beg your pardon, Senator. I am talking about Hualapai power, using the run-of-the-river power, together with pumped storage.

Senator JACKSON. I am talking about the peaking power. How many hours a day would you be using the line for that?

Mr. Goss. Normally, about 9 hours a day, Monday through Friday; about 4 hours a day on Saturday, and either nothing at all on Sunday, or for a very short time.

Senator JACKSON. What would be the cost per kilowatt hour of transmitting the peaking power over this distance?

Mr. Goss. I don't have it per kilowatt-hour, Senator. We will get that and supply it to the committee, for this normal operation. That would vary, of course, greatly, with the way the individual utilities operated.

However, we do have a direct comparison here, and you mentioned the Northwest peaking power.

There are 1,050,000 kilowatts of Northwest peaking power contracted for. The department has signed contracts with the Bonneville Power Administration for 525,000 kilowatts of peaking power from the Northwest, from the Bonneville system. This we expect to bring over our own direct-current line.

The cost of this power at the Oregon border is \$7.50 based on the fact that we exchange energy for it at the rate of 2,500 kilowatt-hours a year for each kilowatt of capacity. In the early years, the Northwest does not need this energy, and so they require us to pay 3 mills for this. In other words, we are paying \$7.50 a kilowatt-year at the Oregon border, which is some 540 miles from the city of Los Angeles.

Now that we found it to be feasible, although it was not a great profit to the Southwest, and there was a mutual benefit to the Northwest and Southwest, arising out of this intertie, we signed our contracts and are in the process of building the line. Compared to Northwest peaking at \$7.50 at the Nevada-Oregon border, Hualapai would always be less at Los Angeles.

Senator JACKSON. As you know, we are building 1,300,000-kilowatt direct-current line from The Dalles to Hoover Dam. This is at a cost of between \$120 and \$140 million. My understanding is that the line should be completed, if it is on schedule, by 1972. As you know, its purpose is to provide peaking capacity to the Southwest in the summer and to the Northwest in the winter.

The information I have is that thus far neither the Bureau nor Bonneville Power have signed any contracts for use of the 1,300,000-

kilowatt capacity. The best information I have is that the line will not be fully loaded until 1980.

I raise with you the question of the marketability of the peaking capacity that you hope to obtain from the proposed pump storage facility at Hualapai.

Mr. Goss. Senator, it is a very good question. In the first place, as you may remember, the department of water and power testified before the Congress on the question of building the second line from the Columbia River to the Boulder City area. In the first place, we did not feel there was a market there for the power that would justify building this line, and in the second place, it interfered with possible customers over our own line, and we were at that time trying to find someone to share the 1,300,000-kilowatt line we were building.

I think the experience since the Department of the Interior, Bureau of Reclamation, and the Bonneville Power Administration have been trying to find people to contract for service over this line indicates that the department of water and power was right when it testified in opposition to the second line.

I don't believe that this Hualapai actually competes with that line. I think the fact of the matter is that the cost of Northwest peaking power delivered over the direct current line would always have a great deal of difficulty finding a market in that area, because, frankly, it costs too much, in my opinion, when it gets there.

Senator JACKSON. One can argue about that, but we are confronted with a fact, not a theory, and that is that this power will be available in 1972, 1,300,000 kilowatts. I wonder in this connection, by the way, if any studies have been made by you or your associates of the effect of the Hualapai pump storage project on the loadings and the payout on the Hoover-Dallas direct current line. Has any study been made on that?

Mr. Goss. No, sir, Senator. As I say, I think that the problem with contracts over the direct current line to the Boulder City area is the fact that although there is a need for peaking power, and there is a need, there is a market for the surplus energy from the Northwest over that line, but by the time it gets there, it costs more than the market will bear, and that is something we always have to face in these projects.

I think in the Hualapai project, the actual cost on the basis that I used for evaluating a return to the Federal Government and the participating utilities, the total cost of the project, is low enough so that the market is there, and it will be salable. I know it is as far as the department of water and power is concerned.

Senator JACKSON. What percentage, however, of the total that you are talking about in peaking power are you willing to contract for?

Mr. Goss. As I say, we would be willing to contract for 20 percent of the project. If it turns out, after surveying all the utilities, that there is some left over, we would be willing to contract for an additional amount.

Senator JACKSON. If this is a real good project, why don't you have some commitments from the other utilities? You are talking now about 20 percent. What about the other 80 percent? Or are you going to take an additional percent?

Mr. Goss. We consider 20 percent to be our share, based on a comparison of the size of our system with the size of the other utilities that might become customers for this. As I say, this is, I think—finding a market for this—is the subject of negotiation. It is a negotiation that should be carried on before any money is put into this project.

Senator JACKSON. You will agree that finding a market for it right now is a real problem.

Mr. Goss. No, I do not agree.

Senator JACKSON. You don't think so?

Mr. Goss. I think the market is there, Senator.

Senator JACKSON. I would think you would have some commitments from the other utilities. Your company, that is the city of Los Angeles, has made a commitment, but why not the others?

Mr. Goss. I have a statement that I can make for one other utility, the Southern California Edison Co. They are very interested in this project.

They have discussed it with us in great detail. We furnished them with all the cost information we have. Their position is that they have reservations on two counts: one is the cost of the project. They would like to see that verified.

The second is the operations of the preference law, and their concern as stated to me, is they would not want to make an investment in transmission lines, and facilities, in connection with this project and have the preference law operate in such a way as to render that investment idle. They have said to me, however, only the day before yesterday, that this project, if it is authorized, they would expect to sit down with the Secretary to try to work out satisfactory agreements for participation.

Now, that is as much of a commitment as I think anyone would be willing to make, other than a preference agent such as the Los Angeles Department of Water and Power. Under the operation of the preference law, I think we would have full protection under the preference law, and I think we would have first choice on capacity, and I think we could finance this in any way that the Government would care to go about it.

Senator JACKSON. That is what I was about to get to. Are you supporting—I take it you are—the customary preference clause which would apply to the marketing of the 5,100,000 kilowatts?

Mr. Goss. Yes, sir, the same as it did at Hoover power plant. I think in consideration of participation in this I would propose no change and this, by the way, Senator, is somewhat different from the operations of the preference law that governs this department's participation in the intertie project. In that case, the preference law was somewhat changed. But I don't propose any change here.

Senator JACKSON. Let me put this question to you. Are there any private utilities in the Southwest willing to purchase peaking capacity from Hualapai subject to withdrawal for the use of preference agencies in their service areas?

Mr. Goss. Senator, I am sure I can't answer that question for any utility.

Senator JACKSON. That is pretty important.

Mr. Goss. Yes, it is.

Senator JACKSON. It goes to the heart of what you are advocating here.

Mr. Goss. I don't think so, Senator.

Senator JACKSON. You don't think so?

Mr. Goss. No, I do not.

Senator JACKSON. Well, I think you would have to get an affirmative answer to that question. I can't speak for the private utilities in this regard because I haven't talked to them about it. I do know, however, this area of the preference clause is, shall we say, "slightly controversial."

Mr. Goss. At least, Senator, we can say it is very interesting. However, I will say—

Senator JACKSON. Well, controversy is always interesting.

Mr. Goss. Senator, we have, I think, a pattern of the Hoover powerplant under which the public agencies in Arizona, Nevada, and California have participated in that project since its inception. Now, I would think a similar arrangement could be made here.

The Arizona Power Authority, for example, in Arizona, is a preference agency. The Colorado River Commission of Nevada is a preference agency. We would include, consistent with our commitment with the cities of Glendale, Burbank, and Pasadena, which are preference agencies, we would include them in whatever participation we make, and make arrangements to transmit their power to Los Angeles for them, as we do in the case of the Hoover powerplant.

So I think the preference law can be handled here. It is not an insuperable problem. But until the private utilities know how it is going to operate. I am sure they are not willing to invest large sums of money in the project.

Senator JACKSON. I am not going to pursue this any further at this time, Mr. Goss, but I think by the questions and answers here, obviously there are a lot of problems connected with this proposal that are unresolved and that go to the heart of the project.

I appreciate the effort that you have made. Obviously, a project of this size has to be studied further and a lot more work has to be done on it, and I have appreciated the opportunity to ask you a few questions.

Mr. Goss. Thank you very much, Senator. I think the problems can be solved as they were solved in the case of the Hoover project by just requiring the project be authorized, and that no expenditure be made until the Secretary has negotiated contracts and returned the reimbursable portion of the project with interest over the life of the project, and that can be done.

Senator JACKSON. One other question: who, incidentally, would pay the losses on the Dallas-Hoover line?

Mr. Goss. The losses?

Senator JACKSON. Yes; who would pay the losses?

Mr. Goss. You mean, the losses in energy?

Senator JACKSON. No; I mean the losses in connection with not having a fully loaded line; losses on the amortization of the project.

Mr. Goss. If you will excuse me for saying so—Senator, I don't think that is my problem.

Senator JACKSON. Isn't it a fact that the Bureau and the Bonneville customers would have to pay any losses?

Mr. Goss. I am sorry; I can't comment on that. We made our comments when this was being authorized, and I don't wish to go further than that.

Senator JACKSON. I mention this because of the fact that the power will be available in 1972, and so far there are no contracts. Your proposal has no firm commitments from any of the large users in the Los Angeles area that you have had discussions with. I think you have to have more than that, frankly, with a proposal of this size, to make any sense.

Mr. Goss. So do I, before any money is spent on it. I think the Secretary should have contracts and agreements to repay the cost of the project. I certainly agree with you, Senator.

Senator JACKSON. Senator Kuchel.

Senator KUCHEL. I would like to say, first, for a fellow who is not an engineer, listening to your testimony, it is a great tribute to your Department, to you and to the people with you, the vision and the boldness with which you have sought to begin now to solve a problem for the people of the city of Los Angeles 10, 20, 30, 40 years hence. We have moved apparently into a new era with respect to the problems of meeting hundreds of millions of dollars' worth of indebtedness when we are talking about furnishing electricity. Here is an opportunity, as you suggest, where electric agencies, both publicly owned and those which are investor-owned, could participate to an enormous extent in lessening the burden on the Federal Treasury.

Tell me if you can, Mr. Goss, when Hoover Dam was authorized in the Swing-Johnson Act and the Secretary was given the authority to enter into contracts with publicly owned utilities or privately owned utilities, there was a provision in that bill, was there not, that Hoover Dam should not begin to be constructed until the Secretary had sold entirely under contract the electricity that would be available there?

Mr. Goss. That is correct. He had to have contracts in hand that would repay the cost of that project.

Senator KUCHEL. So what you are recommending with respect to congressional authorization of the dam at Hualapai would be to adopt precisely that same procedure so far as the construction of that reservoir is concerned, and that the Secretary would not go forward, and therefore would be free of any hazard, until he had similar contracts?

Mr. Goss. Yes, sir; Senator, that is exactly what I am proposing. And may I add, Senator, this is what we did on our 750,000-volt d.c. line.

Before we undertook to construct that line, indebted ourselves for the construction of this over \$100-million project between Los Angeles and the Nevada-Oregon border, we had agreements with others to use the line that would make it economically feasible to the Department to do so, and contracts with the Bonneville Power Administration for surplus energy and peaking capacity. Now, I think that should be a prerequisite in these projects, and that is what I propose in this one.

Senator KUCHEL. I want you to advise the committee how it might best proceed to consider what your Department has just recommended.

For example, as you know, the position of the Secretary of the Interior with respect to the overall general Arizona project legislation is different this year than it was in the last Congress.

Mr. Goss. Yes, sir.

Senator KUCHEL. That is a fact. We have to accept that fact. On the other hand, do you not feel that the Bureau of Reclamation might very well furnish to this committee specific technical information and advice that would be helpful?

Mr. Goss. Yes, Senator; I do. As a matter of fact, when I came here today, I only arrived in Washington last night—when I came here this morning three different people handed me a copy of the letter from Secretary Udall to the Honorable Wayne N. Aspinall, chairman of the Committee on Interior and Insular Affairs of the House, and it is a very strange letter, because in the letter Mr. Udall questions this project on a number of points.

However, accompanying the letter and transmitted to Mr. Aspinall with the letter is an analysis of the Los Angeles Department of Water and Power proposal for Hualapai Dam that not only finds the project feasible from an engineering standpoint—he finds it feasible from an economic standpoint, finds the current estimate of the cost to be well within the limits that make it feasible.

Senator KUCHEL. Who are you quoting now?

Mr. Goss. This is the Department of Reclamation.

Senator KUCHEL. Bureau of Reclamation.

Mr. Goss. Bureau of Reclamation of the Department of the Interior, and they find that the market is slightly greater than I thought it was.

Senator KUCHEL. I did not hear the end of that.

Mr. Goss. They find that the market for this peaking power is slightly greater than I thought it was.

Senator KUCHEL. Is that so?

Mr. Goss. That is so.

Senator KUCHEL. Well now, I suppose this committee can have a copy of that.

Mr. Goss. This is a letter dated April 29, 1967.

Senator KUCHEL. Senator Allott reminds me that yesterday he asked for any comments which the Bureau might have, and extracted a commitment that they would furnish that for the record. I wish, however, that the committee might have the letter before it to study.

Senator JACKSON. Here it is.

Senator KUCHEL. I say this to my chairman of the full committee in the absence of the chairman of the subcommittee. I will say, Mr. Chairman, that if we have here a situation where the Bureau of Reclamation already has upheld the feasibility of what the city of Los Angeles proposes to do, and finds marketability of a higher intensity than what Mr. Goss himself has suggested would be present, I think it is of enormous importance to this committee, because if our committee were to consider the kind of central Arizona legislation we had in the last Congress, then what you have suggested today, Mr. Goss, would be completely relevant. As you know, several of us have legislation which includes such reservoir authorization.

Senator JACKSON. Would the Senator yield just for a point of clarification, to avoid having anything misunderstood? The Bureau has not made a study of this. They have made an analysis. They are two different things. There has been no study by the Bureau of this, as such. It is simply an analysis, and the letter will bear this out.

Senator KUCHEL. I think that is an important point, Mr. Chairman, and with your approval, I would like to move that this committee request the Secretary of the Interior and the Bureau of Reclamation to proceed forthwith with a complete analysis of the city's proposal.

Senator JACKSON. We can certainly ask for the Department of the Interior and the Bureau to come up with a full study of this, but I want to point out, just so there is no misunderstanding of this, the title of it is, "Analysis of the Los Angeles Department of Water and Power Proposal for Hualapai Dam." This is on the appendix to the letter right after the first page:

"Mr. Goss' presentation to the committee did not include sufficient descriptive data on the proposed fiscal plan and financial arrangements to provide a basis for engineering estimates and repayment studies. It was necessary, therefore, to meet with Mr. Goss and members of his staff and to review with them the descriptive data and assumptions to be used in analysis. The plan described below is in conformance with the understanding obtained of Mr. Goss' concept of his proposal."

Mr. Goss. Yes.

Senator JACKSON. I just say that so we understand what we are discussing.

Mr. Goss. Yes, Senator; they spent 2 days with me discussing this proposal in great detail.

In addition to that, a party made up of engineers from the department of water and power, consultant Raymond Hill, and representative engineers from the Bureau of Reclamation went up to the site and toured the river for some 20 miles below Hualapai Dam, in order to determine if there were any problems in locating this afterbay.

They found as many as 50 sites at which it could be located. The location is quite flexible.

Senator KUCHEL. Mr. Chairman, your point is well taken. This is an analysis, and I do believe it would be in the public interest if you, as our chairman, requested a complete report on the feasibility of what the city of Los Angeles Department of Water and Power has recommended to our committee.

Senator JACKSON. I think we can handle that by conferring with them and figure out just how this ought to be handled. You know, of course, if we get into a feasibility study, we would have to pass legislation and everything else to undertake to do that. Let us examine this as carefully as we can.

Mr. Goss. Senator, may I comment on that?

Senator KUCHEL. Yes.

Mr. Goss. Because of the time element here, I am well aware of the fact that Arizona would like very much to have their project approved this year, and California would like very much to have this problem solved this year. Our interests are coincident in this, and the same, and the last thing we would wish to do is to delay consideration of a bill that would accomplish all our objectives in the basin.

So I think the committee—we respectfully suggest to the committee that they might consider authorizing this project, subject to a feasibility, an engineering feasibility study by the Bureau, and the negotiation of suitable contracts. That would save a lot of time.

Senator KUCHEL. I think it is an excellent recommendation. I think it is something that this committee ought to consider, particularly in view of the history of similar legislation with Hoover Dam.

Senator JACKSON. I appreciate the modesty of your request.

Mr. Goss. Thank you, Senator.

Senator JACKSON. In other words, this big project is to be authorized conditionally. As you know, it is hard enough to get projects through which require a feasibility study. With all due respect, I now admire and I understand why Los Angeles is as big as it is.

Senator KUCHEL. May I ask you, Mr. Goss, on page 8 you have in technical language two potential alternatives as to what at the end of the period of 75 years would be available in the Federal Treasury as revenues.

One, talking about capacity at the busbar could be sold for \$4.60 per kilowatt-year, and the second to be sold for as much as \$7 per kilowatt-year. What, in your opinion as an expert and engineer, would be a reasonable figure? Would it be the smaller one, the larger one, or something in between?

Mr. Goss. I think it would be in between \$4.60 and \$7.

Senator KUCHEL. So that we are talking about revenues that could be on the order of \$1.5 billion at the end of the period?

Mr. Goss. That is right, from this project alone.

Senator KUCHEL. Yes. You also mentioned that, in your opinion, this project would represent instant insurance against blackouts, blackouts which would cover what area—the Pacific Southwest, the city of Los Angeles, or how large would the insurance policy be? How much area would it cover?

Mr. Goss. It could well cover all the States west of the Rockies, from the Canadian Border to the Mexican Border. As a result of this intertie, the alternating current lines being built by the California power companies and by the private utilities in the Northwest, the DC line being constructed by the department of water and power, as a result of lines either already constructed or under construction, at the present time all the utilities west of the Rockies, and I include in that Colorado, because part of it is east of the Rockies, but considering that is also interconnected as one system, anything that happens in all of these States affects other systems.

For example, recently, the Bonneville Power Administration lost a unit up on their system, and the department of water and power supplied a part of the capacity needed to keep the system stable during that operation.

With the electric systems interconnected in this way, a catastrophe on one system resulting in a loss of generating capacity could very well throw all of the systems into instability, and shut them down.

The beauty of this project, by virtue of its size, by virtue of the fact that the hydroelectric units can be very quickly brought under the load, and by virtue of the location of them near a large concentration of high voltage transmission lines, obviously, this would contribute

greatly to the stability of the system and help to prevent a general blackout such as we had in the Northeast section of the United States.

Senator KUCHEL. You expressed a preference for the kind of authorizing legislation relative to the kind of interest which the public and private agencies would purchase, and I don't want to try to elicit more information on that technical subject. But, Mr. Goss, does the department plan to be in contact with the Bureau of Reclamation relative to any additional developments of this recommendation which you have made today to the committee?

Mr. GROSS. Yes, I do; and I also plan to be in contact with the other utilities in the Southwest in connection with it. This is a resource that should be developed, Senator.

I think it should be developed as a part of the overall plan of the basin. The needs of the basin should be considered in this, and the project should be developed as a part of the basin project, helping to solve the other problems of the Colorado Basin.

However, if the Congress decides not to authorize this project, then I think the department might very well—the department of water and power—might very well go to the Arizona Power Authority and others, and suggest that we get together and amend our present application and build this project strictly as a power project. This is not the best way to do it. It should be done as a part of this basin bill, but it is such a good project that I intend to pursue it, sir.

Senator KUCHEL. I thank you very much.

Mr. MYERS. I am William A. Myers, chairman of the Water and Power Commission of Los Angeles.

If I may inform the committee that the city of Los Angeles' generating capacity today is around 3,100 megawatts, and in 10 years we have to double that capacity; and to be sure, looking forward toward this direction, that is precisely why for peaking power that we this direction, that is precisely why for peaking power that we contracted for the direct current high-voltage line from Bonneville to Los Angeles.

I want to point out that it was only several months ago that Mr. Charles Lewis told me his best estimate was that in 5 years the city of Los Angeles would be sending more power back up to Bonneville than they could ever receive, and we have no real firm estimate at this time of what that line will do for us and the Southern California Edison Co., who are partners with us in this line, in the year of 1980.

We are now faced with a nuclear plant that we, 4 years ago, tried to get going at Malibu, which apparently has been delayed due to certain technical difficulties. The city of Los Angeles is participating in this island plant.

Now, nuclear reactors are not pieces of machinery that you start up from zero and turn on and turn off. They have to operate at a relatively steady load factor. Now, we are looking ahead 10 years hence to generation of more power, and peaking power especially.

The capital investment in peaking plants is exorbitant, and it is not economically feasible. Our position is that we feel that by authorization of this project, which will take 9 years to complete if authorized, will fit into the scheme of things. Hence, where we need the power, when we cannot really get a lot of power out of the Northwest, and

will be a payout project for further development of the Colorado with a project, we have a real need in the city of Los Angeles and southern California for peaking power.

Now, to be sure with the WEST Associates, integration of coal power, and other power, they certainly operate on the same basis as we operate our utility, and there isn't any question about it but what this peaking power would not be attractive to them, and we did not have contracts when we did get into the development of this direct current powerline, with the idea to get it across, commit ourselves into it at that time, and we have only recently firmed up some of those contracts at that time.

It may be a bold undertaking, as some have said, but it is good from an engineering point of view and, for us, it is good from an economic point of view, and we think it is good for Colorado, and we think it is good for all of the upper basin States and all of the States on the Colorado, because it provides a means economically to help the further development of the river.

Senator KUCHEL. I simply congratulate you. I think this is—I use the term, “boldness,” and I think it is. If you don't think that way you would be unable to take care of the problems that the city of Los Angeles will face.

Thank you very much.

Senator JACKSON. Senator Allott.

Senator ALLOTT. Thank you very much, Mr. Chairman.

I appreciate your statement, Mr. Myers.

Mr. Goss, I want to say to you that my service on this committee is not as long as some others. I have only been on here 10 years. But in my opinion, your statement is the clearest, most concise statement of a very complicated engineering project, stated so that we non-engineering people may understand it, of anything I have seen in the 10 years that I have been on this committee.

I congratulate you and I think you have carried your point well.

I don't want to gild the lily at all, but looking at your chart at the end of your statement, we come down to this essentially in your proposal, that you propose a plan which will permit 5,000 megawatts of production instead of 1,500.

Mr. Goss. Yes, sir.

Senator ALLOTT. You propose a plan which will permit \$254 million worth of Federal investment as compared with \$540 million, and you propose a plan which will produce power at the cost of \$1.46.

Mr. Goss. \$1.46 a kilowatt.

Senator ALLOTT. \$1.46 a kilowatt as compared to the \$2.34.

Mr. Goss. Yes, sir.

Senator ALLOTT. Per kilowatt.

So that upon all three counts, both as to the amount of production, the cost of the Federal investment, and the cost per kilowatt, you outshine the proposal that the Bureau and the Secretary of the Interior endorsed so heartily last year.

Mr. Goss. Yes, sir.

Senator ALLOTT. Are you acquainted, Mr. Goss, with S. 1242 introduced by myself, which is very similar to the Kuchel and Moss bills?

Mr. Goss. Yes, sir.

Senator ALLOTT. I recently added an amendment to that and I read it to you. It is very short, to add in section 302 the following:

The Secretary is authorized and directed to continue to a conclusion the engineering and economic studies and negotiations with any non-Federal agencies with respect to proposals by non-Federal agencies to construct and operate the hydro-electric generating and transmission facilities to be installed at or in connection with the Hualapai Dam and reservoir, including pumping storage facilities and not later than 18 months from the date of the enactment of this Act report the results of such negotiations, including the terms of proposed agreements, if any that may be reached, together with recommendationse thereon, which agreement, if any, shall not become effective until approved by Congress.

Will you comment on that?

Mr. Goss. I think that is precisely the way we should proceed on this. The one thing I think has been left out of prior consideration of the project, on the smaller project, there was no consideration of the necessity of requiring the Secretary to do this before the project was authorized and construction was started. I think your amendment is in line with the considerations that I consider necessary.

Senator ALLOTT. Now you had some discussion with the distinguished Senator from California and with the distinguished chairman of this committee, about the intertie line between the Northwest—this is Public Law 88-552—

Mr. Goss. Yes, sir.

Senator ALLOTT. Which the distinguished Senator from Washington, the chairman of this committee, was very vigorous in passing, and I would like to read two or three sections, or portions of two or three sections out of this act, and ask you a question at the end:

This is an Act to guarantee electric consumers in the Pacific Northwest first call on electric energy generated at Federal hydro-electric plants in that region, to guarantee electric consumers in other regions reciprocal priority, and for other purposes.

Section 2 starts as follows:

Subject to the provisions of this Act, the sale, delivery and exchange of electrical energy generated at, and peaking capacity of, five Federal hydro-electric plants in the Pacific Northwest for use outside the Pacific Northwest shall be limited to surplus energy and surplus peaking capacity.

Mr. Goss. Yes, sir.

Senator ALLOTT. You understand that, of course. And then continuing on in section 3(a), so there will be no question, I am reading selected sentences out of this act—I have no objection to the whole act being in the record if anybody wishes it:

The purchaser shall obligate himself not to take delivery of or use any such energy to supply any load under such conditions is discontinuance of deliveries from the Pacific Northwest in 60 days would cause undue hardship to the purchaser or in his territory and, further, the purchaser shall acknowledge full responsibility if any such hardship occurs.

And then, reading another clause from the following section (b):

Electric energy generated at Federal hydro-electric plants in the Pacific Northwest which can be conserved, for which there is no immediate demand in the Pacific Northwest at any established rate, but for the Secretary determines there may be a demand in meeting the future requirements of the Pacific Northwest—and I underscore the following—may be delivered for us outside that region only on a provisional basis under contracts providing that if the Secretary determines at a subsequent time that by virtue of prior deliveries under such

contract, the Secretary is or will be unable to meet the energy requirements of any Pacific Northwest customer, the purchaser will return the full amount of energy delivered to him.

Then I would like to quote another part of a sentence from section 4:

Any contract with the Secretary for the sale or exchange of electric energy generated at peaking capacity of Federal hydro-electric plants in marketing areas outside the Pacific Northwest for use within the Pacific Northwest, shall be subject to limitations and conditions corresponding to those provided in Sections 2 and 3 for any contract for the sale or exchange of hydro-electric energy or peaking capacity generated within the Pacific Northwest for use outside the Pacific Northwest.

I would like to ask you this question, Mr. Goss. In considering these particular clauses here, or considering the act as a whole, which you are acquainted with, I know, have you arrived at your conclusion which you have stated here today, with full consideration of the tentative nature of the deliveries you may or may not have from the Pacific Northwest?

Mr. Goss. Yes, I have.

Senator ALLOTT. Do you have any further comments?

Mr. Goss. No, except, as I said earlier, Senator. It seems to me that the preference, the operation of the preference law, has been accommodated to many situations with equity to the areas involved. In this case I don't think it would be necessary to make such an accommodation as was made here.

Senator ALLOTT. Some questions were asked of you a while ago, Mr. Goss, relative to what you had done to procure contracts. I am not aware of any other situation in which a participant has to go out, or that the burden has been put upon him. I thought this was the responsibility of the Secretary of Interior, with relation to reclamation projects, and I think that is your position now, is it not?

Mr. Goss. That is it, Senator. That is my position. My efforts have been to supply the utilities, all the utilities in the basin States, with information and cost data and other data connected with the project so that they can make an evaluation of it in their own particular instance, and they have indicated great interest and have attended these meetings, and it has been a full revelation of the project to all of them.

Senator ALLOTT. I thank you very much, Mr. Goss. I do, again, compliment you on a very excellent statement.

Mr. Goss. Thank you, sir.

Senator JACKSON. Mr. Goss, I just have one question and I will then turn to Senator Moss.

You mentioned a while back that this project would help the blackout problem. Well, it would not help per se, would it, in dealing with a blackout problem? I mean, it is just another project, and that in itself is not an assurance that you can deal more effectively with it; is that right?

Mr. Goss. Yes, Senator; I think that this project does help. The problem, the serious nature of the problem created by the Northeast blackout was not merely the interruption of service to a broad area of the eastern seaboard, but the duration of that interruption, because of the time required to get these large steam units back on the line and operating, and the loss of generating capacity in steam plants due to the decay of voltage and frequency.

In the case of a hydroelectric plant, you are not concerned with voltage and frequency as far as auxiliaries are concerned. They are free of that difficulty, and they can be started and placed on the line in a matter of minutes. As a matter of fact, the way we operate some of our units at Hoover, two of them in particular, we operate them as motors ready to start generating at a moment's notice as reserve on our system. You can't do that with a steamplant.

A steamplant can only continue to run as long as the system is stable and the voltage and frequency are normal. If the voltage drops, the frequency drops, as is the case in these widespread disturbances, then the steamplant really is off the line and it takes hours to get it back on the line.

Senator JACKSON. What you are saying is that it has greater flexibility, but it is not a solution per se, in any sense of that term. We have had blackouts in the Northwest and we are about 96 percent hydro.

Mr. Goss. Yes, I know you have had interruptions. We have had interruptions, too, but nothing as compared with the Northeast blackout, Senator.

Senator JACKSON. I understand that, but I don't know of any area of the United States that has a higher percentage of hydro at the present time than the Northwest.

Mr. Goss. That is true, and your excellent operating record up there, I think, reflects this.

Senator JACKSON. Well, we are proud of it. I did not know whether you were cranking in this blackout factor as a further aspect of the cost-benefit ratio.

Mr. Goss. No, sir.

Senator JACKSON. Senator Moss.

Senator Moss. Thank you, Mr. Chairman. I regret, Mr. Goss, that I did not have time to hear all of your oral presentation, but I have read your statement, and I want to congratulate you on presenting this matter very lucidly and in a very logical and compelling manner.

I am interested in this question of whether or not there will be adequate market demand for the power if the 5-million-kilowatt plant is built.

Mr. Goss. I think you can use, for example, the department's own system. Ten years ago our generating capacity was 1,600,000 kilowatts. This year our generating capacity is 3,500,000 kilowatts.

Now, that is the amount of generating capacity we have to have to serve the load of the city of Los Angeles, some 2,800,000 people. The same thing that has happened to us is happening to all of the utilities. Their load is growing at a rate that makes it necessary that they double their generating capacity each 10 years.

This means that this area, as I have stated here, based on a study by WEST Associates of the market, the very area that might be considered as a proper market from the standpoint of distance from this project, will have an increase in their required generating capacity of 14 million kilowatts during the 5 years from 1975 to 1980.

As I say here, the combined loads of these utilities is estimated in 1975 to be 28 million kilowatts. By 1980, only 5 years later, it will be 40 million kilowatts. Presumably, by 1985, it will be 56 million kilowatts.

Now, this is a normal experience that all utilities in the Nation are going through and have been going through for a number of decades. The situation, of course, is that we are dealing with bigger numbers all the time. Ten years ago, the department of water and power was installing generating units with a capacity of 156,000 kilowatts, each unit 156,000 kilowatts. The unit that is going on the line on our system right now has a capacity of 340,000 kilowatts.

In other words, the unit is twice as big. Our load growth is such that we have to double our generating capacity in 10 years, and we have to have larger units.

Now, as you add these larger units, and they are going to be nuclear primarily in this area, because of our smog problem in the Los Angeles Basin, and because we cannot depend upon gas as a firm fuel for steam plants in our area, the expansion of the generation in southern California is going to be primarily nuclear. We will expand to the maximum degree possible the use of coal in the Four Corners area.

There is a tremendous concentration energy that we expect to participate in with the other utilities. With a nuclear plant, with the high capital costs, the low fuel costs, the economy makes it necessary and important that they operate at a very high capacity factor. As a matter of fact, 100 percent of the time they are available, they are at full load.

Since the load factor of your system is only about 62 percent, this means you have to have other generation that operates effectively and efficiently at a low capacity factor, and that is where this peaking capacity of 30 percent I mentioned here fits in very nicely.

This determination of the amount of peaking capacity is a result of a computer study which we have run, and which other utilities have run, in which we expand our system for 35 years, plug in the kind of generation we think we are going to build during that period, and determine what other generation matches it most effectively, most efficiently, and most reliably.

Senator Moss. You have computed this in relation to the added thermal capacity and nuclear capacity that you anticipate in the southern California area? This would fit in as the peaking part of that expanded load?

Mr. Goss. Yes, sir, furnish peaking and furnish reserves, because as you have these larger units up to 750,000 and 1 million kilowatts, if you lose one of them, you have to have something else on the line unloaded, ready to pick up that load immediately, and this project fits very nicely that kind of use, and I assume that under normal operation, 20 percent of this capacity will be operating purely as reserve, not carrying any load, but ready to pick up.

Senator Moss. Thank you very much.

I find very fascinating the discussion that you have presented, and one that is most impressive.

Senator JACKSON. Senator Fannin.

Senator FANNIN. Mr. Goss, naturally Arizona is very concerned about this program, because we would like to know what will result—you talk about what can be done as far as power rates. You referred to pumping. You referred to the water pump factor when you state—

Mr. Goss. Assumed in the study made, that was the assumption made by the Federal Government in analyzing this project, that power for pumping would come from the project.

However, I think that the most economical use of this resource, and the greatest economy in the supply of water to the central Arizona project would result from an operation under which the energy from the project would be sold to utilities, and the utilities then would furnish the energy for pumping in the aqueduct.

Senator FANNIN. Naturally, we are interested in what that power would cost, so in this respect you are not going to be of any assistance to us. Is that a correct conclusion?

Mr. Goss. Well, we could be, Senator, certainly. In other words, if we participate in this project and we use some of the energy with our peaking capacity, we could return that energy to you on a 90-percent capacity factor basis. I think you could probably buy it more cheaply from other utilities in your area, but I am not sure of that. We certainly would be willing to negotiate on that basis.

Senator FANNIN. Have you talked to the Arizona Power Authority with regard to this project?

Mr. Goss. Yes, sir. They have been represented at both meetings that we have held with the utilities and water users.

Senator FANNIN. They evidently do not have much hope for this program from what I have been informed about it.

Mr. Goss. I can't answer to that, sir. They were very interested, and their comments to me would not indicate that they found any difficulties with the project.

Senator FANNIN. Of course, the time element is so very important, and you mentioned that, too.

Mr. Goss. Yes.

Mr. FANNIN. Arizona is starving for water, as you well know.

Mr. Goss. Yes.

Senator FANNIN. With a new project coming along that more or less upsets the planning and going forward, naturally we are concerned as to what will take place.

Mr. Goss. Senator Fannin, I do not believe that this should delay the central Arizona project or the basin project bill. If the committee can find a way to amend the bill that includes the Hualapai project in such a way that the project can be authorized, and the Secretary directed to obtain agreements with the participating utilities, I would think that probably this is the way in which a basin project bill can be best expedited.

Senator FANNIN. Were you here yesterday?

Mr. Goss. No, I was not.

Senator FANNIN. I am sure that if you had heard the testimony of the Secretary of the Interior, you would not make the statement as far as the time element is concerned.

One problem, of course, you realize, is the opposition which has been very much in prominence from the conservationists, the so-called conservationists, and concerns what would happen when you have this addition to Hualapai. The other problem is involved in construction of a pump-back system.

Mr. Goss. As far as the operation of the reservoir above the dam, Hualapai Reservoir, I am sure that there can be worked out a regiment of operation that will not interfere with the recreational use of that reservoir.

There is a reach of the canyon, a reach of the river, that will be opened up for recreation to literally hundreds of thousands of people, and would be of great benefit as you have heard this morning. I really don't believe the conservationists will oppose this.

Now, as to the pumping forebay which is a reach of the River below the dam, there is a great deal of flexibility, as I have said, in the location of the downstream dam that impounds an approximate 40,000 acre-feet of water necessary for the pumping operation.

The level of this forebay would go up and down. It would vary, somewhere between 130 and 145 feet, although there is some flexibility in this, too.

However, that stretch of the river certainly would not be available for any recreational use, and people would have to be, for their own safety, excluded from it as far as participating in the channel itself is concerned.

However, I am sure, as an Arizonan, you are quite familiar with this stretch of the river. Right now it is quite inaccessible. It is not accessible by boat except in a very special kind of a boat, and then with a great deal of difficulty.

The river is very dirty in this stretch and carries a lot of debris, and this stretch of the river, out of the total stretch, the reach from Glen Canyon Dam to Hoover Dam, I think, is a small detriment for a great benefit.

Senator FANNIN. I understand that you have been utilizing the studies that the Department of the Interior or the Bureau of Reclamation have made in relationship to this project, the Hualapai Dam.

Mr. Goss. I have been using their studies, our own studies, and the studies of our consulting engineers, in connection with this dam, and this reach of the river.

Senator FANNIN. Have your people been on site?

Mr. Goss. Yes, sir.

Senator FANNIN. Making studies?

Mr. Goss. Yes, sir.

Senator FANNIN. Down below the dam?

Mr. Goss. Yes, sir.

Senator FANNIN. The forebay?

Mr. Goss. Yes, sir.

Senator FANNIN. How extensively? Core drilling, or anything of that nature?

Mr. Goss. No. That isn't necessary.

Senator FANNIN. Is this going to be a fill?

Mr. Goss. I don't think there is a stretch of this river that has been more investigated from that standpoint, beginning back in the early twenties, by the U.S. Geological Survey.

Senator FANNIN. Below the site?

Mr. Goss. All through this area, and in addition to that, the Bureau of Reclamation has made studies of many damsites in this area, and in connection with our own application to build Bridge Canyon Dam, we studied other sites along here as well, so there is a wealth of information as to the geology.

Senator FANNIN. I know that you are better qualified than I am to speak on the subject of investigation from the standpoint of engineer-

ing, but I have been down the canyon. I recall the extensive investment that was necessary as far as the Marble Canyon site is concerned. I am just concerned now as to what you have done in relationship to the development, because I am afraid that we are going to have another delay, a long delay.

Mr. Goss. We took along with us on a recent survey of this stretch up the river 2 weeks ago, approximately, Consulting Engineer Raymond Hill, who has a great deal of experience on this river and on other projects similar to this, and he found the location of this afterbay dam feasible at a great many sites. He found some sites that were preferred.

He found that we could get the equipment in there to do it, to do the work, and since that time we have interviewed people engaged in this kind of construction, and obtained estimates of costs, to check against the costs used by the Government in their prior survey.

We were also able to, on this recent trip, make a more definitive determination of the amount of excavation that must be done of loose material. So I think the cost estimates that are being used here are quite valid, quite within the range.

Senator FANNIN. From what you have said, I would judge that you are still undecided as to the exact location of the afterbay?

Mr. Goss. No.

Senator FANNIN. You said there are several sites being investigated.

Mr. Goss. No. There are several sites that can be used for this. The final selection of the site will be the result of first, an economic determination of which results in the best use of the reach of the river for this purpose.

And, also, we will, of course, give consideration to the interests that others have in this.

Senator FANNIN. What is your estimate of the time that would be involved in all of this work you have described?

Mr. Goss. I have the 18 months that was proposed in Senator Allott's amendment, which is adequate time. I don't think it should require that long. I think we should be able to complete the engineering, feasibility, and development of this project, and negotiate the necessary agreements within a shorter time than 18 months.

Senator FANNIN. But there is a great deal yet to be determined in consideration of what will be done.

Mr. Goss. There is more to be determined but not a major amount. Most of the work has been done—has been done in connection with our own application—Arizona's application, consulting engineers' studies, and the Bureau's studies.

Senator FANNIN. Thank you, Mr. Goss.

Senator JACKSON. Thank you, Mr. Goss; and your colleagues. We appreciate having your testimony.

I am sure you understand that the questions do not have anything to do, necessarily, with one's feeling toward the witness. We just have to make a record here and get the facts.

Mr. Goss. Thank you, Senator. I greatly appreciate the opportunity to be here.

Senator JACKSON. We appreciate your coming, and we appreciate the fact that this is a tremendous problem. Obviously one cannot expect

full and complete answers to things that have not been thoroughly, and could not possibly be thoroughly reviewed in depth in the time that has been available.

We thank you very much.

Mr. Goss. Mr. Chairman, I have a question.

The letter from Mr. Udall to Congressman Aspinall—is that in the record?

Senator JACKSON. That was put in the record yesterday. I believe I am correct. It was put in the record yesterday, my staff confirms.

Mr. Goss. Thank you, sir.

Senator JACKSON. Thank you, and we appreciate having your statement.

The first witness tomorrow will be Mrs. Ruth Weiner, Grand Canyon Workshop, Colorado Open Space Coordinating Council in Denver. We will resume at 10 a.m., in this room.

(Whereupon, at 5:10 p.m., the committee adjourned, to reconvene at 10 a.m., Thursday, May 4, 1967.)

CENTRAL ARIZONA PROJECT

THURSDAY, MAY 4, 1967

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER RESOURCES
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10:05 a.m., in room 1202, New Senate Office Building, Senator Clinton P. Anderson (chairman of the subcommittee) presiding.

Present: Senators Anderson, Jackson, Hayden, Bible, Church, Kuchel, Allott, Jordan, Fannin, and Hansen.

Also present: The Honorable Morris K. Udall, U.S. Representative from the Second Congressional District of the State of Arizona.

Staff members present: Jerry T. Verkler, staff director; Stewart French, chief counsel; William Van Ness, special counsel; Roy Whitacre and Mike Griswold, professional staff members; E. Lewis Reid, minority counsel, and Darryl Hart, assistant minority counsel.

Senator ANDERSON. We will continue the hearing.

I am going to ask my colleague, Senator Montoya, to present the people who will be representing our State at this time.

Senator Montoya.

STATEMENT OF HON. JOSEPH M. MONTOYA, A U.S. SENATOR FROM THE STATE OF NEW MEXICO

Senator MONTOYA. Mr. Chairman and members of the subcommittee, I wish to thank the members of the subcommittee for this opportunity to appear here today in support of the central Arizona project and, in particular, in support of the Hooker Dam portion of that project.

I am particularly pleased to be able to appear before this subcommittee so ably chaired by the Senior Senator from New Mexico, Clint Anderson, because he, too, is equally aware of the benefits to be derived to the State of New Mexico from the proposed Hooker Dam.

This project has had a long and tedious legislative history. On several occasions the Senate has approved authorizing legislation only to see it die in the House. I hope that this year this long overdue legislation can be passed by both Houses of Congress.

The advantages of the central Arizona project are already a matter of record, so I will not repeat them here. However, I do want to briefly restate for the record our reasons for special interest in the proposed Hooker Dam and Reservoirs.

In addition, we also have here with us this morning representatives from the State of New Mexico who will go into more detail on the various aspects of the Hooker Dam project.

Very briefly, however, the Hooker Dam project is essential to New Mexico for the following reasons:

(1) The Gila River is an erratic stream that fluctuates widely on both a seasonal and annual basis. Floods cause damage in the area and deposit silt in irrigation structures and on the nearby farm fields. It is not practical to construct permanent diversion structures because of the fluctuating flow. Hooker Dam would provide needed flood protection.

(2) The economy in the Gila River area in New Mexico is largely comprised of small, irrigated acreages combined with nonfarm activities such as seasonal timber and mining operations. Reservoirs on the Gila River would provide a dependable water supply for municipal, industrial, and agricultural uses and would yield some additional water in New Mexico for future requirements. Economic growth, therefore, will be enhanced.

(3) The recreation potential of the area would be substantially improved and outdoor recreation, fish and wildlife benefits would result for the people of New Mexico, the surrounding States and the many visitors from all over the United States.

Water resources development as provided for in the central Arizona project represent an important investment in the future of the Southwest States and I urge your favorable consideration of authorizing legislation.

Mr. Chairman, with your permission, I would like to introduce to the committee the witnesses who expect to appear before you at your sufferance here this morning.

Will these witnesses please stand up, and then they will later be called by the chairman. Mr. S. E. Reynolds, secretary of the New Mexico Interstate Stream Commission. Mr. I. J. Coury, chairman, New Mexico Interstate Stream Commission. Mr. Hilton A. Dickson, Jr., member, New Mexico Interstate Stream Commission. Mr. Claude S. Mann, legal adviser, New Mexico Stream Commission.

I understand we have another New Mexican constituent who expects to appear here in opposition and I would like to also present him to the committee, Mr. Jeffry Ingram, Southwest representative.

Mr. INGRAM. I think you are incorrect, Senator. I am not appearing for them. I hope this is clear to the Senator. I don't know who misrepresented this.

Senator MONTROYA. Thank you, Mr. Chairman, for the courtesy you have shown me.

Senator ANDERSON. Dr. Weiner.

STATEMENT OF MRS. RUTH WEINER, REPRESENTING THE COLORADO OPEN SPACE COORDINATING COUNCIL, INC.; THE COLORADO MOUNTAIN CLUB; AND OTHER AFFILIATED ORGANIZATIONS OF THE OPEN SPACE COORDINATING COUNCIL, INC.

Mrs. WEINER. Mr. Chairman, members of the committee, I would like to summarize my statement, and I understand that my complete statement will be entered into the record.

I would also like to submit for inclusion in the record two supplementary statements prepared by members of the Colorado Open Space Coordinating Council.

Senator ANDERSON. Without objection they will be included in the record.

Mrs. WEINER. Thank you.

My name is Ruth Weiner. I am here as representative of the Colorado Open Space Coordinating Council and the Colorado Mountain Club; other affiliate organizations of the Colorado Open Space Coordinating Council which have specifically endorsed this statement are listed at the end of the statement. The purpose of these organizations in sending a representative to these hearings is to express the united opposition of the Colorado conservation movement—represented by the 19,000 Coloradans who are members of the COSCC affiliate organizations—to the construction of dams in the Grand Canyon. These groups are also united in their support of an extended Grand Canyon National Park, from Lee Ferry to the headwaters of Lake Mead, as has been proposed in H.R. 1305. As residents of the State of Colorado, we take strong exception to the abolition of Grand Canyon National Monument and part of Grand Canyon National Park as proposed in S. 1243, the bill introduced by the Senators from Colorado, the Honorable Gordon Allott and the Honorable Peter Dominick. Although introduced by Senators from our own State, this legislation does not represent our point of view, nor do we find that it is representative of the position of the majority of urban residents of Colorado, who make up about two-thirds of the population of the State. Since the Grand Canyon Workshop of COSCC began to publicize the Grand Canyon issue in 1965, we have received support, voluminous correspondence, and to date about \$10,000 in nondeductible contributions from people opposed to dams in Grand Canyon. About 50 percent of this has been from Colorado, and another 25 percent from residents of the Colorado River Basin States.

The only support for the Grand Canyon dams seems to come from agricultural water users (as represented by the National Reclamation Association, for example) and other groups which benefit economically from Bureau of Reclamation projects. There has certainly been no public outcry to construct dams in Grand Canyon. We would be interested to know how the mail of the Colorado senators has gone on this issue. In this connection, Senator Dominick wrote to a Denver constituent in 1965 that he knew of no plans for building dams in the Grand Canyon. We are also told that these dams will yield great recreational benefits, especially for those too old and infirm to hike, boat, and so on, yet we know of no testimony given by organizations concerned with the welfare of the old and infirm in support of these dams.

The correspondence and contributions we have received, on the other hand, have come from people of all ages and walks of life. Many of our correspondents comment that they are elderly. Some have sent contributions for our campaign although they do not have sufficient financial means to travel to the South Rim just to look at Grand Canyon, much less boat down the river or rent a motorboat on some lake there. We have had letters from people who are blind—who can never possibly see Grand Canyon—but who want it to remain unchanged. The cross section of the American people that has contacted us seems to be totally unselfish in its desire to preserve part

of our scenic heritage for all future generations to enjoy. It does not seem to matter whether or not they will see, hike into or boat down Grand Canyon.

We represent a point of view which is widespread in the Colorado Basin States, even among many who stand to benefit economically from the Colorado River Basin project: that dams should not be built in the Grand Canyon unless it is imperative to the Nation's security and welfare to do so. We in COSCC, and other conservation organizations, have worked to coordinate this point of view and give it a voice at these hearings. Gentlemen, our main reason for appearing here is to demonstrate that there are citizens and taxpayers of Colorado and other basin States who do not want any dams in Grand Canyon, and who have gone to considerable expense, for no personal gain, to say so in a public forum.

We also are well aware that recreation for any number of people is not the main issue; the United States would not spend \$511 million only to build an artificial lake simply for boating. However, the recreational argument is used to try to "sell" these projects to the taxpaying public. The central issue in the proposed legislation is water allocation in a water-short area, a problem by no means solved by any of the proposed legislation. Some of the bills are indeed an attempt to remove the problem from the States of the Colorado Basin and place it on the U.S. taxpayer.

The administration proposal has gone in an enormous way towards answering our fundamental objections and we congratulate the Secretary of the Interior on this.

We feel that the proposal for financing the central Arizona project made by the Secretary of the Interior and embodied in the legislation introduced by Senators Hayden and Jackson is commendable and imaginative, and represents more realistic thinking than prior proposals involving dams. While we have a number of reservations about CAP, we do think the financing proposal is a valuable and imaginative one, and is consonant with our own suggestion that in some way the users pay for the water, as they would in the case of higher M. & I. rates and the proposed ad valorem tax. A significant contribution has been made by the authors of this proposal to conservation and to the entire Southwest in determining that in this one instance the Federal Government and private utilities could cooperate to provide pumping power for CAP. In this connection, we are once again at odds with other spokesmen from Colorado. The State still does not support the financing proposal, but there are a fair number of Colorado citizens who do.

Although we support the financing proposal proposed in the Hayden and Jackson bills, CAP itself has brought with it a political framework of proposals, each controversial in its own right. There is some justification for the opposition of our Governor, among others, to authorization of CAP in the absence of assured augmentation of the Colorado River. Importation is a complex and controversial affair, in the rudimentary state of research, which has not yet even been considered in detail by Congress. Other means of augmentation, such as desalinization and cloud seeding, are also still in the exploratory

phase and as yet extremely expensive. The entire augmentation-importation problem is properly the concern of the national water commission, and should be presented to Congress in a separate proposal, for consideration on its own merits. The Mexican Treaty obligation ought also to be considered by such a commission, and legislation regarding it drawn up independently.

Second, there is pressure to authorize the five Upper Basin projects proposed in section V of S. 861 simultaneously with CAP. I should like to submit for the record, as appendix I of my statement, an analysis of these five projects which was prepared by the Grand Canyon Workshop of COSCC in 1966. We feel that none of these projects is justifiable on economic grounds—the land in each of them costs from two to five times as much to irrigate as it is worth after irrigation. The Dallas Creek, San Miguel, and West Divide projects are particularly objectionable from this point of view. These three, and the Dolores project, would alter substantially the character of areas now widely used for recreational purposes. The Dolores project, in particular, would destroy one of the last stretches of wild river in Colorado. I would like to submit for the record the statement of Dr. Henry Toll of Denver, who has done considerable boating on the Dolores, in opposition to this project. We have no particular objection as conservationists to the Animas-La Plata project, but the economics of the project appear almost as dubious as the rest. Perhaps some better projects could be suggested, or some other means of guaranteeing water for Colorado.

We all know that the five Colorado projects are not being proposed on their own merits, but primarily so that Colorado's water will be used consumptively, thus laying a legal claim to it in accordance with western water law. It would be more beneficial to the State, in fact, if, instead of laying claim by using the water, the State of Colorado could lease its share to downstream users by contract, since there is a considerably longer growing season downstream. Under the present compact and water practice this is not feasible—a downstream user can simply lay claim to the water, without having to pay for it, if he is first to use it. We wonder if a different practice might not be instituted. This was in fact suggested by Congressman Haley in the House hearings in March.

Third, we feel we must register objection to the site proposed for Hooker Dam, since the reservoir would invade the Gila wilderness. Could not another site be selected downstream which would accomplish the reclamation purpose of the dam almost as well?

I also ask to submit for the printed record, following my statement, a comparison of the Hooker and Connor sites. The Connor site is 26 miles downstream near Redrock, N. Mex., and would not infringe on the Gila wilderness.

Senator ANDERSON. Have you seen any of those locations?

Mrs. WEINER. No, Mr. Chairman, I have not. This addition to the statement was prepared by several members of our committee who are extremely familiar with the area, who have seen it. I myself have not.

Fourth, whether or not it was so intended, the promise of CAP water has led to some land speculation on the strength of promises

alone. I would like to quote from a brochure distributed by Arizona Properties, 20 South Scott Street, Tucson :

* * * The Case Grande Valley is the Heart of the CAP which will ultimately cost nearly \$2 billion. This will create a lush garden state for millions of people in a Shangrila atmosphere. It will bring a surge of new industry and resorts into the Valley. Never before has so much money been spent on so few people * * *.

Are the taxpayers of the entire Nation being asked to put money in the pockets of Arizona land speculators? In this connection, a considerable controversy now exists, according to several Arizona newspapers, as to whether CAP is really a good thing for Arizona. While we are not presuming to judge the pros and cons of this argument, it seems significant that respected members of Arizona's academic community question the value of CAP to the State.

Finally, we have taken the position before, and we reiterate it here, that we cannot support CAP except in conjunction with an extension of Grand Canyon National Park from approximately Lee Ferry in the northeast to the headwaters of Lake Mead. The bill introduced by Senators Allott and Dominick, S. 1243, while extending the national park boundaries to include Marble Gorge, abolishes the Grand Canyon National Monument and puts this land and an additional 13 river miles of the present national park into the Lake Mead recreational area. This is a tacit admission that building a dam which would impound water within the boundaries of a national park or monument is neither within the letter nor the spirit of the law. Nor does it seem the intent of the laws creating the national park system and Grand Canyon National Park to permit downgrading of a protected area from national monument to recreation area, and to alter park boundaries, just to make a nonessential development more convenient. Either passage of a bill like S. 1243, or construction of the proposed Hualapai Dam, would set a pattern for eating away land now preserved as national park and national monument. As far as the Goss proposal which was presented yesterday is concerned, our opposition to Hualapai Dam is not primarily because earlier proposals were not economical, but because the dam is not presently necessary.

We cannot leave the subject of Hualapai Dam without commenting on the recent proposal of Los Angeles Department of Water and Power to prepurchase power from a Federal combined pump-storage-run of the river plant at the Hualapai site, which would have a 5-million-kilowatt capacity, and would thus be more reasonable economically. However, our opposition to this dam, and the opposition to the Grand Canyon dams so widespread throughout the country, is not primarily because the earlier proposals were not economical, but because these dams are not necessary. Similarly, the administration's financing proposal for CAP is made primarily in order to spare the Grand Canyon, not because the earlier Interior proposal was a poor one economically. This point of view was given excellent expression by Federal Power Commissioner Charles Ross in his statement on the "scenic Hudson" bill—H.R. 13508 of the 89th Congress:

* * * a controversy has arisen over the necessity to develop the Colorado River above and below Grand Canyon * * * the Secretary of the Interior is

faced, as we were in the Storm King case, with conflicting interests. It is one thing for the * * * Secretary to assure the Nation that a power development will be compatible with other uses; it is entirely a different thing to determine without bias whether a power development should be constructed at all. In the latter case, too frequently, both ourselves and the Secretary may well be influenced by our natural inclination to believe we can have our cake and eat it as well * * * the Department's expertise * * * oftentimes obscure(s) the fundamental issue whether our national heritage of historic sites and natural beauty requires any development at all. There are certain intangible aspects of living which cannot be adequately measured. It is those intangible features which provide the quality of life which in turn maintains the moral, spiritual and philosophic vitality of a nation. Economic vitality, on the other hand, and the affluence that goes with it merely reflect the inherent stability of society resulting from endeavors of those who have enjoyed the quality of life sought since the beginning of time by every generation.

The administration's financing proposal for CAP, embodied in S. 1004 and S. 1013, demonstrates the choice the Secretary has made, and a choice a large segment of the American people approve. Moreover, we should remind ourselves that Hualapai Dam is being proposed now to finance importation of water into the Colorado, a project not yet determined to be feasible or authorized by Congress.

There is no foreseeable reason to build Hualapai Dam, so let us protect the entire Grand Canyon now, and end the threat of dams there. There is considerable question as to whether Hualapai Dam is even wanted, and by whom. We urge the removal of this dam, as well as Marble Gorge Dam, from any legislation, and to enact legislation as soon as possible which will make all of the remaining free river in the Grand Canyon—278 miles of it—into a national park.

Senator ANDERSON. Thank you very much.

(The data referred to follow :)

The statement above was endorsed by the specific organizations, participants of the Colorado Open Space Coordinating Council:

Aiken Ornithological Society, American Camping Association, Rocky Mountain Section, Colorado Mountain Club, Colorado White Water Association, Denver Beautiful, Inc., Denver Field Ornithologists, Federation of Western Outdoor Clubs, Mile-Hi Alpine Club, PLAN—Boulder, Regional Parks Association, Sierra Club, Rocky Mountain Chapter, Springs Area Beautiful Association, and Trout Unlimited, Cutthroat Chapter.

In addition, the following two organizations endorse the expressed opposition to the Grand Canyon Dams, without giving their endorsement to other aspects of the statement:

Colorado Federation of Garden Clubs and Colorado Federation of Women's Clubs.

APPENDIX I

ECONOMIC PROFILE OF THE FIVE COLORADO PROJECTS

Animas-La Plata.—Total cost: \$102 million; allocation to irrigation: \$97 million; total acres to be irrigated: 106,000 (56% full service, 44% supplemental service); number of acres Class 3 or 4: 14,000; average cost of irrigation per acre: \$950; present average market value of land in the area: \$100/acre dry, \$300/acre irrigated. Cost of irrigating is three times the value of land after it is irrigated.

Dolores.—Total cost: \$47 million; allocation to irrigation: \$39 million; total acres to be irrigated: 61,000 (53% full service, 47% supplemental service); number of acres Class 3 or 4: 20,000; average cost of irrigation per acre: \$630;

average market value of land in the area: \$100/acre dry, \$300/acre irrigated. Cost of irrigation is twice the value of the irrigated land.

Dallas Creek.—Total cost: \$38 million; allocation to irrigation: \$27 million; total acres to be irrigated: 29,000 (52% full service, 48% supplemental service); number of acres Class 3 or 4: 20,000; average cost of irrigation: \$950/acre; present average market value of land in the area: \$100/acre dry, \$300/acre irrigated. Cost of irrigation is more than three times the irrigated land value.

San Miguel.—Total cost: \$70 million; allocation to irrigation: \$55 million; total acres to be irrigated: 39,000 (68% full service, 32% supplemental service) no land classification available; average cost of irrigation: \$1,400/acre; present average market value of land in the area: \$100/acre dry, \$300/acre irrigated. Cost of irrigation is almost five times the value of the irrigated land.

West Divide.—Total cost: \$100 million; allocation to irrigation: \$68 million; total acres to be irrigated: 40,000 (47% full service, 53% supplemental service); number of acres Class 3 or 4: 19,000; Average cost of irrigation: \$1,700/acre; present average market value of land in the area: \$100/acre dry, \$400/acre irrigated. Cost of irrigation is more than four times the value of the irrigated land.

SUMMARY

The total cost of the projects is estimated to be \$357 million, of which \$286 million is allocated to irrigation. \$232 million—81% of the irrigation allocation—is not recoverable from the projects but is to be paid for by anticipated surpluses from the Colorado River Storage Project. Total land to be irrigated is 275,000 acres, of which 85,000 acres—about 30%—is known to be class 3 or 4 and only marginally suited for irrigation. Average cost of irrigating over the five projects is \$1118/acre. Is this the best agricultural use for \$357 million?

An example: the West Divide project.—Water from the Crystal River would be impounded and distributed; \$62 million of the \$68 million irrigation allocation is for canals and tunnels to put 115,600 a-f of water on 40,000 acres, 19,000 of which would be newly irrigated. Predominant crops: alfalfa, small grains, pasture, a little fruit. Growing season: 118 days/year (frost-free); elevation: 5,000 feet to 7,900 feet.

DISCUSSION OF THE PROPOSED HOOKER DAM AND RESERVOIR, NEW MEXICO

The proposed Hooker Dam on the upper Gila River in New Mexico, as a part of the Central Arizona Project, should not be authorized for the following good reasons: (1) its reservoir would infringe on the first established U.S. Wilderness Area, the Gila Wilderness; (2) better alternative reservoir sites that would not flood a Wilderness Area and that would better serve the reclamation purposes exist only 26 miles downstream near Redrock, New Mexico; and (3) a feasibility study providing documentation of the Hooker site plan has never yet become available. These points are discussed below.

(1) *Infringement of the Gila Wilderness.*—The reservoir behind Hooker Dam would extend from four to six miles as the crow flies and seven to nine river miles into the Gila Wilderness Area, depending on whether a high or low dam is built. This Wilderness Area was established by the Forest Service in 1924, after Aldo Leopold and Clinton Anderson convinced the United States Forest Service to set aside this tract as a wilderness reserve. The Gila was the first Wilderness Area to be established in the United States. The deep canyon of the Gila River above the Hooker Dam site is considered to be one of its chief scenic attractions.

Though there is now a dirt road leading up the Gila River to the Hooker Dam site and to the edge of the Primitive Area and $\frac{3}{4}$ mile from the Wilderness Area boundary, improved heavy duty roads would have to be built in this area for the construction of a Hooker Dam. The U.S. Forest Service anticipates that local sportsmen and recreation groups will pressure for establishment of marina facilities, concessions, and campgrounds along the reservoir. Though, according to the Forest Service, the facilities needed to satisfy the recreation needs of the general public will be confined to the lower portion of the reservoir outside the Primitive and Wilderness Areas, the Forest Service will have a very serious administrative problem keeping power boats out of

the Wilderness, but letting unpowered craft in. We seriously question the sagacity and the principle of putting an artificial water highway across a boundary of a Wilderness Area, thus creating a nearly insoluble management and administrative problem (the Forest Service Regional Forester at the Albuquerque office has stated in writing that his agency will have to let any craft without a motor into the "Wilderness segment of the reservoir," and that they will have to keep motorized craft out. He was not able to say how this would be accomplished).

This matter brings up an important legal and semantic point of definition: how can there be a "Wilderness segment of an artificial reservoir"? Wherever the shorelines of an artificial, a man-made reservoir encroach upon a Wilderness Area, neither the water surface nor the shorelines are Wilderness. A seven-to-nine-mile long impoundment with artificially fluctuating shorelines is in no way analogous to a natural beaver pond, or to a lake created naturally by a landslide. Many biological arguments support this point of view and these relate to the size of the impoundment and the fluctuations that will be involved in managing the water levels for irrigation downstream.

The construction of a Hooker Dam might, strictly speaking, require the re-drawing of the Wilderness boundaries around the impoundment area, and we will oppose this move with vigor. The Wilderness Area was there first, and the impoundment that would cover part of it comes 43 years later. The Wilderness Act specifically states that the works of man shall be non-permanent in any Wilderness Area. The way to avoid this man-made infringement into the Gila Wilderness is to place the dam downstream where it will not conflict with the Wilderness Area itself.

(2) Alternative dam and reservoir sites that would better serve the reclamation purposes and recreation interests exist only 26 miles downstream at Redrock, New Mexico. The enclosed map will show that the narrow gorge of the "Gila Middle Box" above Redrock has a similar configuration with that of the Gila Gorge in the Wilderness Area; e.g., it is a narrow box canyon; it also is a scenically beautiful area, and it lies only 600 feet lower in elevation and extends from 19 miles (at its upstream end) to 26 miles (at the lower end) downstream from the Hooker site. According to field geologists who have studied both areas, two potential damsites exist at the downstream end of the gorge, as indicated on the enclosed map; according to them, the bedrock at this site is as well-suited for a dam abutment as the rocks at the Hooker site, and the geology of the reservoir area will provide a non-porous basin that will hold water well. A dam about 240 feet high could be built at either end of these Connor sites at an elevation of 4,320 feet, and this spillway level would flood the gorge to just beyond its upper end, about to Ira Canyon, about one mile below the lower (Dale) McCauley farm. It would not affect (cover) any farmland and would serve the extensive Redrock irrigation district at and below Redrock, New Mexico plus other districts downstream. The only farmlands that would be served by the Hooker damsite that would not be served by the Connor (Gila Middle Box) site area the two ranches owned by the McCauley's, and four other small ranches upstream.

The Connor reservoir would lie almost entirely inside the Gila National Forest, so there is little if any problem of land acquisition. The Gila Middle Box damsites would be only about five miles upstream from Redrock, New Mexico. Any type of mass recreation or use by power boats could be permitted on the whole of this reservoir, thus presenting no administrative problems peculiar to the Hooker reservoir area.

A dam at the Connor site would be far more effective for flood control than would a dam at the Hooker site, because it would retain water from four large creeks that enter the Gila River below Hooker: Mogollon Creek, Duck Creek, Mangas Creek, and Bear Creek, plus several other large washes. According to the U.S. Geological Survey, the tributaries between the Hooker site and Redrock, New Mexico contributed as much or more flood runoff during the catastrophic floods of 1941 and 1965 in this drainage as those above the Hooker damsite. On the basis of the U.S. Geological Survey data, we feel that the proposed flood control purpose of the Hooker site should be discounted in favor of the much larger flood control service that would be provided by the Redrock site.

The drainage area that would feed into the Hooker reservoir is outlined on the attached map, and the additional drainage area served by the Redrock dam-site is also noted. The latter would increase the total water catchment area by a hundred and fifty-five per cent. The streams in both the Hooker and Redrock drainage basins drain off the Continental Divide and the high country of the Mogollon Range. The U.S. Geological Survey runoff data make it clear that a dam at the Hooker site would have comparatively limited value for flood control.

(3) *Information Gap on the Proposed Hooker Dam.*—The customary report to Congress and for the benefit of other interested parties, in the form of a feasibility report that would outline the Bureau of Reclamation's proposals for this dam and reservoir and appurtenant works in detail, apparently has never become available, if it was ever even drawn up. For example, the exact height of the dam, the nature of the dam construction, the resulting storage capacity, have not been made available to the public, and, as far as we can tell, it has not yet been made available to Congress. This lack of documentation is surprising in view of the fact that the Hooker Dam has been under consideration by Congress for two years, and by the Bureau of Reclamation for more than three years. Basic details on the proposed Hooker Dam have not been specified anywhere in the testimony presented at the hearings in 1965 and 1966 on H.R. 4671. Only about two paragraphs are devoted to the Hooker damsite in the voluminous Pacific Southwest Water Plan (1964) printed by the Bureau of Reclamation in describing the Central Arizona Project. The only information we have been able to obtain concerning the Bureau's plans for the proposed Hooker site have been through the U.S. Forest Service; their Albuquerque office furnished us with data on the heights of the proposed dams at Hooker (4,882-foot elevation and 222 feet high; 4,988-foot elevation and 333 feet high), and U.S. Geological Survey quadrangle sheets with the position of the proposed dam and reservoir shown. They were not able to refer us to a published feasibility plan or a detailed report by the Bureau.

We feel that about as much information is now available on the Bureau's proposal for Hooker dam and reservoir as there is presented here on our proposed alternative damsite at Redrock. If the Bureau of Reclamation's proposed high Hooker dam will cost about 29 million dollars, the alternative Connor damsite may cost less since it would involve a lower dam height in a similar geological setting.

Relationship of the proposed Hooker Dam and reservoir to the Wilderness Act.—In the definition of wilderness in the Wilderness Act, several points of the Law must be considered in relation to the Bureau's proposal for Hooker Dam. "An area of wilderness is . . . defined to mean an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable; . . .". (emphasis added). Hooker reservoir would be a DEVELOPMENT; it would destroy the primeval character and influence in the Gila Gorge. It would be a permanent "improvement;" it would not preserve natural conditions. It would provide an imprint of man's work that would not only be noticeable but would be obvious inside the existing Wilderness Area.

Section 2 of the Wilderness Act reads ". . . in such a manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character . . .". (Emphasis added). Hooker reservoir would impair the wilderness character of the shoreline and cover with water the wilderness of the Gila Gorge.

In addition to these points, it is important to avoid setting new destructive precedents for interpretation of the existing Wilderness Act. If an artificial impoundment is considered a wilderness feature inside the Gila—our first established Wilderness Area in the United States, then in the future any such works of man connected with reclamation projects could be termed a "wilderness feature" in any other Wilderness Area in the United States. We must oppose this interpretation of wilderness.

Item (4) under Special Provisions in the Act which permits the President to authorize the establishment and maintenance of reservoirs in Wilderness Areas

makes it clear that such projects must be "needed in the public interest" and "will better serve the interests . . . than will its denial." We contend that the Connor damsite will better serve the purposes declared for the Hooker Dam proposal.

SOME COMPARISONS BETWEEN THE HOOKER AND REDROCK (CONNOR) DAMSITES,
GILA RIVER, NEW MEXICO

The Redrock damsite drains an area 155% larger than the Hooker site, and at times of flood it catches 155% more water discharge than Hooker, judging by the catastrophic floods in 1941 and 1965. Maximum speed of floodwater flow and therefore potential devastation is also 155% higher at Redrock than at Hooker, judging by the 1941 flood. Hence the flood control purpose of a dam in the upper Gila R. would clearly best be served by a dam at Redrock. Only 19 miles of floodplain lie between the Hooker site and the upstream end of the Redrock reservoir; this is the only stretch of the Gila that Hooker would serve but the Redrock site would not serve for reclamation purposes. Within this area only a handful of people, some residents of small towns such as Gila, Riverside and Cliff live on the floodplain; as of 1959, only about 43 dwellings existed within 800 feet of the Gila River, according to our examination of aerial photographs and USGS maps of the area. The acreage of potentially irrigable land within this stretch is about 6,000 acres. For all the floodplain areas downstream from Redrock (Gila Middle Box, or Connor site) the irrigation benefits of the two dams would be the same.

The Redrock (Connor) reservoir would flood only Forest Service land and less than 200 acres of rangeland if it were built with a spillway elevation of 4320'. It would provide a scenic reservoir area of easy access for mass recreation, and would have none of the administrative problems (keeping power boats out of the Wilderness Area) intrinsic to the Hooker site reservoir.

The most up to date and detailed data on evaporation rates at the two sites, according to the U.S. Weather Bureau and the U.S. Geological Survey Water Resources Division, only provide records from as far away as Tucson, and Elephant Butte Dam area on the Rio Grande in New Mexico. Extrapolations from these data provided by both agencies for the two damsites indicate that there is no difference in rate of water evaporation between the two proposed dam areas (Hooker and Redrock). Calculations of possible water evaporation from the reservoir areas will depend entirely on the surface water area or geographic extent of the reservoirs.

The Corps of Engineers has studied the Redrock (Connor) site primarily in terms of a high dam structure some 290 ft. high that would provide a reservoir capacity equivalent to that for the high Hooker dam of 333 ft. height. But this plan would involve a very expensive dam structure that would not only be in the Gila Middle Box valley or gorge, but would extend upward on the rimrocks of the gorge. The Corps' proposed high dam at Redrock would therefore spread the reservoir water out over an immense geographic area, and hence would be subject to excessive evaporation. However, if a lower dam of about 240 ft. height placing the spillway at an elevation of 4320', the reservoir would lie almost completely within the gorge, and evaporation would be much lower than at Hooker, either with a high or a low dam there. The lower evaporation loss would be related to the small surface area of a Redrock reservoir at elevation 4320'. A low Redrock dam set within the narrow gorge would probably be far less expensive than a high dam at Redrock.

Considerations of the problems related to the Gila Wilderness Area boundaries are of critical importance, in our view. An infringement by the reservoir created by a high or low Hooker Dam into the Gila Wilderness should be strictly avoided, in our opinion. A discussion of this matter is presented in our attached written statement.

In summary, flood control benefits would be superior at the Redrock damsite, and irrigation benefits would be similar at the two sites, at least in terms of the broad public interests, not in terms of local individual interest. Inasmuch as the Redrock site would provide no administrative problem with a Wilderness Area (but the Hooker site definitely would) we strongly favor the construction of a dam at the Redrock site. For all the reasons reviewed here we oppose the construction of a dam at the Hooker site.

Basic data for proposed Hooker high and low dams and the Redrock (Connor) Dam site

PUBLISHED USGS DATA ON THE 2 SITES, NEW MEXICO REPORTS

	Hooker	Redrock
Drainage basin area.....square miles..	1,864	2,829
Average stream discharge of Gila River at each site.....acre-feet per year..	89,770	139,000
Maximum flow in flood of 1941.....cubic feet per second..	25,400	40,000
Minimum flow.....do.....	17	3

OUR CALCULATIONS

	Hooker high dam	Low dam	Redrock, 4,320 foot elevation
Reservoir surface area:			
In square miles.....	3.6	(¹)	1.2
In acres.....	2,300	1,280	787
Reservoir capacity (acre-feet).....	285,000	98,000	² 84,000
Cost (Pacific Southwest water plan).....	(³)	\$28,000,000	(³)

	Hooker site	Redrock site
Evaporation rate from reservoir, annual in inches (from USGS Professional Paper 272-D; U.S. Weather Bureau Technical Paper 37; based on 10 years data).....	62	62

¹ About 2.² Our calculation.³ Estimate not available.

THE RIVER OF SORROWS

(By Henry W. Toll, Jr.)

But the river still mourns for its people
 With weird and disconsolate flow,
 Dolores, The River of Sorrow,
 Dolores, The River of Woe.

Alfred Castle King
 "The Passing of the Storm"

Fifty miles northeast of the Four Corners lies Colorado's least known and most characterful river. Like the Colorado main stem into which it flows, the Dolores is striking for the relative absence of habitation along its banks and the extremity of the wilderness through which it flows. Like the Colorado, its future as a wild river is in jeopardy. As in the case of every area subjected to massive dam-building, once we have progressed along this road, posterity has no opportunity to either enjoy or return to the previous state. The author's purpose is to acquaint you with this remarkable river and a modicum of the history which makes it so interesting, whether you be an aficionado of river-running, a casual traveler to the Four Corners area, or purely a lover of the mountain West.

The mists of antiquity obscure who named the Rio de Nuestra Senora de las Dolores and when they did so, but the padres, Dominiques, and Escalante knew it by that name when they joined the river near the site of the present day town of Dolores. That was August 11, 1776, and the search for a northern route to the California missions, which was to become one of the great American sagas of endurance and exploration, was still in its second week.

Less than six weeks before, the Declaration of Independence had been signed in Philadelphia and the population of the colonies faced with a war for independence could neither know nor appreciate the significance of the Spanish exploration in what was then another nation. Three decades would pass before Pike's "mistake" in geography would lead to the visitation of Santa Fe by an officer of the United States. A century would pass before the ruins of Mesa Verde would be discovered less than fifty miles away.

The Spanish explorers encountered their first troubles in the upper canyons of the Dolores and hence these become of historical interest in any consideration of the Four Corners area. The emanuensis of the expedition, Escalante, was to document its encounter with the uppermost canyons of one of the most complex systems in the entire Colorado drainage basin and to leave names upon the land which remain today. Accordingly, its traverse takes one through an area as interesting for its history as for its rare natural beauty and the dramatic change from sub-alpine to desert terrain.

If you are interested in fluminology and are looking for something distinctly different in terms of western rivers, you will want to consider the Dolores. Like some other challenges in this life, this should not be taken lightly or inadvisedly. Otis Marston, the dean of Colorado river-runners and writers notes that "this river is no run for beginners; it has some very difficult water, requiring much skill to negotiate". The Dolores differs from other desert rivers in that its flood waters are icy cold, its descent rapid, its channels more rock-cluttered, and its lability of flow extreme. The stakes of the game are higher and a swim in its snow-fed waters is alleged to be a vivid experience.

Also critically different for the would-be navigator is the sharply delimited season in which the river may be attempted. Time is of the essence and depends upon the magnitude of the winter snowfall in southern Colorado and the time of the thaw. A random consideration of flow tables will show that fluctuations from less than 100 second feet to more than 10,000 second feet may occur annually. Only in late April and early May is the stream flow sufficient to attempt a traverse of the river.

Of the approaches through Colorado to the Four Corners area, the least conventional but most characteristic courses southward from Montrose 26 miles to Ridgway. At Ridgway, the well-beaten tourist track lies southward to Ouray and Silverton; however, in summertime when the weather is good, Highway 62 West from Ridgway joins 145 at Placerville to constitute the more "direct" but not faster route to Cortez. If you know Ouray and Silverton, then surely you will want to follow the Lizard Head Pass route through the upper watershed of the Dolores. Shortly after cresting the pass (10,222 foot elevation), the road joins the Dolores as a sparkling mountain stream. The peaks of El Diente (14,200 feet) and Mt. Wilson (14,236 feet) dominate the basin. Snow water discharged from the slopes of these giants will drain into the Colorado River at an elevation of 4,090 feet after a 250-mile course as tortuous as it is precipitous.

When you reach the town of Dolores, you will have spanned the less navigable portion of the stream. In the mid-1880's this valley was an area in which the red man still manifested his domain and resented the intrusion of the white. One early settler, Mr. T. H. Akin, noted "cowmen had to go out together as if a man went out alone he hardly ever returned as the Indians got him".

It was also near the town of Dolores that one of the nation's earlier trans-basin water diversions was made. Here a two-mile tunnel built in 1885-86 by Major Hannah diverts water into the Montezuma Valley of the San Juan watershed. West of Dolores the road to Cortez turns south and the river turns abruptly north to enter the first of the canyons which also bears the name Dolores. The remarkable physiographic feature of this part of Colorado is the fact that the river coursing roughly northward cuts "across the grain" of a series of alternate uplifts and valleys which lies perpendicular to the river's path. In this traverse, the river cuts not only across the grain of the country but also across the geologic and human history of western Colorado as well. The most dramatic example of the geomorphic aberration of the river is the Paradox Valley through which the river cuts at right angles to the long axis of the valley entering and leaving through sharp clefts in the south and north Valley walls. To give a rough idea of the spacing of these canyons and their intervening valleys, the sequence can be tabled as follows:

Dolores Canyon	40 miles
Gypsum Valley (Intervening)	24 miles
Slick Rock Canyon	33 miles
Paradox Valley	7 miles
Paradox Canyon	8 miles
Mesa Canyon	29 miles
Gateway Canyon	30 miles

The last three valleys merge one upon another and do not exhibit the paradoxical phenomenon seen in the upper portion.

For purposes of running the river there is an excellent launching site at the Bradfield Ranch a few miles west of Cahone at the Glade Bridge crossing. In May, on the upper reaches, one should be ready for cold nights and heavy frost. At times this frost may reach a thickness of several inches and is then designated by the uninitiated with the title of snow.

The usual philosophical arguments as to the type of equipment to be used are present here as elsewhere. The author feels that the optimum is a 7-man inflatable raft manned by one individual. Ten-man rafts can be used very satisfactorily; however, in the tighter stretches these are much less maneuverable. Their greater width and larger oar span increase the niceties of navigation. Kayaks have been used and portage is possible throughout the entire length of the river, but, except for the very expert, the stretches from Slick Rock to Bedrock, and to a lesser extent from Bedrock to Gateway, offer less hazardous kayak water. Below Gateway, only the most expert kayak travel is again advised.

The stretch from the bridge near Cahone to Slick Rock offers beautiful campsites, occasionally in groves of spectacular Ponderosa pines. Rapids in the area of Glade Canyon and below can be run at random by rubber rafts with sharp attention to rock hazards. In the area where the canyon flexes sharply (almost 180°) in the area of the Mucho Grande Mine is a major obstacle of the upper canyon. This rapid, christened "Snaggletooth" by "Doc" Marston, is one to look at. To the author's best personal knowledge, it has been portaged more times than run. The water level factor is critical here as the barrier rocks at the top at some levels of water bar the approach to the natural shoot below. In any event, the drop is impressive and the runner will wish to savor the anticipation of the attempt. A primitive road at this area renders portage easy. In the event of miscalculation, the foot trip to the nearest outpost of civilization can be described as arduous.

Escalante and his companions took their fresh supply "on the hoof" and for them the dense underbrush of the canyons and the "slick rock" of the sandstone walls, known even today as the Escalante sandstone, impeded the progress of the longhorn Spanish steers and was a tribulation for animals and men alike. The tortuosity of the Slick Rock Canyon and the height of its walls limiting access and escape deflected the Spaniards eastward in Gypsum Valley. This decision made with judicious "casting of lots" and due consideration of the mountain wall evident to the west was an historic decision which ultimately led, by a circuitous north and west route, to the discovery of the Great Salt Lake. The magnificent mountain vistas of both Gypsum Valley and Paradox Valley which so influence Escalante are one of the striking features of the terrain, and in the Spring, white-capped ranges of Utah, particularly the LaSalles, stand in striking beauty.

The Dolores Canyon ends as the river transects Gypsum Valley. The two population centers of Slick Rock and Poverty Flats offer an opportunity to replenish supplies of potable drinking water. Below Slick Rock is small Glen Canyon with magnificent sandstone walls which opens again into the larger main Valley. The Slick Rock Canyon lying beyond also shares some characteristics of Glen Canyon and through it the river takes a most tortuous course which includes a classic Muleshoe Bend, a small edition of the Bowknot Bend of the Green in Labyrinth Canyon. In Slick Rock Canyon are a number of interesting side canyons and a few very primitive cliff dwellings. Deer and semi-wild stray stock, particularly burros, add entertainment to the trip. At one spectacular spot, the river abruptly narrows to a total width of 15 or 20 feet, and the boat running through is literally poured from the spout of a pitcher. In no canyon in the Colorado system is there less evidence of the hand or presence of man. It is a pleasant and relatively easy boat trip from Slick Rock to Bedrock.

Emerging from Slick Rock Canyon, the river enters the Paradox Valley. Here, as at Slick Rock above, a highway crosses the river affording lateral access to it. Here also, at the thriving population center of Bedrock, the sole resident of the town maintains a store where supplies may be obtained. The Paradox Valley was once extensively occupied by a Pueblo Indian culture, of which sixteen sites have been identified. This entire population, according to legend, was wiped out in a single day by hostile marauders from the north. Today much of the evidence of their occupancy has been obliterated by the rapidity of erosion in the area

and the blowing sands. Petroglyphs are to be found in this area in LaSalle Creek and also south of Bedrock in the main river canyon. The annihilation of this entire local culture inspired the opening stanza quoted above.

The Paradox Valley was famous in western history as a route through which rustlers and bad men traversed to sell stolen stock in the mining camps or to rob the banks of the same communities. Tom McCarty, the surviving escapee of the famous Delta Bank Robbery, returned to this valley after his escape. More than one rustler of yore forgot in his carefully laid plans to account for the high Spring floods in the Dolores to find, what he had remembered in another season as a modest stream, a raging river, and his escape with stolen stock a dangerous challenge instead of a foregone conclusion. Early day reports indicate "fights between cattlemen over brands were frequent."

The early settlers of the Valley entered from the Utah end in 1883 and their wagons were lowered by rope from ledge to ledge. For many years law was administered from the sage brush court, and such encumbering formalities as the right to counsel or to be present at one's own trial were usually not allowed to clog the wheels of justice. Tradition has it that at least a dozen homicides occurred in this Valley. One acquittal of an accused came when the majority of those in court that day found that the victim was "a dangerous member of the community". The apparent consensus was that the shooting had improved the moral tone of the community. The local cemetery was established in 1886—"The Valley was such a healthy place we had to shoot a man to start a cemetery".

The Paradox Valley proper is 25 miles in length and two to five miles in width. It has been used by one sociologist as a sufficiently sequestered place to warrant a study of the effects of outside world events on an isolated population. One scientific writer, considering its unique features and geologic history as reflected in the Valley's walls, rendered such scientific rhetoric as "the rimrocks speak in the voice of mystic beauty to the changing lights of the dawn and sunset".

The meander of the river through the valley divides the water-blessed "West Paradox" from the arid "East Paradox". In the Spring, nesting waterfowl abound in the natural but unprotected refuge. The river exits through a sharp notch in the northern wall to enter Paradox Canyon. This short canyon above the junction with the San Miguel contains three rapids. The last of the three, located about a mile above the junction, embraces a few decisions better made from bank than mid-stream.

At the San Miguel junction, Mesa Canyon begins. Clinging to the sandstone of the East wall of Mesa Canyon are remnants of the almost unbelievable "hanging flume". This structure, years in construction and costing \$173,000 (dollars of the 1890 type), was part of a hydraulic placer project which ran for seven years without completion and with total loss to the investors. Only a partial skeleton of the flume remains today. What was not taken for local construction suffered the whips and scorns of time. The heavily anchored supporting timbers, too difficult to remove, remain like the fossil of an unending serpentine dinosaur undulating along the curves of the canyon wall for six or seven miles.

At low water Mesa Canyon is a tedious trip. Once the spectacle of the flume is passed, a martial line of buttes, each too similar to the last, is the order for an entire day. Mesa Canyon culminates at long-awaited last with the Knife Edge Butte which incises the sky above the town of Gateway. This cleaver-like fin of rock was sculpted in ages past by an ancient river in whose now dry bed the town of Gateway stands.

For those who choose to go on from Gateway, thirty interesting miles remain with three major rapids. At high water only the first of these is formidable. Six or seven miles below Gateway the lie "The Narrows". Failure to look at this rapid prior to transit will give the survivors something to tell their grandchildren about. After acquiring a fine head of velocity from a steep and constricted shoot, the river breaks into three boulder-strewn channels. For a full half-mile, the runner will wish to know with exactitude the course he proposes to take. Again portage may be undertaken, this time on a road which extends from Gateway to the ranches below. Distance, not terrain, is the principal adverse factor in considering portage. After this one, the rapids below are an anticlimax. The river again enters the sandstone, winding past several ranches and a heron rookery to join the Colorado. A mile beyond the junction lies the Dewey Bridge, with several spots in the general area where one can "take out". After one

week (optimum running time) and one hundred and seventy miles later, you are in desert country totally different from the point of departure. Do not under-rate the Dolores. With reasonable skill and a little luck it may not be "The River of Sorrows".

Publicity in extensive amounts may lead to invasion by the many of a spot once loved for its solitude. The romance of this area, seldom trod by human foot, may be in some measure destroyed by more general knowledge thereof. Why then an article of betrayal such as this? The reason is simple and cogent. Several of the Colorado Basin plans call for damming the Dolores at multiple levels with all that this implies ecologically and aesthetically for the downstream areas. In the case of the Dolores, the effect to be anticipated is perhaps more profound than in many others. An evaluation of the Dolores was undertaken in the Spring of 1965 by the Colorado Mountain Club and the Colorado White Water Association. That study supported the thesis that the Dolores should be preserved as a "wild river". This article is written to encourage support of the position that it should be so designated and protected. Let us not change the opening poem to read

But the people still mourn for their river
With weird and disconsolate flow,
Dolores, The River of Sorrow,
Dolores, The River of Woe.

DON'T DAM THE DOLORES

Senator ANDERSON. Mr. Reynolds.

STATEMENT OF S. E. REYNOLDS, SECRETARY OF THE NEW MEXICO INTERSTATE STREAM COMMISSION; ACCOMPANIED BY I. J. COURY, CHAIRMAN; HILTON A. DICKSON, JR., MEMBER; AND CLAUD S. MANN, LEGAL ADVISER, NEW MEXICO INTERSTATE STREAM COMMISSION

Mr. REYNOLDS. Appearing with me are Mr. I. J. Coury, chairman of the New Mexico Interstate Stream Commission, who represents the northwest part of our State on that commission; also Mr. Hilton Dickson, former attorney general of the State of New Mexico, presently city attorney for Silver City, a member of the Interstate Stream Commission, representing the southwest corner of our State. Also with us is Mr. Claud Mann, legal adviser to the New Mexico Interstate Stream Commission. Mr. Chairman, if he may, when I have finished summarizing my statement, Mr. Mann would like to address himself briefly to a legal question.

Senator ANDERSON. Very well.

Mr. REYNOLDS. The central Arizona project, as it would be authorized by the legislation being considered by the Subcommittee on Water and Power Resources, includes the Hooker Dam and Reservoir on the Gila River in New Mexico as a unit of the project. This unit would provide flood control, outdoor recreation, fish and wildlife benefits, and a firm water supply through river regulation for municipal, industrial, and agricultural uses.

The Gila River system drains about 5,600 square miles in New Mexico. It rises at about 11,000 feet in timbered and mountainous terrain and descends to about 3,600 feet as it flows into Arizona. A major portion of the basin in New Mexico is included in the Gila and Apache National Forests.

The economy in the Gila and San Francisco River areas in New Mexico is sustained by small, irrigated acreages combined with cattle-

grazing operations, seasonal timber operations, and other nonfarm employment. Fishing, hunting, and other recreation activities are of growing economic importance.

Historically, the mining of gold, silver, and copper contributed substantially to the economy of the area. The mining of gold and silver has declined since the turn of the century but the Kennecott Copper Corp. still carries on a large copper mining and milling operation just outside the Gila River Basin near Silver City. This activity employs about 1,400 people.

The Phelps Dodge Corp. is now constructing, at an estimated cost of \$100 million, the first stage of a large copper ore mill. This first stage will process about 25,000 tons of copper ore per day and will employ about 600 workers. Subsequent stages of development for milling and smelting could employ an additional 1,000 people.

The Bureau of Reclamation, using funds provided by the State of New Mexico, has made a reconnaissance investigation of the potentialities for improved and more intensive utilization of the land and water resources of the Gila River Basin in New Mexico (Memorandum Report, Upper Gila River Investigations in New Mexico; January 1963). The Bureau's study shows that there is an obvious need for area redevelopment and that such redevelopment could be substantially advanced and the general economy of the area enhanced and stabilized through land and water resource development programs described in the report on the studies.

The Gila and San Francisco Rivers are erratic, silt-laden streams that fluctuate widely both on a seasonal and annual basis. Flood flows cause damage in the area and deposit silt in irrigation structures and on the fields. Permanent diversion structures are not presently practical because of the fluctuating flows.

Reservoirs on the Gila River system would provide flood protection and yield additional water in New Mexico for future requirements for municipal, industrial, irrigation, and recreational purposes.

The fact that a major portion of the Gila River Basin in New Mexico is included in national forests and wilderness areas suggests the important recreational potential of water resources development. The recreation potential of the area is substantial because of its proximity to the population centers at Albuquerque, El Paso, Phoenix, and Tucson.

New Mexico supports authorization of the central Arizona project, including the Hooker Dam and Reservoir unit in New Mexico.

Section 304 of S. 861, S. 1242, and S. 1409 would direct the Secretary of the Interior to offer to contract with users in New Mexico for water from the Gila River system in amounts that will permit consumptive use of water in New Mexico not to exceed an average of 18,000 acre-feet per year over and above the consumptive uses provided for by the decree in *Arizona v. California, et al.*, when the central Arizona project is completed and in operation. That section would further direct the Secretary to offer to contract with water users in New Mexico for water from the Gila River system in amounts that will permit consumptive uses of water in New Mexico not to exceed an annual average of an additional 30,000 acre-feet. This further increase in consumptive use would not begin until works capable of importing

water into the Colorado River system have been completed and water sufficiently in excess of 2,800,000 acre-feet per annum is available from the mainstream of the Colorado River for consumptive use in Arizona to provide water for the exchanges authorized.

These provisions are consistent with the Arizona-New Mexico agreement reflected in a memorandum dated May 12, 1966, and addressed to Senator Anderson by Congressmen Rhodes, Udall, and Senner, of Arizona and in a letter to Congressman Udall from Senator Anderson dated May 16, 1966. Copies of these documents are attached to this statement.

S. 1004 and S. 1013 would authorize only 18,000 acre-feet of increased consumptive use in New Mexico conditioned upon the completion and operation of the main aqueduct of the central Arizona project. If the Congress finds it wise or necessary to allay the concern of the Columbia River Basin States by excluding from the legislation any authorization of studies of projects to import water to the Colorado River, New Mexico can agree to provisions which would authorize only 18,000 acre-feet of increased consumptive use in New Mexico. However, if studies of works which might reasonably be expected to augment the supply of the Colorado River by importation and otherwise in an amount sufficient to provide as much as 2.8 million acre-feet annually for consumptive use in Arizona are authorized, the legislation should also authorize, as would S. 861, S. 1242, and S. 1409, additional consumptive uses in New Mexico of 30,000 acre-feet annually for a total of 48,000 acre-feet annually as contemplated by the Arizona-New Mexico agreement.

We are confident that studies and projects to augment the supply of the Colorado River by an amount sufficient to give Arizona at least 2.8 million acre-feet of consumptive use will be authorized ultimately—and with the support of areas having a surplus supply. We fully expect that, when this is done, Arizona will honor the May 1966 Arizona-New Mexico agreement in its entirety.

The Eel River Flood Control and Water Conservation Association's recent recommendation that California's north coast be considered as the initial source of water to meet prospective shortages in the Lower Colorado River Basin gives some hope of a noncontroversial proposal for augmenting the water supply of the Colorado River. New Mexico earnestly hopes that the subcommittee will give its careful attention to this opportunity for mutually benefiting areas of surplus and areas of deficient water supply.

New Mexico recognizes the desirability of a compromise on the issue of new power dams on the Colorado River, and does not object to eliminating the Marble Canyon unit from consideration for authorization. Furthermore, New Mexico does not object to deferring the authorization of the Hualapai power unit if other means of financing and furnishing low-cost pumping power for the central Arizona project, which are satisfactory to the Congress, can be devised.

At the House hearing the Wilderness Society raised questions concerning the Hooker unit, because the Hooker Dam would back water into the Gila wilderness area. At a capacity of 265,000 acre-feet, the Gila Reservoir at normal water surface would back water about six-tenths of a mile through the Gila primitive area, and about 7 miles

into the Gila wilderness area. There would be at normal water surface a total of 141 acres of the primitive area inundated, a total of some 480 acres of the wilderness area inundated.

The Gila wilderness occupies about 438,000 acres of the 2.7 million acre Gila National Forest, that is, the Hooker Reservation would affect about one-tenth of 1 percent of the Gila Wilderness Area. The Wilderness Society suggested that there were preferable alternative sites downstream from Hooker. Perhaps I should say that they suggested there might be, and asked that these alternative sites be investigated. As a matter of fact, the downstream sites have been carefully evaluated by the Bureau of Reclamation in studies dating back to about 1930.

These downstream sites, particularly the Lower Cliff site and the Connor site, are all more costly than the Hooker site would be. The reservoirs at these sites would inundate developed areas along the Gila River, and each of them would have a greater amount of loss by evaporation from the reservoir for a comparable yield than would the Hooker site.

Senator ANDERSON. Mr. Reynolds, how long have you been State engineer?

Mr. REYNOLDS. Nearly 12 years now, Senator.

Senator ANDERSON. Have you visited this area?

Mr. REYNOLDS. Yes, I have been in the area.

Senator ANDERSON. Have you seen Hooker Dam site?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. Is it heavily burdened with trees?

Mr. REYNOLDS. Not at the damsite. This is rather rough-looking channel there, gravel, sand.

Senator ANDERSON. You have seen more gravel than trees.

Mr. REYNOLDS. At the site and immediately above it; yes, sir.

Senator ANDERSON. Go ahead.

Mr. REYNOLDS. The society seemed most concerned about the precedent-setting implications of the Hooker proposal. This concern seems ill founded to me. The Hooker site was reserved for water resources development in 1916 by water power designation No. 1. This is, Senator, about 8 years before your efforts toward having that named the first wilderness area. That was done, you will recall, in 1924.

The consideration of the potential Hooker project was responsible at least in part for the provision in the Wilderness Act under which the President may permit water resources development within wilderness areas, if such development would better serve the public interest than would the denial of such development.

It appears to me certainly that the effects of the Hooker project on wilderness values is as the Secretary of the Interior said the other day, de minimis, and I think that these effects on wilderness values would be more than offset by the enhanced recreation opportunity alone that would result from the development of Hooker, quite aside from the many other benefits that would be derived from the project.

S. 861, S. 1242, and S. 1409 would require the Secretary to give priority to the completion of planning reports on certain participating units of the Colorado River storage project in Colorado, Utah, and Wyoming. We are pleased to support early completion of reports on

these projects. These bills also would authorize five Federal reclamation projects in Colorado. The State of New Mexico has reviewed and commented favorably on the Bureau of Reclamation reports on each of these projects and supports their authorization.

One of the five projects to be authorized, the Animas-La Plata, would also furnish water for irrigation, municipal, industrial, and recreation purposes in northwestern New Mexico.

After review of the Bureau of Reclamation's 1962 feasibility report on the Animas-La Plata project, the New Mexico Interstate Stream Commission in a meeting in Farmington, N. Mex., on January 20, 1964, acted to recommend to the Governor that the State generally concur in the conclusions and recommendations of the report and offer its cooperation to secure the early authorization and construction of the project. Adoption of these recommendations is reflected in a letter from the Governor of the State of New Mexico to Secretary Udall dated January 28, 1964.

The regional director's March 1966, supplemental report on the Animas-La Plata project recommends some revision of the project described in the 1962 report. The State of New Mexico generally concurs in those recommendations.

The Animas-La Plata project as revised will furnish water for 5,500 acres of presently irrigated land in New Mexico. These lands are now served from La Plata River. This stream is equitably apportioned between Colorado and New Mexico by the La Plata River compact which became effective in 1925. But the supply of this stream is insufficient and the irrigators in both States are chronically short of water when it is most needed by crops.

By making available a reliable supply of water, the Animas-La Plata project will greatly increase the capability of these presently irrigated lands to produce alfalfa and silage, which is used for livestock feeding in the area. A reliable supply also will make it possible for the irrigators to convert acreage to higher value crops, such as fruit and vegetables.

The project will furnish water for the irrigation of a total of 11,200 acres of new lands in New Mexico; 1,700 acres of this total is Ute Mountain Indian land. These new lands will also be capable of producing fruit and vegetables as well as alfalfa and silage for livestock feeding.

The project will also furnish a total of 13,500 acre-feet of water annually for municipal purposes to Aztec and Farmington and smaller downstream communities that could be served by extension of the Farmington system.

Recreation benefits would be furnished by the Meadows Reservoir to be constructed on the Ute Mountain Indian Reservation west of La Plata River in New Mexico. Under the project plan a permanent pool of 2,600 acre-feet and 232 surface acres would be retained in this reservoir for recreation purposes. The Ute Mountain Tribe has expressed its interest in participating in fish and wildlife and recreation development at Meadows Reservoir in accordance with the Federal Water Project Recreation Act of 1965.

The total construction cost of the project is estimated at \$109 million; of this amount about \$26 million is allocated for the construction of works benefiting New Mexico. The benefit-cost ratio of the project as computed for a 100-year analysis period is 1.73 on the basis of total benefits and 1.11 on the basis of direct benefits only.

The estimated annual depletion of water by the New Mexico portion of the project is 34,100 acre-feet. The Secretary of the Interior has acquired a permit for the appropriation of this water in accordance with New Mexico law. The priority date of this permit is May 1, 1956. As the Bureau report points out, the anticipated depletion from project water use in New Mexico is well within the apportionment of consumptive use made to New Mexico by the Upper Colorado River Basin Compact.

The Bureau report reflects that about \$14.5 million of the power revenues apportioned to New Mexico from the Upper Colorado River Basin fund would be needed to repay irrigation costs. The Colorado River storage project repayment analysis of January 1963, shows that power revenues creditable to New Mexico would be available in the amount required to repay the costs within the 50-year repayment period after making allowance for the prior commitments to the authorized Hammond and San Juan-Chama reclamation projects.

New Mexico is pleased to commit the necessary portions of its allocations of water and of power revenues, and fully supports the authorization and construction of the Animas-La Plata project.

Section 501(b) of the bills that would authorize the Animas-La Plata project would give the consent of the Congress to the Animas-La Plata project compact between the States of Colorado and New Mexico. The States of Colorado and New Mexico are in agreement that the project, because of its interstate character, must be operated by the Secretary at all times and that, to insure equitable operation of the project, there must be an agreement between the States in the nature of an interstate compact. Negotiating commissioners for the States of Colorado and New Mexico have reached agreement on the compact wording set forth in section 501(b). We ask that language requiring the Secretary to operate the project at all times in accordance with the Animas-La Plata project compact be included in the legislation.

A substantial portion of the project water supply will be used on Indian reservations for irrigation, municipal, and industrial purposes. To insure that there are no excessive shortages for any class of users the ratio of project water delivered to project water required should be the same for Indian and non-Indian uses in each State. The language of the act or the legislative history should make it clear that the Congress does not intend the project works to be used to satisfy any preferential rights of the United States or Indian tribes, such as might be claimed under the Winters doctrine.

New Mexico supports legislative provisions—for example section 502, S. 861—which would direct reimbursement from the Colorado River development fund or the Lower Colorado River Basin development fund for all expenditures made from the Upper Colorado River Basin fund to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River storage project.

The bills before the subcommittee—for example section 10, S. 1004—would provide guidelines for the operation of reservoirs on the Colorado River. These guidelines will serve to protect to some extent the interests of both the Upper Basin and the Lower Basin while leaving sufficient discretion with the Secretary to permit a practical operation of these reservoirs within the terms of the Colorado River compact. New Mexico offers no objection to these provisions.

For the people of the State of New Mexico, for Governor Cargo, and for each of us, I wish to express great appreciation of the opportunity to present the views of the State of New Mexico on pending legislation to authorize the central Arizona project.

(The attachments referred to follow :)

MAY 12, 1966.

MEMORANDUM

To : Senator Clinton P. Anderson.

From : Congressman John J. Rhodes, Congressman Morris K. Udall, and Congressman George F. Senner, Jr.

(1) Hooker Dam and Reservoir shall be constructed to an initial capacity of 98,000 acre feet and in such a manner as to permit subsequent enlargement of the structure to give effect to the provisions hereof.

(2) New Mexico shall be entitled to increase her consumptive use from the Gila River System, including tributaries, in excess of the amounts permitted by the Decree in *Arizona v. California* in its present form an average of 18,000 acre feet annually in any period of ten consecutive years, including reservoir evaporation. This increase in consumptive use shall not start until delivery of Colorado River water to downstream users in Pinal County has been accomplished in accordance generally with H.R. 4671 (Committee Print No. 19). New Mexico shall be further entitled to increase her consumptive use from the Gila River System, including tributaries, by an additional amount averaging 30,000 acre feet annually in any period of 10 consecutive years. This further increase in consumptive use shall not start until works capable of importing 2.55 million acre feet annually into the Colorado River System have been completed. The additional consumptive uses provided for hereby shall be subject to all present rights in New Mexico and Arizona as established by Globe Equity Decree No. 59 or otherwise and junior thereto. Such consumptive uses in New Mexico shall be made only to the extent possible without economic injury or cost to present downstream users.

Sufficient Colorado River water shall be made available to users of Gila River System water downstream from Coolidge Dam to replace any diminution of supply or reduction in flow resulting from the increase in uses by New Mexico as provided herein, including any uses to replace losses by evaporation from Hooker Reservoir. In determining the amount of water required for this purpose, full consideration will be given to any difference in quality of the waters involved; in addition, downstream users shall be reimbursed for losses of hydro-electric power at Coolidge Power Plant resulting from increased upstream usage. Such reimbursement shall be from the Lower Colorado River Development Fund.

(3) In the event it is necessary to obtain modification of the decree of the Supreme Court in *Arizona v. California* to accomplish any of the foregoing objectives the parties shall cooperate diligently to secure a modification accomplished by Interstate Compact or by an amendment to the Decree by the Court, whichever appears to be the most appropriate procedure.

(4) The Buttes Dam and Reservoir shall be so operated as to not prejudice the rights of any users above San Carlos Reservoir as those rights are defined under the Globe Equity Decree No. 59.

(5) Arizona and New Mexico shall cooperate diligently in any way necessary to implement the principles set forth herein.

The contents of this memorandum have been concurred in by Mr. Steve Reynolds, the Chief Water Engineer of the State of New Mexico. It is the intention of Congressman Udall to insert this agreement in the record of the House Interior

and Insular Affairs Committee hearings on H.R. 4671 and related bills. However, Mr. Udall will not, of course, make such an insertion until we have received your concurrence.

U.S. SENATE,
COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES,
May 16, 1966.

Hon. MORRIS K. UDALL,
U.S. House of Representatives.

DEAR MO: I am in receipt of the memorandum of May 12 from Congressman Rhodes, Congressman Senner and yourself with reference to the Hooker Dam and Gila River system.

I am glad to concur in this memorandum since I understand that it has been concurred in by Steve Reynolds, the State Engineer of the State of New Mexico.

Sincerely yours,

CLINTON P. ANDERSON.

Mr. REYNOLDS. With your permission, Mr. Mann, at this time, will proceed to discuss a legal point related to this legislation.

Mr. MANN. Thank you, Mr. Chairman.

The last time we appeared before this committee on hearings relating to the central Arizona project, we stated that we would favor the project if and when we could negotiate an agreement with Arizona for the amendment of the decree in *Arizona v. California* to permit additional uses of the water in New Mexico by virtue of Hooker Dam or by compact between the two States permitting such additional uses in excess of those specified in the Supreme Court opinion. Such an agreement has been reached with Arizona representatives and the same is incorporated in the present bills now under discussion before this committee.

We felt that to enable New Mexico to use water over and above the amount specified in the Supreme Court decree, and to make legally certain that such uses could be made, that the decree would have to be amended or that the two States should enter into a compact permitting such uses.

However, the negotiating representatives of the two States decided that, if the objectives of the agreement could be legally accomplished without objection of the United States to the wording in the congressional legislation, it would simplify the entire matter. As a result Congressman Udall of Arizona requested an opinion from the office of the Solicitor of the Department of the Interior as to whether under the wording of the legislation users in New Mexico could legally contract with the Secretary of the Interior for actual use of Gila system river water in quantities in excess of the uses specified in the Supreme Court decree.

Under date of August 11, 1966, the Solicitor addressed a letter to the Honorable Thurgood Marshall, Solicitor General of the United States, expressing his view that no amendment of the Supreme Court decision was necessary, nor was a compact between the States necessary.

Under date of August 18, 1966, the Solicitor General of the United States replied to the letter of the Solicitor of the Interior Department, concurring with his conclusion that under the provisions of H.R.

4671 as amended, it was not necessary to amend the Supreme Court decree in order for New Mexico users to contract for additional uses in accordance with the Arizona-New Mexico agreement.

However, Mr. Chairman, so far as I know, the letters and opinions to which I have referred have never been made a part of the hearings held on the central Arizona project. I therefore now respectfully request, Mr. Chairman, that copies of these letters and the memorandum brief referred to in said letters be made a part of the record of this hearing. We have only one copy of each letter and of the memorandum brief but we can have copies made and delivered to the clerk of this committee for insertion in the record at this time, if we are permitted to do so.

Senator ANDERSON. Without objection, that will be granted.
(The documents referred to follow :)

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SOLICITOR,
Washington, D.C., August 11, 1966.

HON. THURGOOD MARSHALL,
Solicitor General, Department of Justice,
Washington, D.C.

DEAR MR. MARSHALL: Representative Morris K. Udall of Arizona has transmitted to the Secretary the text of an amendment to the pending Colorado River legislation, H.R. 4671, which has been adopted by the House Committee on Interior and Insular Affairs.

Representative Udall requests our opinion on whether, in the event the legislation becomes law with the amendment, users in New Mexico may legally contract with the Secretary of the Interior for and actually use Gila system water in quantities in excess of the uses specified in the Decree in *Arizona v. California* without first obtaining an amendment to that Decree.

I have analyzed the question raised by Representative Udall, and am of the view expressed in the enclosed proposed opinion that the contracts provided for could be entered into and the water provided and used thereunder without an amendment of the Decree. However, by reason of the fact that the question involves an interpretation of the Decree, I have thought it desirable to request your review before coming to a final conclusion.

Members of my staff and I are, of course, available for consultation, and we shall be pleased to render any assistance you may desire.

Sincerely yours,

FRANK J. BARRY, *Solicitor*.

OFFICE OF THE SOLICITOR GENERAL,
Washington, D.C., August 18, 1966.

FRANK J. BARRY, Esquire,
Solicitor, Department of Interior,
Washington, D.C.

DEAR MR. BARRY: This is in response to your letter of August 11, 1966, transmitting a draft Solicitor's Opinion dated August 9, 1966 and requesting my review of the conclusion reached therein that the Decree in *Arizona v. California*, 376 U.S. 340, need not be amended to permit contracts between users in New Mexico and the Secretary of the Interior for use of Gila River System water made pursuant to Congressman Udall's amendment to H.R. 4671, also transmitted.

Based upon your analysis in the Opinion of the operation of the amendment and the manner in which the contract authority would be exercised, including the statement that no permission from the State of New Mexico, its officers, attorneys, agents or employees would be involved, I concur in your conclusion that H.R. 4671 as amended does not require the amendment of Article IV of the Decree in *Arizona v. California*.

Sincerely,

THURGOOD MARSHALL,
Solicitor General.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SOLICITOR,
Washington, D.C., August 19, 1966.

M-36694.

Memorandum to : Secretary of the Interior.

From : Solicitor.

Subject : Lower Colorado River Basin Project—Effect of proposed amendments to H.R. 4671 requiring exchange of Gila River water for mainstream Colorado River water.

By letter to you dated June 13, 1966 (copy attached), Representative Morris K. Udall advised that H.R. 4671, which would authorize construction of the Lower Colorado River Basin Project, including the Central Arizona Unit, would also, under a then proposed amendment, direct the Secretary of the Interior to offer to contract with users of Gila River water in New Mexico for water in excess of the water allocated to such users under Article IV of the Decree of the Supreme Court of the United States in *Arizona v. California*, 376 U.S. 340 (1964).

In that letter Congressman Udall requested our opinion as to whether, under that provision, water users in New Mexico might legally contract with the Secretary for use of water from the Gila River System in quantities in excess of those specified in the Decree in *Arizona v. California*, *supra*, without first obtaining an amendment to that Decree permitting such adjustments to be made. The proposed amendment referred to by Representative Udall has been incorporated into H.R. 4671 as reported by the House Interior Subcommittee on Irrigation and Reclamation to the full Committee on Interior and Insular Affairs and as ordered reported favorably by the full committee.

I have concluded that the Congress has power to direct the Secretary, as provided in the proposed amendment to H.R. 4671, and that the provision is not in conflict with or in violation of the rights adjudicated and fixed by the Supreme Court in *Arizona v. California*, 376 U.S. 340, as between the States of New Mexico and Arizona. Therefore, no amendment to the Decree in *Arizona v. California* need be made to implement the proposed amendment.

ANALYSIS OF THE PROPOSED AMENDMENT TO H.R. 4671

In effect, the amendment to relevant provisions of H.R. 4671 would direct an exchange of mainstream Colorado River water by the Secretary of the Interior for certain Gila River water. In turn, the Secretary would be directed to offer to enter into contracts making available to users in New Mexico the Gila River System water he had so acquired by means of the exchange with Arizona users.

Specifically, the Secretary would be first directed, in contracting for the delivery of water to Arizona contract users who presently use water from the Gila River System, to require these users to accept mainstream Colorado River water in exchange for water from the Gila River System in the amount of 18,000 acre-feet per year. The amendment further provides that such exchanges shall be accomplished without economic injury or cost to the affected Arizona contractors and to present users of Gila River water in New Mexico and Arizona.

The 18,000 acre-feet of water made available in this manner from the Gila River System would be required by the amendment to be offered by the Secretary of the Interior, to water users in New Mexico to permit an additional consumptive use of water in New Mexico not to exceed an annual average of 18,000 acre-feet in any period of ten consecutive years. The net effect would be that New Mexico users would receive from the United States by contract with the Secretary of the Interior 18,000 acre-feet of Gila River System water annually over and above the quantities of Gila River System water apportioned directly to the State of New Mexico by Article IV of the Supreme Court Decree in *Arizona v. California*.

The amendment further provides that an annual average of an additional 30,000 acre-feet of water in any period of ten consecutive years would be made available on the same basis to New Mexico users when and so long as works capable of importing water into the Colorado River System have been completed and there is, as a result, water sufficiently in excess of 2,800,000 acre-feet per annum available from the mainstream of the Colorado River for consumptive use in Arizona to provide water for such additional exchanges.

Existing rights are protected adequately in the language of the amendment.

APPORTIONMENT OF GILA RIVER SYSTEM WATER

With respect to the waters of the Gila River System, the Supreme Court, in *Arizona v. California*, 373 U.S. 546 (1963), stated:

"... the tributaries [including the Gila River in Arizona and New Mexico] are not included in the waters to be divided [in accordance with the Boulder Canyon Project Act] but remain for the exclusive use of each State." 373 U.S. at 567.

The Court, in reaching this conclusion, pointed out that:

"... only ... [Arizona] and New Mexico could effectively use the Gila waters, which not only entered the Colorado River too close to Mexico to be of much use to any other State but also reduced virtually to a trickle in the hot Arizona summers before it could reach the Colorado." 373 U.S. at 572-574.

And finally,

"Having determined that tributaries are not within the regulatory provisions of the Project Act the Master held that this interstate dispute [between Arizona and New Mexico] should be decided under the principles of equitable apportionment." 373 U.S. at 595.

The Court went on to accept the terms of a compromise settlement agreed upon by the two States. The terms of this compromise were included in the final Decree issued by the Court. (See Article IV of the Decree, 376 U.S. 340 (1964)). In view of the fact that no exceptions were filed to these recommendations, the Court found it unnecessary to make a judicial determination as to the rights of the two States under the principles of equitable apportionment. The relevant portions of Article IV of the Decree are attached hereto as Exhibit B.

The Decree enjoins water users and officials in the State of New Mexico from diverting and using more water from the Gila River System than provided for in the compromise agreement between the States of New Mexico and Arizona. It is clear that, without more, an unauthorized diversion and use of 18,000 additional acre-feet of water from the Gila River System by New Mexico and water users therein would violate the terms and conditions of the Decree.

But here we have under consideration a proposed Congressional direction providing for the acquisition by the United States of Gila River System water now held under the Decree by Arizona users and the disposition of that water by the United States to users in New Mexico. The supplemental water thus provided for would become available to New Mexico users, not under the principles of equitable apportionment referred to by the Supreme Court in *Arizona v. California*, *supra*, but by a specific Congressional direction and allocation. Under such legislation, the allocation of tributary waters in the Gila River System would become part of the Congressionally authorized comprehensive plan of development of the entire basin. The proposed amendment would provide for the apportionment and allocation, as to the waters in this tributary, in much the same manner as Congress provided for the apportionment and allocation by the Secretary of the Interior of mainstream water of the Colorado River in the Boulder Canyon Project Act.

The allocation and apportionment of tributary water of the Colorado River System and the direction to the Secretary to distribute such water to users in New Mexico and Arizona in accordance with a Congressionally authorized plan is clearly within the broad powers of Congress over the Colorado River. See *Arizona v. California*, *supra*, 373 U.S. at 497. In that case, the Court stated that:

"... Congress still has broad powers over this navigable stream. Congress can undoubtedly reduce or enlarge the Secretary's power if it wishes. Unless and until it does, we leave in the hands of the Secretary, where Congress placed it, full power to control, manage, and operate the Government's Colorado River works and to make contracts for the sale and delivery of water on such terms as are not prohibited by the Project Act." (Emphasis supplied.) 373 U.S. at 594.

The power of Congress to authorize this particular reclamation project is not limited to the mainstream or navigable portions of the Colorado River. See *United States v. Gerlach Livestock Co.*, 339 U.S. 325 (1950) wherein the Court held that:

"... in conferring power upon Congress to tax 'to pay the debts and provide for the common defense and general welfare of the United States,' the Constitution delegates a power separate and distinct from those later enumerated, and one not restricted by them, and that Congress has a sub-

stantive power to tax and appropriate for the general welfare, limited only by the requirement that it shall be exercised for the common benefit as distinguished from some mere local purpose."

* * * * *

"Thus the power of Congress to promote the general welfare through large-scale projects for reclamation, irrigation, or other internal improvement, is now as clear and ample as its power to accomplish the same results indirectly through resort to strained interpretation of the power over navigation. 339 U.S. at 738."

In enacting the proposed amendment, Congress would, in effect, extend the authority already vested in the Secretary under the Boulder Canyon Project Act (respecting mainstream Colorado River water) by directing him to secure and dispose of tributary waters of the Gila River System—thus enabling the Secretary to carry out and effectuate the reclamation program and project authorized under the proposed legislation.

The achievement of the objectives of the Federal Reclamation laws by utilization of the principles of exchange is no innovation with the proposed amendment. The principles of exchange of both water and power for the purpose of constructing, operating and maintaining Federal reclamation projects are specifically recognized in Section 14 of the Reclamation Project Act of 1939 (53 Stat. 1187, 1197).¹ The proposed amendment would provide a specific directive to the Secretary to apply the principle of exchange with the respect to water in the Gila River System to achieve the objectives of the legislation authorizing the Lower Colorado River Basin Project.

Concededly, the Gila River System water which the Secretary would acquire under the proposed amendment is "property" of Arizona water users apportioned to them under Article IV of the Decree in *Arizona v. California*. As such, this "property" is protected by the Constitutional guarantee of just compensation under the 5th Amendment of the Constitution. Section 8 of the Reclamation Act of 1902 (32 Stat. 390, 43 U.S.C.A., sec. 383) recognizes the inviolability of such rights by requiring Federal officers to recognize State-created water rights and pay just compensation for them if taken under the power of eminent domain. However, neither Section 8 of the Reclamation Act of 1902, *supra*, nor any other relevant statute purports to limit the authority of Federal officers to take such rights under the power of eminent domain so long as the owners are justly compensated therefor. See *City of Fresno v. California*, 372 U.S. 627, 629-30 (1963); *Ivanhoe Irrigation District v. McCracken*, 357 U.S. 275 (1958); *Dugan v. Rank*, 372 U.S. 609 (1963); *United States v. Gerlach Livestock Co.*, 339 U.S. 725 (1950). See also *Arizona v. California*, 373 U.S. 546 (1963), and *Turner v. Kings River Conservation Dist.*, 360 F.2d 184 (9th Cir. 1966).

The right of just compensation would be fulfilled in the present situation by the provisions of the amendment for the exchange of mainstream Colorado River water for such Gila River System water. That the affected Arizona users are required to accept 18,000 acre-feet of mainstream Colorado River water in exchange for that quantity of Gila River System water as a condition to their receiving additional supplies of mainstream water by participation in the Central Arizona Unit is in no sense a deprivation of their rights to just compensation.

It is settled beyond question that Congress can condition the participation in the benefits of a Federal reclamation project. See *Ivanhoe Irrigation District v. McCracken*, 357 U.S. 275 (1958); *City of Fresno v. California*, 372 U.S. 627 (1963). The Supreme Court settled this issue in *Ivanhoe* when it stated:

"Also beyond challenge is the power of the Federal Government to impose reasonable conditions on the use of federal funds, federal property, and federal privileges. See *Berman v. Parker*, 348 U.S. 26, 99 L. Ed. 27, 75 S. Ct. 98 (1954), and *Federal Power Com. v. Idaho Power Co.*, 344 U.S. 17, 97 L. Ed. 15, 73 S. Ct. 85 (1952). The lesson of these cases is that the Federal

¹ Section 14 of the Reclamation Project Act of 1939, *supra*, provides, in relevant part, as follows:

"The Secretary is further authorized, for the purpose of orderly and economical construction or operation and maintenance of any project, to enter into such contracts for exchange or replacement of water, water rights, or electric energy, or for the adjustment of water rights, as in his judgment are necessary and in the interests of the United States and the project."

Government may establish and impose reasonable conditions relevant to federal interest in the project and to the over-all objectives thereof." 357 U.S. at 294.

The United States having lawfully acquired water from the Gila River System, it follows that the United States can, under terms and conditions determined by Congress, dispose of that water as a part of the operation of a Federal reclamation project. See *Nebraska v. Wyoming*, 325 U.S. 589 (1945); *Arizona v. California*, 288 U.S. 423 (1931). And see also *Dugan v. Rank*, 372 U.S. 609 (1963); *Ivanhoe Irr. Dist. v. McCracken*, *supra*; *City of Fresno v. California*, 372 U.S. 627 (1963); and *Turner v. Kings River Conservation Dist.*, 360 F.2d 184 (9th Cir. 1966). Nothing in the Constitution would prohibit Congress from imposing such conditions as a prerequisite to participation in the project. In *McCulloch v. Maryland*, 4 Wheat. 316, 421, 4 L. Ed. 479, 605 (1819), the Court laid down the basic guideline for determining the constitutionality of Congressional action:

"Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consist with the letter and spirit of the Constitution, are constitutional."

It follows, therefore, that, in so acquiring and disposing of Gila River System water, the United States would not be bound by or transgress upon the terms of Article IV of the Decree in *Arizona v. California*, *supra*, which enjoins and proscribes the diversion or use of quantities of Gila River system water in excess of those specified therein. The injunction set forth therein applies, by its terms, only to the "State of New Mexico, its officers, attorneys, agents and employees." Water users in New Mexico who obtain additional quantities of water under contracts with the United States would not receive such water by reason of the acts or permission of the State of New Mexico or its officers, attorneys, agents or employees. Rather, their rights would derive from the United States in the exercise of its power to acquire and dispose of property in connection with the construction, operation and maintenance of a Federal reclamation project—a power which is entirely outside of and separate from the State action which is the subject of Article IV of the Decree.

I conclude, therefore, as stated at the outset of this memorandum, that should the legislation, if enacted, include the amendment enclosed with Congressman Udall's letter of June 13, 1966, users in New Mexico may, to the extent therein provided, legally contract with the Secretary for the use of Gila River System water in quantities in excess of the uses specified in the Decree in *Arizona v. California*, without first obtaining an amendment to that Decree.

FRANK J. BARRY, *Solicitor*.

Mr. CORY. Mr. Chairman, I have a statement here by Mr. Floyd Davis, the mayor of the city of Farmington, on the legislation that is pending before this committee. Mr. Davis said regretfully he could not be here, and I have the statement, and with your permission I would like to have it made a part of the record, sir.

Senator ANDERSON. Is there objection? The Chair hears none. It will be made a part of the record at the end of the questioning.

Senator KUCHEL?

Senator KUCHEL. Mr. Reynolds, while I don't have the pleasure of knowing you very well personally, I do know you by your excellent reputation as an engineer, as one skilled in water problems of the Colorado River, and I am very glad, with my senior colleague from New Mexico, to welcome you here.

In the last Congress, as the documents appended to your statement indicate, the State of New Mexico was interested in the passage of H.R. 4671, on which meetings were held by representatives of the Colorado River Basin States, and an agreement was reached to endorse that legislation. Am I not correct in that?

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. It is also true that representing the State of New Mexico in your capacity as the Secretary of the New Mexico Interstate Stream Commission, as a member of the State government official family, you spoke for the State of New Mexico in those seven State meetings?

Mr. REYNOLDS. To some extent, yes, sir.

Senator KUCHEL. Would it be fair to say, therefore, that, to the extent that you were entitled to speak for New Mexico, New Mexico did favor H.R. 4671 of the last Congress in all its provisions?

Mr. REYNOLDS. Subsequent to reaching an agreement with representatives of the State of Arizona concerning additional uses in New Mexico, we did support the provisions of H.R. 4671. I think, Senator, it would be more precise to say that with respect to the question of the 4.4 priority, we did not object to that provision. We saw this as a matter to be settled by the States of Arizona, California, and the Congress of the United States.

Senator KUCHEL. Mr. Reynolds, I am not going to try to twist your fine, frank wording to try to extract from you some great endorsement of the 4.4 provision. What I am leading up to is the problem of importation of water into the river, on which I think there is no question, but you and those who you represented were in favor of additional water importation into the river basin.

Mr. REYNOLDS. New Mexico last year and this year would like to see the Colorado River augmented.

Senator KUCHEL. And so that the record may be clear, from the standpoint of the people I represent, believing in the wisdom of the 4.4 provision, your statement is that you did not object to it, and that it is a part of H.R. 4671 that you endorsed the bill as a package.

Mr. REYNOLDS. We supported the bill.

Senator KUCHEL. Now, with respect to importation, I think it most important that my able senior colleague from New Mexico, and my able senior colleague from Arizona, indeed everybody on the committee, bear in mind what Mr. Reynolds observed on page 5 of his statement, and I quote it:

S. 1004 and S. 1013 would authorize only 18,000 acre feet of increased consumptive use in New Mexico conditioned upon the completion and operation of the main aqueduct of the Central Arizona Project. If the Congress finds it wise or necessary to allay the concern of the Columbia River Basin States by excluding from the legislation any authorization of studies of projects to import water to the Colorado River, New Mexico can agree to provisions which would authorize only 18,000 acre feet of increased consumptive use in New Mexico. However, if studies of works which might reasonably be expected to augment the supply of the Colorado River by importation and otherwise in an amount sufficient to provide as much as 2.8 million acre feet annually for consumptive use in Arizona are authorized, the legislation should also authorize, as would S. 861, S. 1242 and S. 1409, additional consumptive uses in New Mexico of 30,000 acre feet annually for a total of 48,000 acre-feet annually as contemplated by the Arizona-New Mexico agreement.

In the last Congress my good friend, the chairman of this subcommittee, Senator Anderson, entered into an agreement with the three Representatives of the State of Arizona in the House of Representatives and you have attached that agreement to your statement, and I think it represents a constructive attempt by the Representatives in the Congress, or at least some of them, from the two States, to arrive

at an amicable settlement of a dispute involving waters that apparently from the decree are to be treated differently from the mainstream waters.

This agreement was directed entirely to the provisions of the Morris-Udall bill at the last session of the Congress, H.R. 4671, is that not true?

Mr. REYNOLDS. This agreement is implemented by the language which appeared in H.R. 4671, in our opinion.

Senator KUCHEL. And H.R. 4671 provided for the construction of a reservoir on the river, did it not?

Mr. REYNOLDS. With respect to the Gila River?

Senator KUCHEL. No. H.R. 4671, is it not true that H.R. 4671 provided for construction of a dam at Bridge Canyon?

Mr. REYNOLDS. Oh, yes, sir.

Senator KUCHEL. And further provided that the revenues from the hydroelectric power should feed a development fund?

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. And it further provided for studies by the Secretary of the Interior on the feasibility of importing water into the Lower Basin?

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. And provided further that when the President determined that the importation had reached 2.5 million acre-feet of water, the 4.4 provision should lapse.

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. And under all those circumstances, the Representatives in the House of Representatives from Arizona, and the distinguished senior Senator from New Mexico, were able to come to an agreement relative to Hooker Dam, which to your credit you helped to engineer and to arrange, is that not true?

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. And your able counsel has stated that the memorandums have the support of the Solicitor of the Department of the Interior, and apparently the Solicitor General of the United States.

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. Whose written comments are now going to be made a part of this record.

Mr. REYNOLDS. Yes, sir.

Senator KUCHEL. Would you state to the committee that if we did not have a bill before us somewhat similar to H.R. 4671, that this memorandum agreement of last year might still be used by the committee to reflect the views of the two States?

Mr. REYNOLDS. I am not sure I understand, sir, but certainly it is necessary that legislation authorize the central Arizona project for this agreement in the underlying memorandum to have effect.

Senator KUCHEL. I think what I want to know particularly is this: It appears to me that the memorandum of agreement rests in part on the understanding that congressional legislation will bring more water into the Colorado River Basin by way of importation.

Mr. REYNOLDS. With respect to the 30,000, the second block of 30,000 acre-feet of increased consumptive use, this is true.

Senator KUCHEL. And if there were no water to be imported into the Colorado River Basin, then that agreement would be meaningless.

Mr. REYNOLDS. The first block of 18,000 acre-feet would be available, whether or not there is importation.

Senator KUCHEL. The additional waters which in good faith you sought to obtain for the people of your State would lapse, if there were no importation.

Mr. REYNOLDS. It would lapse in this legislation, I think, necessarily. As we have indicated in the statement, we fully expect that the river will be augmented, and that use of that 30,000 acre-feet ultimately will be implemented by that augmentation.

Senator KUCHEL. Mr. Reynolds, the truth is the water in that river is going to have to be augmented, isn't it, in order to provide for the increased population and the increased demands of your State and all your neighboring States in the river basin?

Mr. REYNOLDS. It is my opinion, sir, that the Colorado River must be augmented.

Senator KUCHEL. Under those circumstances would you venture, would you be able to state to this committee your views respecting the provisions of H.R. 4671 last year as compared with the bills introduced this year reflecting the administration's 1967 position?

Mr. REYNOLDS. Yes, sir. When we review the history of H.R. 4671, we arrive at the conclusion that it failed to pass last year for two important reasons.

One, the controversy over the importation studies that would have been authorized. Two, the construction of dams on the Colorado River.

We think that it is important that progress be made on the central Arizona project, and we should not like to see that progress stopped by controversies that can be resolved later.

Senator KUCHEL. Mr. Reynolds, I want you to tell the committee a little bit more about your views, because if you feel that controversy over importation was one of the reasons that H.R. 4671 did not pass last year, and if you further feel that importation, or if I may use what apparently is a little broader term, augmentation of the river is vital to the future of the States in the basin, then why should the controversy about importation or augmentation lessen in the years ahead rather than now?

Mr. REYNOLDS. I think it will, particularly as to the importation. With the understanding of the water supply of the entire West is improved. As I say, I think it is most important that we not stop all progress until those controversies have been resolved, and it does appear that we could proceed with the authorization and construction of the central Arizona project without necessarily resolving those controversies in this legislation. They still must be resolved I think.

Senator KUCHEL. Now if they could be resolved in this legislation, in this session of the Congress, would you favor their resolution now rather than the present administration version?

Mr. REYNOLDS. Certainly we would not object to provisions authorizing importation studies, and as our statement has said, we would not object to deferring the authorization of the Hualapai unit. I think by implication we would not object to the authorization of that project at this time.

Senator KUCHEL. That is as far as you can say to this committee. You would not object to the authorization of the Hualapai Dam?

Mr. REYNOLDS. If the Congress finds this the wise and necessary way to finance the central Arizona project, we would not object.

Senator KUCHEL. But you would not endorse it. I don't want to quibble, Mr. Reynolds, but I think we are getting down now to where everybody can understand what the basic issues are. In your capacity as a representative of New Mexico, would you be able to endorse the Hualapai Dam?

Mr. REYNOLDS. I think we will have to return to our position on H.R. 4671.

Senator KUCHEL. In which?

Mr. REYNOLDS. We did approve the terms of that bill.

Senator KUCHEL. We are going to have opposition to importation on a rather permanent basis. Do you not think so, Mr. Reynolds?

Mr. REYNOLDS. Not necessarily. There is evidence certainly from the recommendations made by the Eel River Association at the House hearing that they at least encourage a study for the purpose of augmenting the water supply of the Colorado River.

Senator KUCHEL. I concur in that, and surely to put it in perspective, you and I would both feel that the problem of importation ought to be a broad gage problem, in which every conceivably or potential area of surplus water might be studied for feasibility, do you not agree?

Mr. REYNOLDS. Certainly, I agree. Every means of augmenting the supply of the river should receive consideration.

Senator KUCHEL. Now, we had a young lady earlier this morning, as you know, testify here with respect to this entire problem, whose testimony at its conclusion said that her organization and people who feel like her would oppose the construction of a dam on the river as long as there were people around to oppose, or words to that effect.

How can you feel that there will not be opposition in the future to the construction of any reservoir for the purpose of producing hydroelectric power, or controlling the river? Don't we have to be realistic and say there is always going to be opposition?

Mr. REYNOLDS. Yes, I think there probably will be. I don't think it is foregone that that is the only solution to importation.

Senator KUCHEL. And surely every possible alternative ought to be studied.

Mr. REYNOLDS. Certainly.

Senator KUCHEL. I agree with that, and I think that is your position. Mr. Reynolds, I thank you very much for your statement and for your testimony.

Mr. REYNOLDS. Thank you, sir.

Senator ANDERSON. Senator Bible?

Senator BIBLE. No questions, Mr. Chairman.

Senator ANDERSON. Senator Allott?

Senator ALLOTT. Mr. Reynolds, it is nice to see you here again.

Mr. REYNOLDS. Thank you, sir.

Senator ALLOTT. We have all known you for a long time, and we respect your judgment and your ability.

At the bottom of page 6 of your testimony you say, that S. 861, 1242, and 1409 "would require the Secretary to give priority to completion of planning reports on certain participating units of the Colorado River storage project in Colorado, Utah, and Wyoming."

Just so the record will be clear, you, of course, know that the feasibility reports have already been concluded not only on the Animas-La Plata, but also on the Dallas Creek, the West Divide, the San Miguel, and Dolores.

Mr. REYNOLDS. Yes, sir, we have commented on those feasibility reports. We commented favorably.

Senator ALLOTT. I just wanted to straighten that out.

I would like to ask you this question. We have been presented here with the administration bill and the Hayden bill, the administration bill being introduced by request by the chairman of the full Interior Committee. Can you see any way, under either of those bills, where any money in any kind of a fund could be approved which would help to pay for study or importation of water, except down the road maybe 50 or 100 years?

Mr. REYNOLDS. There might be some residual from the steamplant. This I would think would be relatively small.

Senator ALLOTT. The other day the Secretary of the Interior used what I think is an unfortunate term. He called the construction of the Hualapai Dam as pointing the gun at the head of the Northwest. I do not regard it as such.

Would it be fair to say, Mr. Reynolds, that without some money being developed from overall legislation, that even a comprehensive study or survey, whether reconnaissance or feasibility, could not be made until Congress especially and particularly in other legislation authorized it, if one of these three bills were not enacted, either the Kuchel, Moss, or Allott bill?

Mr. REYNOLDS. I am not sure I comprehend the question, Senator.

Senator ALLOTT. Let me restate the question. I am trying to get at a rather sensitive point here. The fact is that under the two bills that have been introduced by our distinguished senior Member in Congress, Mr. Hayden, and we all respect him, under that bill it would be impossible to proceed even with a look at the possibility of river augmentation. Do you agree with that?

Mr. REYNOLDS. As I understand it, it does not authorize the study of importation works.

Senator ALLOTT. Now it has already been suggested in your testimony that there are other areas besides the Washington area, the Columbia River Basin, that might be looked at, as for example northern California.

Mr. REYNOLDS. Yes, sir.

Senator ALLOTT. And Mr. Ely in his statement the other day made the flat statement that they would welcome such an investigation and study for the possibility of augmentation of the Colorado River. The point it seems to me is that pursuing the two administration bills which are essentially alike, what we are doing is being even denied the right to look at the possibility of river augmentation. Do you agree with that?

Mr. REYNOLDS. Yes. I would perhaps expand on my answer by saying that it would not seem to preclude authorization of studies in other legislation, if necessary to successful enactment of some legislation.

Senator ALLOTT. But when you and so many people in so many States have for several years been pursuing the subject of development of the entire river basin, the passage of either one of those two bills would limit it essentially to a narrow field, and leave out the wider aspects of basin legislation, basin augmentation, development of a fund, a basin fund, and a solution to the other problems involved in the basin. Do you agree to that?

Mr. REYNOLDS. Yes, sir.

Senator ALLOTT. I don't know whether I have made this entirely clear, but I think that what occurs to me in this matter is that it isn't that any of us say we ought to take water from the Columbia River or we ought to take water from northern California, but rather upon the enactment of these two administration bills we would not even be accorded, within their provisions, the privilege of looking at the possibility of the development of an augmented supply. You may comment on that or not as you see fit, but I think this point should be made.

Mr. REYNOLDS. I might comment this far. I would hope that the omission of that authorization in this particular legislation would not preclude investigations perhaps under other legislation.

Senator ALLOTT. But having committed water in the basin for a number of years to the central Arizona project, we would not be providing for any of the additional things that I know you think are necessary, and that many of the rest of us think are necessary for the full development of the basin.

Mr. REYNOLDS. Yes, sir. Certainly the authorization of the central Arizona project increases the urgency, the necessity of investigation of augmentation of the water supply of the Colorado River.

Senator ALLOTT. Mr. Reynolds, may I ask you if you have been present at all of the hearings?

Mr. REYNOLDS. I was not here yesterday afternoon.

Senator ALLOTT. You weren't here then when we discussed the matter of water from the Upper Basin being a necessary part of the feasibility of the central Arizona project as contained in the two administration bills?

Mr. REYNOLDS. Yes, sir.

Senator ALLOTT. Do you agree with that?

Mr. REYNOLDS. Yes, sir.

Senator ALLOTT. So that in the event that legislation was passed here which did not authorized Dallas Creek, the West Divide, and the San Miguel, to that extent water from the Upper Division to which they are entitled under the terms of the various compacts and acts of Congress will be resolved through the central Arizona project until some indeterminate time in the future to finance and pay for the central Arizona project.

Mr. REYNOLDS. Yes, sir. As I understand it, water to which the Upper Basin is entitled but which is not used by the Upper Basin could furnish a part of the supply of the central Arizona project.

Senator ALLOTT. And the longer then that these three particular projects as they refer to my own State were deferred, that much longer would the central Arizona project be able to utilize that water in the repayment of the obligations of the central Arizona project.

Mr. REYNOLDS. That is true as I understand the facts.

Senator ALLOTT. I am sure, Mr. Reynolds, you understand it about as well as anyone. There is one question I would like to ask you, because the maps which are available to me here are not illustrative of this fact. There has been some discussion, and I understand you mentioned this before I walked into the room.

For my own information, will you describe to what extent if any, because this question has been raised by some of the preservationists in this country, would the Hooker Dam and the reservoir invade the Gila wilderness?

Mr. REYNOLDS. Hooker Dam and Reservoir, constructed to a capacity of 265,000 acre-feet, would back water for about six-tenths of a mile through the Gila primitive area, and for about 7 miles up a narrow canyon into the Gila wilderness area, some 480 acres of the Gila wilderness area would be inundated by the reservoir at normal water surface.

Senator ALLOTT. For about 7 miles in a very narrow canyon.

Mr. REYNOLDS. Yes, sir.

Senator ALLOTT. Would this canyon be of the general concept of the Grand Canyon except on a smaller basis, I mean general conformation?

Mr. REYNOLDS. I think it is a great deal smaller. Perhaps the walls are not as sheer as those which you think of in connection with the Grand Canyon.

Senator ALLOTT. Then the committee here does have to make a determination and policy whether or not we will adhere strictly to the provisions of the wilderness bill, which the distinguished chairman of this committee, this subcommittee, was such an ardent advocate of, or whether we can permit just a little invasion and a little modification of the wilderness areas.

Mr. REYNOLDS. Senator, I don't think this would take any stretching of the wilderness bill at all. That bill certainly has a provision under which the President, by appropriate finding, may permit the construction of water resources projects within wilderness areas when the permission of such projects would better serve the public interest than would their denial. I think the authorization and construction of Hooker Reservoir would be perfectly consistent with the terms of the Wilderness Act.

Senator ALLOTT. Don't misunderstand me. I don't want anything I say to be taken as being in opposition to the Hooker Dam, but I do think I would disagree with your statement that the construction of the Hooker Dam is in violation of the wilderness concept, unless the paragraph in that act permitting the President to make certain exceptions was invoked, and the President so found. But as far as the principles of the act are concerned, it is technically, I think, a violation of the wilderness area.

The reason I ask you these questions to straighten out my own mind as to the actual invasion of the primitive area and the wilder-

ness area, is simply because in the future, having enacted this legislation, I am sure that Congress is going to be required in the national interest from time to time to make some slight modifications, and it is just a question of how slight is slight, and when the national interest justifies it. Your explaining this situation to me has been of very great help. Thank you very much.

Mr. REYNOLDS. Thank you, Senator.

Senator ANDERSON. Senator Jordan?

Senator JORDAN. Thank you, Mr. Chairman.

Mr. Reynolds, you have been a very informative witness, and I have listened with a great deal of interest to your testimony and your answers to questions which have been propounded to you. Your answers have been forthright and constructive. I shall not ask questions dealing with names of projects, but because you are informed, I would like to get a little information for the record.

Will you tell me, Mr. Reynolds, about how much water you have to apply in New Mexico to an irrigated acre to call it a full and adequate water supply? How many acre-feet per acre?

Mr. REYNOLDS. Along the Gila River the situation involved here, sir, about 3 acre-feet per acre per annum.

Senator JORDAN. That is your application?

Mr. REYNOLDS. Yes, sir.

Senator JORDAN. How much of that 3 acre-feet per annum is consumptively used and how much of it returned by percolation to the stream flow?

Mr. REYNOLDS. In the neighborhood of six-tenths to two-thirds of the amount applied would be consumed. The balance would return to the stream system.

Senator JORDAN. In other words, the loss to the watershed, to the whole drainage, by reason of evaporation, transpiration, and what actually enters into the product and goes to market would constitute about 2 acre-feet per year.

Mr. REYNOLDS. That is a good rule of thumb, sir.

Senator JORDAN. We use that in my State. I just wanted to verify the figure as to how you might apply it down there.

Tell me, Mr. Reynolds, what are your evaporation losses from reservoirs in that plant?

Mr. REYNOLDS. In the area of the Hooker Dam, as I recall the number, it is in the neighborhood of 5 feet per year. If I may, I will look over my shoulder for a confirmation on that. I am informed that the figure of 5 feet is correct for the gross evaporation. From that should be deducted the normal rainfall to arrive at the net evaporation.

Senator JORDAN. Yes, the annual net loss after deducting the rainfall is approximately 5 acre-feet per year from the reservoir's total.

Mr. REYNOLDS. The 5 acre-feet per acre—

Senator JORDAN. Five feet.

Mr. REYNOLDS. Is correct for the gross. At the Hooker site you would probably deduct in the neighborhood of 15 inches from that to arrive at the net evaporation.

Senator JORDAN. This is not the net you are giving, just the gross?

Mr. REYNOLDS. Right, sir.

Senator JORDAN. Are you quite familiar with the whole Colorado River Basin?

Mr. REYNOLDS. I certainly would not count myself among the foremost experts on that subject that are in this room. I have some acquaintance with it.

Senator JORDAN. You seem to be about as expert a witness as we have had here. Here is a general question that perhaps you can answer. What is the ratio in the Colorado River Basin of storage to annual runoff?

Mr. REYNOLDS. Throughout the basin?

Senator JORDAN. Throughout the entire basin.

Mr. REYNOLDS. Doing some quick arithmetic——

Senator JORDAN. Take your time.

Mr. REYNOLDS. At least four times; the storage amount is at least four times the annual runoff at Lee Ferry.

Senator JORDAN. In other words, you have storage equal to four times the amount of the average annual runoff.

Mr. REYNOLDS. At least that, sir.

Senator JORDAN. I know of no other river in the whole United States that is so well controlled. Would you agree with me that under such a system of high control—that is, ratio of storage to annual runoff—it makes it possible to use this cyclical storage to capture the runoffs in the year of high water yield, and carry it over to use in a year of critical water deficiency?

Mr. REYNOLDS. Yes, sir.

Senator JORDAN. We have had testimony here earlier that an estimate of water supply for the Colorado River this year will be about 66 percent of the average supply.

Mr. REYNOLDS. Yes, sir.

Senator JORDAN. That by reason of the fact that you have storage four times as great as the annual runoff, that this will not be as serious to you as if the ratio of storage to annual runoff was 1 to 1.

Mr. REYNOLDS. That is right, sir.

Senator JORDAN. The reason I am asking these questions is because it has a direct bearing on my own problem in my own State, where we don't have the abundance of storage, the ratio of storage that you do down here. Would you agree with me, Mr. Reynolds, that in a river system where the ratio of storage to runoff is less than 1 to 1, it would be foolhardy to set up a reclamation program based on average yields of water?

Mr. REYNOLDS. I think certainly in general this is true.

Senator JORDAN. Yes.

Mr. REYNOLDS. I can envision circumstances in which it might not be.

Senator JORDAN. In other words, if we were to accept an average annual runoff, with storage ratio on the order of 1 to 1, and we get a one-third diminution in the supply as you have down there, and your use of that river's waters is based on long averages, you might find yourself in a very serious condition——

Mr. REYNOLDS. Yes.

Senator JORDAN (continuing). With respect to that critical water year.

Mr. REYNOLDS. You would have some very deep annual shortages on any river that I know anything about.

Senator JORDAN. I thank you for your expert advice. I expect to use it later in another matter. I appreciate it.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Mr. Chairman, I was not here to hear the testimony, but I have heard Mr. Reynolds and some of you other gentlemen before, and I appreciate very much being with you again. I will read your testimony with a great deal of interest.

I am certainly very pleased to have you associated with Arizona on this project and to have Hooker Dam as a part of the project. I am very familiar with the area involved. I have traveled in that area many times and appreciate its potential. I again want to thank you for the privilege of being associated with you.

Mr. REYNOLDS. Thank you.

Senator ANDERSON. Are there further questions? If not, I thank you all very much. I have enjoyed your testimony, and I have enjoyed my association with you over these many years.

Mr. REYNOLDS. Thank you very much, Mr. Chairman and distinguished members of the committee.

(The statement of Mayor Davis referred to follows:)

STATEMENT OF MAYOR FLOYD G. DAVIS, FARMINGTON, N. MEX.

Mr. Chairman and members of the Senate Subcommittee for Water and Power Resources, it gives me a great deal of pleasure to appear here today and tell you of the great need we have for municipal and industrial waters from the Animas-La Plata Project. My name is Floyd G. Davis and I am Mayor of Farmington, New Mexico, and have been selected by the other municipalities in our area to testify in their behalf. I will be speaking for the communities of Aztec, Farmington and the Kirtland District, which represents an estimated 35,000 people.

The basis of our appeal for municipal and industrial water is the problem of supplying sufficient water for our future population and the immediate problem of improving the quality of our present water supply to those areas without treatment facilities.

In support of our estimate for future population growth, I would like to focus attention on the factors that will be stimulating this population expansion, first. Then, I would like to present the existing problem we have in improving the quality of our water.

GROWTH FACTORS

We expect our population to grow because of the development of our resources. These resources are in the form of land and water for agriculture, coal, petroleum products and natural gas, electric energy, recreation opportunities for tourists, and above all, a vast human resource for new industry.

There are agricultural areas surrounding our municipalities in both the San Juan Valley and the Animas-LaPlata Valley. As the result of the interest of canning companies in opening up this region as a new growing area, farm incomes and employment have already started to gain. Even though it is small this gain is significant and resulted in \$250,000, of new income the first year of the contract farming program. Acreage under contracts more than doubled last year, and purchases increased accordingly. This year more farm land will be under contract and we anticipate that within four years a cannery will be built. A major sugar beet company is looking at our area because of the high tonnages and large sugar content of beets that have been grown here; and within ten to fifteen years a beet sugar plant is very possible. Fertilizer companies are also looking at our area because of its agricultural potential and because of the ready supply of natural gas from which to manufacture anhydrous ammonia. Meat packing plants will also be a factor in our future growth because of the increase in forage and feed crops in the future and the ideal conditions that will develop for cattle

feeding. New Mexico State University is convinced of our expanding agricultural future and has under construction a one-third of a million dollar experiment station, the first crops to be produced this year. They have estimated a potential of \$86,000,000 annual income from agriculture and related businesses with the completion of all projects.

We look forward to the continuation of growth from the further development of the energy resources of our area—coal, natural gas, crude oil, and electric power. Nearby coal deposits are already being mined at the rate of 5,000 tons per day, which by 1970 will increase to 25,000 tons per day in supply fuel for the WEST Electric Power Generating complex. This coal resource has also attracted the interests of petro-chemical companies, and our City is already working with a major firm on the location of a coal-using petro-chemical plant that will be consuming coal at the same rate as our electric power facilities. In the 1970's about 1,000 new jobs are expected to result from this activity alone and the total electric generating capacity of the Four Corners area will exceed three times the present output of Boulder Dam. We are relying on this large volume of low cost power to attract other industrial users. The growth of the Four Corners area in the 1950's was stimulated by an accelerated oil and gas development, which has now leveled off. Estimated reserves of these resources are many times in excess of present requirements. Changing international conditions are bound to have an effect on our oil and gas industry—stimulating more production and a renewed search for more reserves. This will be accomplished by the construction of new wells and the pressures increasing our population in the 50's will be renewed.

We expect more people and business in our communities because of the emerging tourist industry which will be well underway in the next ten years. There are presently five National Parks and Monuments within an hour's drive of our area, good hunting and fishing, and numerous opportunities for outdoor sports the year round. The completion of U.S. Highway 64, which will put our area on a new trans-continental Highway in 1969, will open up this potential for visitors from all parts of the country, and we expect this Highway to out-draw Route 66 because of the greater number of tourist attractions it will pass through or near by.

In addition to the growth pressures I have already mentioned, others will come from new investment in manufacturing plants to utilize the abundant human resources we have available. There are more than 20,000 Navajo Indians residing on that portion of the reservation in our trade area. This labor resource has already attracted a major U.S. electronics company, Fairchild Semiconductor, Division of Fairchild Camera and Instrument Corporation; and our industrial files contain 55 other projects which will mean new investment and new job opportunities.

In view of these conditions, I believe our estimates of future population and future water requirements to be in line. I would now like to turn to the problem of our quality of water difficulties.

QUALITY OF WATER PROBLEMS

My own community has treated water assuring our people of safe and potable water supply. We are now in the process of entering into a contract with the Kirtland District, which is presently unincorporated, to furnish them Farmington city water, through a three mile pipeline. As the Kirtland District expands and grows they will need additional water facilities, due to their present practice of getting water from wells or cisterns with increased salinity. This delivery of water to Kirtland from Farmington will improve the quality of the water for the time being, but future needs will have to be met out of the Animas-La Plata Project.

The area surrounding Aztec is all irrigated farming, yet urbanization is creeping in and agricultural land is being sub-divided for homes. These home-builders have the same demands for a good safe water supply as those living in the City, and may be served with City water in the future. Annexation is a very real possibility to solve the fire protection and waste disposal problems they now face. In this case the population and water demand projections could be doubled as there are nearly the same number of people in the area surrounding Aztec as there are in the City proper.

EXTENSION OF CONSERVANCY DISTRICT

The City of Farmington has reviewed the Bureau of Reclamation's proposal that the boundaries of the La Plata Conservancy District be extended to include our City and that a one mill levy be assessed on property within the City of Farmington for the purpose of repaying approximately \$4 million of the cost of the project. Farmington has studied the feasibility report of the Bureau setting forth the benefits to Farmington from the Animas-La Plata Project.

Farmington is a very progressive City and I am sure that they will vote to take any action that is for the good of the community. However, until the project is authorized, I am not able to give a definitive answer on this particular phase, as there are other considerations that need further studying. After authorizing the project, it will take considerable time and effort to properly present this proposal to our citizenry. We do, however, assure the Subcommittee of our cooperation and efforts in the project's behalf.

CONCLUSION

We, in the West, have lived with water problems all our lives and spend a good deal of time studying it and worrying about it. The figures I present as an addendum to this testimony, indicating our projected population and water needs, are realistic and founded on the best knowledge we have and clearly indicate the need we have for municipal and industrial water.

The communities I represent are profoundly sincere in their request for municipal and industrial water from the Animas-La Plata Project. I speak for all of them when I assure you of our willingness and ability to enter into firm contracts for this water when such action is required.

Projected population and water needs ¹ for Farmington, Aztec, and Kirtland District, New Mexico, 1965-2000

	Farmington		Aztec ²		Kirtland ³	
	Population	Water	Population	Water	Population	Water
Year:						
1960.....	23, 000		4, 100		1, 500	
1965.....	24, 000	5, 600	4, 500	1, 600	1, 800	420
1970.....	31, 000	8, 800	5, 300	2, 100	2, 300	660
1975.....	37, 700	12, 300	6, 400	3, 000	2, 900	920
1980.....	45, 900	17, 300	7, 800	4, 100	3, 400	1, 300
1985.....	55, 800	24, 300	9, 500	5, 800	4, 200	1, 800
1990.....	67, 900	34, 000	11, 600	8, 200	5, 100	2, 550
1995.....	82, 600	47, 700	14, 100	11, 400	6, 200	3, 600
2000.....	100, 500	66, 900	17, 200	16, 000	7, 500	5, 000

¹ Water needs stated in acre-feet.

² Unincorporated area in vicinity to be supplied with water estimated to be equal in size to city.

³ Unincorporated area in vicinity to be supplied with water estimated to be double the size of the city.

Senator ANDERSON. Alvin Franks.

STATEMENT OF ALVIN ELLIS FRANKS, PRESIDENT, HOOKER DAM ASSOCIATION

Mr. FRANKS. Mr. Chairman, I am Alvin Franks from Silver City, N. Mex. I have come a long way to be with you today. I have prepared a short statement for your distinguished committee, and I would like, with your permission, to read it.

Senator ANDERSON. Go right ahead.

Mr. FRANKS. My name is Alvin Ellis Franks. I was born on a cow ranch in the territory of New Mexico some 6 years before statehood. I have lived most of my life in New Mexico with a few years being spent in Arizona and Colorado and 1 year in Pennsylvania.

The Gila National Forest and the Gila Wilderness Area have been my backyard and playground. I have hunted, fished, and photographed almost every square mile of this primitive area. I love the Southwest and especially its high country. In addition, I have boated many hundreds of miles on the Colorado River and its lakes and reservoirs including Glen Canyon as a river and as a lake. I have also visited numerous other dams and reservoirs in the United States and Mexico and have observed their beauty and many benefits to both man and nature. I have made my livelihood from various business ventures and ranching in New Mexico. Therefore, I feel I know this area of the Southwest and its problems.

I am here today as president of the Hooker Dam Association, often referred to as the Southwestern Damsiters, representing the people of the four southwest counties of New Mexico. I have with me copies of resolutions and letters from the county, city, and town governments, various organizations and individuals of this area of New Mexico stating their approval and desires for authorizing the central Arizona project including Hooker Dam and Reservoir in New Mexico.

The Southwestern Damsiters, or the Hooker Dam Association, if you please, was organized in 1957 for the explicit purpose of urging water resource development in this area. We were hard hit by water use limitations placed on this part of New Mexico by the Supreme Court, which allowed only known uses in 1957. We are not here to quibble about this division of water but rather to impress on you our need for additional water development, additional water use and the value of Hooker Dam for recreation, flood control, and to meet municipal and industrial needs.

The mining industry in Grant County is expanding quite rapidly. The Phelps Dodge Corp. is reopening their property at Tyrone. This will bring about a new need for industrial and domestic water. This company has announced intentions to employ approximately 1,100 workers when in full operation. The U.S. Smelting, Refining & Mining Co. is also developing their mines at Fierro. This company has about 300 additional employees as compared to 1960 employment figures. This expansion is welcomed but water needs of the growing area must be met.

Municipal water needs of the towns and villages of the area are also expanding rapidly. This problem is coupled with dropping water tables in the well fields which produce our municipal water supply. These needs, along with our agricultural and industrial requirements cannot be met with the 1957 water allotment, which at best could be described as quite skimpy.

Recreation has a tremendous potential in our area. We are, as you know, in the center of one of the fastest growing regions in the United States. Within a few hours' drive approximately 2 million people could use the recreation facilities created by Hooker Dam and Reservoir. This, in a pure sense of economics, means dollars and cents to the residents of this area.

We have heard rumbles of protest from the wilderness society that the Hooker Dam and Reservoir would invade the Gila Wilderness area. It is true that the dam would back water up the narrow canyon floor a short distance. This would be an added value of the reservoir

as it would enhance the beauty of this area, leaving open for rowboating or canoeing a tiny segment of the wilderness now subjected to flooding and erosion, leaving only sandbars and gravel piles enjoyed by no one, not even wildlife.

The Hooker site has long been considered in planning for development of the land and water resources of the Gila River as evidenced by its withdrawal under the water power designation No. 1, dated August 7, 1916. This was long before the Gila Wilderness Area was established in 1924.

We want and need the Hooker Dam at the Hooker site as this site is superior in its recreation benefits, flood control, and evaporation loss to other sites studied on the upper Gila. It would not inundate fertile farmland as other sites on the upper Gila would.

In short, we in the Southwest are not only thirsty but desperate for water. We respectfully request your consideration of legislation to authorize the central Arizona project with Hooker Dam and Reservoir in New Mexico along with its benefits for the 18,000 acre-feet additional water use for New Mexico.

For the file I have these resolutions and letters from the towns and cities and county organizations and individuals. I also have a mile of signatures by your good friends in Bayard, along with a letter addressed to you, Mr. Chairman. I have prepared an album of photos of the Hooker damsite and the area immediately above the site. If you have any questions on the site, or what these photos cover, I would be only too glad to answer them.

Senator ANDERSON. We will place pictures in the file and print the resolutions in the appendix. The mile of signatures is very interesting.

Mr. FRANKS. Thank you.

Senator ANDERSON. Mr. Franks, thank you for that testimony. You are a good sound businessman in my State, and you are a good friend of Hooker Dam and we are glad to have you before us. Have you been to the Hooker damsite, Mr. Franks, at any time?

Mr. FRANKS. Have I been there?

Senator ANDERSON. Yes, have you?

Mr. FRANKS. Yes, many times.

Senator ANDERSON. Do you feel there would be any jeopardy if the dam is built? You now have no dam there. Would any great damage be suffered to the picturesque situation if the dam is built?

Mr. FRANKS. I did not understand the question, Senator.

Senator ANDERSON. Do you favor the location of Hooker Dam?

Mr. FRANKS. Yes, I favor it.

Senator ANDERSON. It will not damage the scenery, will it?

Mr. FRANKS. No, it will not.

Senator ANDERSON. You say you heard rumbles of opposition to it. I am very hopeful that it will be found to be all right, and I think the way you have presented this case you have done a fine job. You have done very well, and we appreciate what you have done.

Mr. FRANKS. Thank you.

Senator ANDERSON. Senator Allott?

Senator ALLOTT. Just one question. What is your business now, Mr. Franks?

Mr. FRANKS. I have more or less retired. I am in the ranching business.

Senator ANDERSON. He has four or five business ventures.

Mr. FRANKS. Yes.

Senator ALLOTT. You are a man of expanded interests, then. I asked that because I note you said you had been born on a cattle ranch before New Mexico became a State, and I wondered if this had been one of your major interests all of your life.

Mr. FRANKS. The Hooker Dam?

Senator ALLOTT. No, the agriculture and ranching business.

Mr. FRANKS. No, I was in the wholesale gasoline and oil business and ranching.

Senator ALLOTT. At least from your statement I gather that you have been a man who has been very vitally interested in all phases of recreation. You speak of hunting, fishing, photography, and I suppose this has continued through most of your life, has it not?

Mr. FRANKS. It has been my hobby.

Senator ANDERSON. So we have here a man then who is essentially a businessman, and has had to depend upon the vicissitudes of a dry country for business expansion, and yet has a very great interest in the esthetic values of the country in which he lives.

Let me ask you this, Mr. Franks. What is your observation with respect to the numbers of people who might possibly use the reservoir behind the Hooker Dam for recreational purposes as compared with those who presently use it in its present pristine state?

Mr. FRANKS. We have a small dam on the Sapello River, which is a tributary to the Gila. The reservoir is some 70 acres in area. It is one of the few lakes in our area, and people from El Paso and Las Cruces and that area literally come up by the dozens. I am sure that if Hooker were built, we would have people from El Paso, Albuquerque, Phoenix, Tucson, and the whole area using it from a recreational standpoint.

Senator ALLOTT. There is one thing I noticed in your statement. I refer you to Mr. Reynolds' reply to me a few moments ago. Can you hear me all right, Mr. Franks?

Mr. FRANKS. Yes, I can now.

Senator ALLOTT. I wasn't sure whether you could. He estimated that the Hooker Dam would back water up to approximately 7 miles in a narrow canyon within the wilderness area, the Gila Wilderness Area. I noticed in your statement you very carefully eliminated the use of any motorboats in that area. You referred to rowboats and canoes.

Mr. FRANKS. I think, being a wilderness area, it would be an ideal answer for the motorboats to stay out of the area, and use rowboats and canoes up in the wilderness area.

Senator ALLOTT. I am very happy to have your observations on this, because 7 miles is a little bit far for some people to row, especially when you have to row back 7 miles. But you did make that distinction on purpose.

Mr. FRANKS. Yes, sir.

Senator ALLOTT. Thank you very much.

Senator ANDERSON. Senator Jordan?

Senator JORDAN. No questions.

Senator ANDERSON. Senator Fannin?

Senator FANNIN. Mr. Franks, we are very pleased to have you with us today, and I wish to express my appreciation for your very forthright statement.

Your support of the central Arizona project is of great benefit to us. I know that because of your vast experience, you are very practical about this overall project. You realize the tremendous recreational benefits this project will bring to both the State of New Mexico and the State of Arizona. So you, of course, have our wholehearted support. We are very pleased to have your statement.

Senator ANDERSON. Senator Hansen?

Senator HANSEN. No questions.

Senator ANDERSON. Thank you very much again, Mr. Franks.

Mr. FRANKS. Thank you, Mr. Chairman.

Senator ANDERSON. Mr. Montoya.

STATEMENT OF F. F. MONTOYA, CHAIRMAN, LA PLATA CONSERVANCY DISTRICT, LA PLATA, N. MEX., ACCOMPANIED BY PRICE W. NELSON

Mr. MONTOYA. With your permission, Mr. Chairman, I will allow one of our other board directors to sit in with me, Mr. Price Nelson.

Mr. Chairman, my name is F. F. Montoya. I have copies of this petition for the committee files at this time.

I am from La Plata, N. Mex. I am chairman of the La Plata Conservancy District. It gives me great pleasure to appear before the Subcommittee on Water and Power Resources of the Senate Committee on Interior and Insular Affairs to present testimony in support of the Animas-La Plata project, in behalf of the people of the La Plata, N. Mex., area.

Agriculture has been traditional with us—and is a way of life with the people I represent. Ever since this country was open for settlement, we have been farmers and ranchers. Our soil is good—and we have been told by the experiment station that we can become one of the most important agricultural areas in the Southwest because of our assets.

Our assets are many—and include a ready and willing labor force of agricultural workers from the Indian reservation areas that surround us. These are the Navajo, the Mountain Ute, and the Southern Ute Indian Reservations.

We have had to live with continuous water shortages. Unless our water supply is guaranteed, we cannot do anything to change the present conditions.

There is only one real problem we face, and that is an assured, continuing water supply throughout the growing season. The Animas-La Plata project will do this.

A guaranteed continuing water supply will mean that:

- (1) We can substantially increase farm income by participating in intensified farming, whereby our land will produce several times as much gross income as it does today. Alfalfa and corn

silage production for feed can be doubled. This increase in feed will support large livestock feeding operations;

(2) Instead of leaving the land and seeking work in nearby towns that are already crowded with unemployed people, we can become full-time farmers and ranchers again and provide job opportunities for the people we are forced to compete with now;

(3) Our climate is such that our vegetables mature in time for an intermediate fresh vegetable market, which has in the past been in short supply. With sufficient water, we can produce enough vegetables during times of short supply from other areas. Soils and climate are also very favorable for fruitgrowing;

(4) No longer will we have the costly job of replacing our diversion dams, irrigation ditches that are periodically washed out by flash floods resulting from sudden storms, when we suffer from too much water at the wrong time;

(5) Recreational facilities would be greatly increased;

(6) Municipal water will be supplied for towns of the San Juan Basin; and

(7) The water would make possible the use of available coal supply for development of electrical power.

I am not speaking just for myself—not speaking just for the farmers in my conservancy district when I ask for approval of this project—but for an estimated 3,000 people from San Juan County who signed their names to a petition directed to the Governor of the State of New Mexico in 1963, indicating their interest and support of the Animas-La Plata project.

Senator ALLOTT. All I want to say is that anybody named Montoya or Anderson are certainly welcome before this committee.

Senator ANDERSON. You need badly to have this water supply.

Mr. MONTOYA. Yes; we sure do.

In summary, irrigated agriculture can play an important role in any program to increase and diversify agricultural production because of the versatility of irrigation farming.

When this project is completed the water can be utilized to make the most efficient use of land, labor, and capital resources.

Mr. Chairman, may I submit for the record the following statements in support of the Animas-La Plata project:

No. 1, joint statement of the board of directors of the Farmington, N. Mex., Chamber of Commerce.

No. 2, the Kirtland, N. Mex., Lions Club.

No. 3, the city of Aztec, N. Mex.

No. 4, the Lower Valley Water Users Cooperation of Kirtland and Waterflow, N. Mex.

Mr. Chairman, thank you for the opportunity to present this statement in support of the Animas-La Plata project.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. I have no questions, Mr. Montoya, except to say we do appreciate your support of this project which we have heard for so long in Colorado also.

Mr. MONTOYA. Thank you, Senator.

Senator ANDERSON. Senator Fannin?

Senator FANNIN. No questions at this time.

Senator ANDERSON. Senator Hansen?
 Senator HANSEN. No questions.
 (The data referred to follow :)

**JOINT STATEMENT OF THE OFFICERS AND MEMBERS OF THE BOARD OF DIRECTORS
 OF THE FARMINGTON, NEW MEXICO, CHAMBER OF COMMERCE, FARMINGTON, NEW
 MEXICO**

Mr. Chairman, we, the undersigned officers and directors of the Farmington, New Mexico Chamber of Commerce, representing more than four hundred business and professional members of our community, respectfully submit the following statement to the Subcommittee on Water and Power Resources of the Senate Committee on Interior and Insular Affairs in support of the Animas-La Plata Project:

1. The orderly economic growth and progress of San Juan County, New Mexico is vitally tied to development of our agricultural resources, our mineral resources (including vast coal reserves), and our manpower resources. A reliable supply of water, not only for irrigation of our rich soils, but for municipal and industrial use, is the top requirement for development of these resources.

2. We have on the vast Navajo Reservation, which occupies one half of the entire 5,500 square mile area of San Juan County, one of the largest available and trainable labor pools in the Southwest. Unemployment of these people is presently running at a rate estimated by Tribal Officers at greater than 70%.

3. Completion of the Animas-La Plata Project can, we believe, greatly increase the potential for employment in the County by providing ample water for diversified agricultural crop production; inducement to food processors and canners, and livestock feeders and meat processors; and massive development of coal reserves for electric power generation.

4. Recreational facilities development, flowing naturally from the reservoirs, and stream improvement related to the Animas-La Plata Project, will further add to employment opportunities and benefits to local economies in both Southwestern Colorado and Northwestern New Mexico.

5. New Mexico State University is right now in the process of constructing a modern Agricultural Experiment Station on 250 acres of ground in our County. This installation has been carefully designed to serve the manifold interests of farmers and ranchers throughout our County. We see in this valuable facility a tremendous factor for guidance to success in our agricultural economy—not only on the 37,000 irrigated acres already existing in our County, but on the acreage involved in the Animas-La Plata Project, and in the Navajo Indian Irrigation Project adjoining it on the south.

BOYD F. SCOTT, *President.*

Also signed by other officers and directors.

MAY 2, 1967.

**CHAIRMAN OF SUBCOMMITTEE ON WATER AND POWER RESOURCES OF THE SENATE
 COMMITTEE OF INTERNAL AND INSULAR AFFAIRS.**

GENTLEMEN: This is written in support of the Animas-La Plata Division Project.

We members of the Kirtland Lions Club would like to add our support to this very vital project. Our area will be in dire need of domestic water in the near future. With the continued growth our subquality wells will not furnish a safe, adequate water supply. We feel that this project would enable our area to continue its very necessary growth.

Therefore we urge you to support this fine project.

Sincerely,

BRUCE BODKIN,
President of Lions Club.

MAY 2, 1967.

To Whom It May Concern:

GENTLEMEN: The City of Aztec wishes to lend its full support and petition for the Animas-La Plata diversion project as proposed. The importance of this project for industrial, municipal, and agriculture use, is very great and badly

needed in the entire area. The additional irrigable land and the increased industrial and municipal water is needed for the expansion and economic progress necessary for this region. The City Commission of the City of Aztec has petitioned that the United States of America construct this project.

JOHN R. MCGINN,
City Manager.

MAY 2, 1967.

CHAIRMAN OF SUBCOMMITTEE ON WATER AND POWER RESOURCES OF THE SENATE
COMMITTEE OF INTERNAL AND INSULAR AFFAIRS.

DEAR SIR: I represent the Board of Directors and membership of the Lower Valley Water Users Cooperation, an organization consisting of about 325 members which is endeavoring to secure household water for the Kirtland-Waterflow area. I would like to express my concern and interest in the Animas-La Plata Diversion Project. There is no doubt that this project is necessary to the growth and development of this area. Please rest assured that any assistance that this group can give in support of this project will be forthcoming.

Sincerely,

JIM DUNLAP,
President, Lower Valley Water Users Cooperation.

Senator ANDERSON. Mr. Bishop is next.

**STATEMENT OF FLOYD A. BISHOP, WYOMING STATE ENGINEER;
ACCOMPANIED BY JOHN BEREMAN, INTERSTATE STREAMS
ENGINEER FOR THE STATE OF WYOMING; THOMAS CAHILL,
ASSISTANT ATTORNEY GENERAL; AND C. J. KUIPER, ASSISTANT
COMMISSIONER, UPPER COLORADO RIVER COMMISSION**

Mr. BISHOP. Mr. Chairman, I have with me as my associates today Mr. C. J. Kuiper, who is an assistant commissioner on the Upper Colorado River Commission, and also is a former employee of the Bureau of Reclamation and was one of the principal engineers involved in the United Western investigation. On my left is Tom Cahill, special assistant attorney general in the Wyoming attorney general's office, and on my right is Mr. John Bereman, who is interstate streams engineer for the State of Wyoming.

Senator ANDERSON. Thank you.

Mr. BISHOP. First, Mr. Chairman, I would like to express Governor Hathaway's regrets for his inability to be here today. Previous commitments made it impossible for him to appear and present this statement. I would say that the statement is rather lengthy, and I will do my best to summarize where possible. However, it doesn't lend itself too well to summarization. I will be as brief as I possibly can, sir.

Senator ANDERSON. Go right ahead.

Mr. BISHOP. Mr. Chairman and members of the committee, thank you for this opportunity to present testimony on behalf of the State of Wyoming with respect to the proposed authorization of the Colorado River Basin project.

Wyoming has a vital interest in the Colorado River. The headwaters of the Green River, one of the major tributaries of the Colorado River, originate in Wyoming, as do some of the headwaters of the Little Snake River. The streams of our State contribute an average of more than 2 million acre-feet per year to the total flow of the Colorado River system. We have agreed with our sister States in the

Colorado River drainage, through the Colorado River compact of 1922 and the Upper Colorado River Basin compact of 1948, to a division of the water resources of this river system, and our primary concern today is to see that the provisions of these compacts are not modified or circumvented by the legislation currently being considered by this committee.

Wyoming has a past record of supporting good reclamation projects throughout the West. Indeed, our State has benefited greatly from reclamation activity down through the years, not only through increases in irrigated agriculture but also from the availability of electric power for our industries and municipalities, and the improved recreational facilities which have been created by many of these projects. We recognize and appreciate the need for reclamation development in the West and we understand the desires of our sister States to provide for such development. We are particularly concerned about the plight of Arizona. We realize that her struggle to have the central Arizona project approved has been long and arduous. We recognize the demonstrated need for the project and the intimate connection between this project and Arizona's future growth and prosperity.

We realize also that some of the legislation under consideration by this committee contains provisions for projects which will benefit our sister States of Colorado, New Mexico, California, Utah, Nevada, and, to a lesser extent, Wyoming. From the broad viewpoint, we can see a number of benefits in some versions of this legislation. However, we believe that as presently written the legislation contains a dangerous precedent by proposing to authorize Federal projects which would be dependent upon the use of water in excess of compact apportionments.

INTERSTATE COMPACTS

Interstate compacts providing for the division of the water of the Colorado River system have been agreed upon between the several States in the basin and approved by the Congress. These include the Colorado River compact of 1922 and the Upper Colorado River Basin compact of 1948. The 1922 compact involves all seven States in the drainage of the Colorado River. It provides for a division of water use between the Upper Basin and the Lower Basin, with the dividing point between the two basins being located at Lee Ferry near the Utah-Arizona State line. This 1922 compact apportioned from the Colorado River system in perpetuity, to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of $7\frac{1}{2}$ million acre-feet annually. On the basis of an erroneous evaluation of the available water supply which indicated the average annual flow of the Colorado River to be approximately 20 million acre-feet, the 1922 compact granted the Lower Basin the right to increase its use by an additional 1 million acre-feet per year, and recognized the possibility of a future burden for delivery of water to Mexico. These added commitments beyond the basic allocation of $7\frac{1}{2}$ million acre-feet to each basin were to be fulfilled from the so-called surplus which we now realize does not exist.

The States of the Lower Basin contend that the Upper Basin is obligated to deliver at Lee Ferry an average of $7\frac{1}{2}$ million acre-feet per

year to satisfy the requirements of the Colorado River compact of 1922, plus an additional three-fourths of a million acre-feet per year in satisfaction of half of the Mexican Treaty burden. We do not concur in this contention. The 1922 compact clearly encompasses the water of the entire Colorado River system, including the Gila River and other Lower Basin tributaries within the United States. From this total water supply, the compact apportionments were made. The Lower Basin States contend that these Lower Basin tributaries are not to be counted in the total water supply, and that uses of water from these tributaries are not to be counted as part of the overall apportionment to the Lower Basin under the compact.

The Lower Basin States claim that the decree in *Arizona v. California* lends credence to their contention. This decree provided that the use of water from tributaries within the Lower Basin would not be counted in arriving at an apportionment between the individual States of the Lower Basin. It must be remembered, however, that, in apportioning water among the Lower Basin States, the Supreme Court relied upon the Boulder Canyon Project Act which dealt only with waters of the main stream which would be diverted under contracts with the Secretary of the Interior. Conversely, the 1922 compact clearly stated that if a treaty with Mexico was consummated, the burden for delivery of water to Mexico would be upon the "Colorado River system" which included "that portion of the Colorado River and its tributaries within the United States of America." This was reiterated in the treaty itself which placed the burden upon "the waters of the Colorado River, from any and all sources * * *" (Treaty series 207, art. 10).

If the theory of exclusion of the tributaries is extended to its logical conclusion, the Green, the Yampa, the San Juan, the Gunnison, and all other Upper Basin tributaries should be excluded from the compact.

It is our belief that the Lower Basin water supply apportioned by the compact consists of the sum of the following:

1. Seven and one-half million acre-feet of water delivered by the Upper Basin at Lee Ferry.
2. The virgin flow of all of the Lower Basin tributaries of the Colorado River.
3. Runoff from precipitation which falls on the river or reservoirs or on lands which drain directly to the Colorado River.

We believe further that before the Upper Basin is required to deliver any water at Lee Ferry to satisfy the Mexican treaty obligation, the sum of the three aforementioned sources of water must be less than 9 million acre-feet which is accounted for as follows:

1. Seven and one-half million acre-feet of beneficial consumptive use in the entire Lower Basin.
2. One and a half million acre-feet to Mexico.

In the event the sum of the three sources of water falls below 9 million acre-feet, then and only then is the Upper Basin obligated to deliver additional water at Lee Ferry. The additional delivery required if such deficiency occurs is limited to one-half of the amount by which the total water supply available to the Lower Basin fails to produce 9 million acre-feet per year.

Unfortunately, the two basins have been unable to find a mutually agreeable solution to this controversy. Apparently, the ultimate solu-

tion will come through later litigation or negotiation. However, in view of the depth of this disagreement, there appears to be no prudent course for us to follow in evaluating obligations on the available water supply except to assume that the upper basin may have to deliver at Lee Ferry as much as 8¼ million acre-feet annually.

EXISTING LOWER BASIN USES

Next we would like to present some facts on Lower Basin consumptive uses at the present time from the main stream of the Colorado River. As used herein, consumptive use is defined as diversions less returns.

Most of the figures in this tabulation have been quoted from the 1964-65 report of the Colorado River Board of California. I think you will notice some differences between these figures and figures which have been quoted previously in this hearing. These figures quoted here are considerably less in some instances than some of the other figures we have heard. So we do feel that they are conservative.

Average annual consumptive use from main stream in Lower Basin, years 1961 through 1965:

	1,000 acre-feet
Arizona ¹ -----	976.4
California ¹ -----	4,989.4
Nevada ¹ -----	24.2
Mexico ² -----	1,850.4
Lake Mead evaporation ³ -----	800.0
Computed net losses—Hoover Dam to Mexico ⁴ -----	988.2
Total -----	9,628.6

¹ Colorado River Board of California Annual Report 1964-65, table 4, averaged.

² Colorado River Board of California Annual Report 1964-65, table 6, averaged.

³ USDI Pacific Southwest Water Plan Report, January 1964, table 12.

⁴ Colorado River Board of California Annual Report 1964-65, table 5 averaged, with adjustments suggested in following text.

The foregoing clearly shows that even without the central Arizona project the Lower Basin is presently using more water from the main stream than would be supplied to them under the compact by the Upper Basin, when development therein is complete, and that this excess use at the present time from the main stream of the Colorado River may be as much as 2.1 million acre-feet annually. The central Arizona project as proposed in the legislation being considered by this committee would require an additional 1.2 million acre-feet and Nevada proposes to utilize 0.3 million acre-feet per year. Increased evaporation losses connected with this new additional development are assumed to be offset by the savings realized from the proposed channel improvement program. The combined total of all these ultimate demands upon the main stream in the Lower Basin is 11.1 million acre-feet per year, and even if we assume that California will cut back to her decreed allocation of 4.4 million acre-feet, the demand would still be 10.5 million acre-feet per year, or nearly 3 million acre-feet per year in excess of the 7.5 million acre-feet required to be delivered to the Lower Basin at Lee Ferry. We think it is both legally and morally wrong to authorize expensive Federal projects in the lower basin which depend on the availability of a greater portion of water than the Lower Basin entitlement.

DEPENDENCE ON UPPER BASIN WATER

The record of the House hearings concerning this Colorado River Basin project legislation during both sessions of the 89th Congress and also during the present session of the 90th Congress is replete with references to the effect that the water supply for the central Arizona project is dependent upon Upper Basin water which is presently in excess of Upper Basin needs. As the Upper Basin develops, the water supply in the Lower Basin will progressively diminish, and sometime within the next 30 years the surplus of water flowing from the Upper Basin to the Lower Basin will cease to exist, providing that nothing is done to thwart the normal development of the Upper Basin region. The figures cited previously show that the Lower Basin has already developed a reliance upon a water supply that will diminish as the Upper Basin develops, and this reliance would be significantly expanded if the central Arizona project is built as proposed. This being the case, Wyoming fears that future pressures arising from the developed economies in the Lower Basin will be muscled with sufficient political strength to effectively inhibit the future development of Wyoming. Arizona's past and present difficulties in getting the central Arizona project approved are related to exactly that kind of situation in the Lower Basin. This is clearly brought out in the records of the Arizona Senate Journal, 16th Legislature, First Special Session, 1944, at 16, where Governor Osborne makes the following statement to his own Arizona Legislature:

Now of course we would like to take from California some of that 4,400,000 acre-feet of water, but neither unrecognized filings against it, nor wishful thinking on our part can accomplish that . . . The Federal Government, having expended tens of millions of dollars of the people's money to provide irrigation and power facilities for the use of this water in one State, will not wipe out that investment and divert that water to another State. Arizona cannot compel that any more than we can turn back the pages of history. The time has long since passed when Arizona could obtain the water which California has put to beneficial use.

PROPOSED PROJECTS WITHIN THE STATE OF COLORADO

The same situation pertains to the water supply situation in the Upper Basin. The division of water here is controlled by the Upper Colorado River Basin compact of 1948. Our analysis of the available water supply indicates that the State of Colorado may be in excess of her compact apportionment of Colorado River water if all five of the projects proposed in some versions of this legislation for authorization are constructed. In order to clarify this facet, we are submitting herewith a detailed analysis of the situation. The figures used in this analysis are taken from a letter dated March 24, 1967, from Mr. Floyd Bishop, Wyoming State engineer, to the Honorable Harold T. Johnson, chairman of the subcommittee on Irrigation and Reclamation of the House Committee on Interior and Insular Affairs. Reference is made in the above-mentioned letter to a letter dated March 11, 1966, from Mr. Ival Goslin, executive director of the Upper Colorado River Commission, to Floyd A. Bishop; and to a letter dated March 15, 1966, to Mr. Jay Bingham from Mr. Felix L. Sparks, director of the Colorado Water Conservation Board, in which Mr.

Sparks concurs with these figures. Copies of these letters are attached for inclusion in the record.

A summary of the figures shown in these attachments follows:

Total depletions of Colorado River water within the State of Colorado

	<i>1,000 acre-feet</i>
Present depletions.....	1,786
Depletions due to presently authorized Federal projects.....	140
Probable future depletions.....	346
Depletions due to the 5 projects proposed to be authorized by present legislation	378
Total Colorado depletions.....	2,650

I would only point out that this figure agrees rather closely with the figure indicated by Senator Allott yesterday of 2,646,000 acre-feet per year.

The concurrence of Mr. Sparks to the foregoing figures, as indicated in this letter of March 15, 1966, referred to previously, lends special credence to these figures. It should also be noted that for several of the projects involved, the depletions shown herein are less than those cited for the same projects by the Honorable Wayne Aspinall of Colorado, chairman of the House Committee on Interior and Insular Affairs, in testimony before the House Subcommittee on Irrigation and Reclamation on March 17, 1967.

Early in 1965, the Upper Colorado River Commission retained the firm of Tipton & Kalmbach, Inc., of Denver, Colo., to study and report on the water supplies of the Colorado River. The objective of this study was to make an independent analysis of the expected flows in this river system based on current data and technology, in order to be in a better position to evaluate the effects of the proposed central Arizona project and other developments proposing to utilize water from the Colorado River. In July 1965, a report entitled "Water Supplies of the Colorado River" was issued by Tipton & Kalmbach, Inc., consisting of two parts, Part I—Text, and Part II—Appendixes. Copies of both parts of this water supply study are attached hereto for inclusion in the record. The Tipton & Kalmbach study concludes that if it is assumed that all reservoirs authorized by the upper Colorado River storage project are constructed and operating with a combined capacity of 29 million acre-feet, and if delivery made at Lee Ferry amounts to 8¼ million acre-feet per year as previously discussed, for satisfaction of the compact and the Mexican Treaty burden, then the limit of the depletions in the States of the upper division would be 5.6 million acre-feet per year including reservoir evaporation, or an available 4.7 million acre-feet per annum after reservoir evaporation losses (See p. 21, Pt. I—Text, Tipton & Kalmbach Report of July 1965.)

Under the Upper Colorado River Basin compact, Colorado's share of the Upper Basin apportionment amounts to 51.75 percent of the total amount which is available to the Upper basin. Based on the 4.7 million acre-feet annually available for consumptive use in the Upper Basin as stated in the Tipton & Kalmbach study less the 50,000 acre-feet apportioned to Arizona from the Upper Basin entitlement, Colorado's share would be 51.75 percent of 4.65 million acre-feet, or only about 2.40 million acre-feet per year.

Comparing the previously stated estimates of total Colorado depletions of the Colorado River including the five proposed new projects in the State of Colorado, amounting to 2.65 million acre-feet per annum, with the figure of 2.40 million acre-feet per year to which Colorado would be entitled under the compact on the basis of the previously cited figures from the Tipton & Kalmbach report, it can be seen that Colorado would be exceeding her apportionment by about 250,000 acre-feet per year. Deferral of the Dallas Creek project, West Divide project, and San Miguel project would reduce this excess to about 50,000 acre-feet annually.

Senator ALLOTT. Your statement says 22,000 acre-feet.

Mr. BISHOP. Senator, I made a correction in my statement to account for the 50,000 acre-feet which is apportioned from the Upper Basin total allocation to the State of Arizona, and this was not reflected in the printed statement. That is correct.

Senator ALLOTT. Could I ask you one other question?

Mr. BISHOP. Yes, sir.

Senator ALLOTT. You made a statement which apparently was not in your written statement, and I interpreted that to say, interpreted the way you said it, that you were charging the 50,000 acre-feet which goes to Arizona to Colorado's share.

Mr. BISHOP. No, sir.

Senator ALLOTT. You did not contemplate that, did you?

Mr. BISHOP. No, sir, not by any means. I certainly would not want to do that.

Senator ALLOTT. All right.

IMPORTANCE OF COMPACT APPORTIONMENTS

Mr. BISHOP. The realities of the yield of this river and the obligations which have been placed upon it must not be ignored. The original negotiators of the 1922 compact used what have proven to be incorrect figures in dividing the waters of the river. We simply cannot go on using incorrect figures in analyzing additional projects which place a burden on the river. Future projects must be evaluated on the basis of a realistic analysis of the available water supply in conjunction with full recognition of the commitments already made on this water supply through existing interstate compacts. In view of the recognized inadequacy of the present water supply in the Colorado River system to meet present and future demands, it is imperative that any Colorado River Basin Project Act involving a proposed use of water in excess of existing compact allocations contain strong assurances that water from outside the natural drainage area of the Colorado River system will be made available to fulfill these demands.

Senator ANDERSON. Can I stop you for just one second there?

Mr. BISHOP. Yes, sir.

Senator ANDERSON. The original negotiators of the 1922 compact used incorrect figures in dividing the water of that river, you say?

Mr. BISHOP. Yes, sir.

Senator ANDERSON. You mean they were incorrect at that time.

Mr. BISHOP. I am sure they were the best figures available at that time, but based upon what we know as a long-term average of the

available water supply at this time, it appears that they assumed there was considerably more water than actually is the case.

Senator ANDERSON. There was water at that time.

Mr. BISHOP. At that time based on the figures they had, that is true; yes, sir.

Senator ANDERSON. I wonder if there is some other reason except that which you mentioned. Those original negotiators did a very careful job, and I am never going to forget Mr. Carpenter, who was the real genius. The group carefully studied all the figures at that time.

Mr. BISHOP. Mr. Chairman, I would agree with that wholeheartedly. I think they did a wonderful job, and they certainly based their conclusions on the best information that was available at that time. The only problem was they had a limited period of time on which to base their computations of the available water supply.

Senator ANDERSON. Mr. Hoover was greatly impressed by some of the men on this project. One of them was a man from my home State. He was brought to Washington very quickly, having been recommended by good people.

Mr. BISHOP. I might also mention that Frank Emerson was the Wyoming representative in those negotiations, and he was later Governor of the State of Wyoming, and a very fine and capable man.

Senator ALLOTT. Mr. Chairman, may I interject a remark, I feel as the chairman has indicated and as you have indicated, Mr. Bishop. The compact was arrived at upon the basis of probably what was the best information available, and of course we can always take advantage of hindsight in being critical. Even among Monday quarterbacks they do that. But the thing that occurs to me, and I think you would agree with that, would you not, that as far as the Upper Basin States, the error if it was made, was not in the attempt to ascertain the amount of waters then available in the Colorado River, but rather while the broad implication was that they were dividing the waters of the river equally, with the diminishing water supply we have been caught on the horns of the absolute flat guarantee of delivery at Lee Ferry. This has been the detrimental factor as far as the upper States are concerned.

Mr. BISHOP. Yes, sir; I agree with that wholeheartedly.

Senator ALLOTT. If a mistake was made at that time, and there is no questioning the competency and ability of these gentlemen who were wrestling with as major a problem as we are now, I think it was made in this respect of not dividing the waters equally, rather than putting us, the upper States, in the position of delivering a specified flat amount which was based upon an assumption of water available which has not proven out in subsequent years.

Mr. BISHOP. Yes, sir. I would only add to that that I really think it was their intent to divide the water equally at that time. Their assumption that there was more water in the river than has proven to be the actual case led them to include this provision whereby we are required to deliver a certain minimum to the Lower Basin.

Senator ALLOTT. They might have been thinking in those terms, but unfortunately you know as well as anyone that isn't what the compact said.

Mr. BISHOP. Yes.

Only in this way can there be a meaningful assurance that the slower developing areas will be able in future years to utilize the water which is granted to them by the compacts. Such assurance was the original

intent of these documents and it is unthinkable that the Congress would now consider taking any action which might nullify or circumvent the protection granted the individual States through these agreements. In taking this position, we are not unmindful of the efforts of sponsors of many of the bills under consideration to provide some degree of protection to Wyoming and the Upper Basin by including specific language, such as that in the Allott bill, which provides that "Rights of the Upper Basin to the consumptive use of water apportioned to that basin from the Colorado River system by the Colorado River Compact shall not be reduced or prejudiced by any use of such water in the Lower Basin." It seems apparent that the authors of these bills, in most cases, made every possible effort to protect the legal rights of Wyoming and the other Upper Basin States. However, those of us who are charged with the responsibility of protecting Wyoming's interests must look beyond the legalities to the practical problems of the future as we see them.

FUNDAMENTAL PROVISIONS RECOMMENDED FOR INCLUSION

This being the case, we recommend for inclusion in any Colorado River Basin project legislation the following fundamental provisions:

1. There should be authorized, concurrently with the central Arizona project, a project which will import into the Colorado River drainage or its service area, sufficient water to satisfy the Mexican Treaty burden. The cost of this importation project should be a nonreimbursable obligation of the United States.

2. In conjunction with the foregoing, there should be a provision for an immediate reconnaissance study of all possible sources of augmentation of the water supply of the Colorado River system. The satisfaction of the Mexican Treaty burden would only partially solve the water supply problem of the Colorado River Basin, and the long-range need for further augmentation will still exist even after the first provision has been fulfilled.

3. As an integral part of any Colorado River Basin project authorization, there should be sufficient revenue-producing features to assure adequate financing of the augmentation measures needed to supplement the water supply in the drainage.

4. The authorization of the San Miguel project, West Divide project, and the Dallas Creek project in the State of Colorado should be conditioned upon completion of the importation project to relieve the Colorado River Basin of the Mexican Treaty burden.

5. If a priority to the consumptive use of 4.4 million acre-feet annually is granted to California by Arizona, it should be clearly stated that such priority involves only those two States and does not involve any granting of priority to California by the Upper Basin.

EXPLANATION OF FUNDAMENTAL PROVISIONS

PROVISION NO. 1

The first of the foregoing suggestions concerns authorization of an importation project to satisfy the Mexican Treaty obligation. We recognize that the Northwest States are not ready to accept the possibility of a diversion from their area. We believe that consideration

should be given to the possibility of importing water for this purpose from the surplus of northern California streams. Physical feasibility of such an undertaking has been established on a reconnaissance level by the Department of Interior in the interim report on the united western investigation prepared in December of 1950 and the 1964 Report on the Pacific Southwest Water Plan. Minor adaptations of the plans as presented in these reports would result in supplying sufficient water to those portions of California presently served from the Colorado River to enable augmentation to the water supply in the Colorado River system on an exchange basis. We further believe that the Mexican Treaty burden is a national rather than a regional or sectional obligation. When the Mexican Treaty was entered into, it was considered that 1.5 million acre-feet could be delivered to Mexico annually without impairing the availability for use in the Upper and Lower Basin of the quantities allocated by the Colorado River compact of 1922. The reason for this optimism is apparent from the report of the Senate Foreign Relations Committee on the treaty. The committee stated that "according to all the testimony, the average annual virgin runoff from the Colorado River Basin is approximately 18 million acre-feet a year." (Senate Ex. Rept. No. 2, 79th Cong., first sess., p. 4.)

In addition, the Mexican Treaty burden was negotiated during the period of hostilities in World War II, simultaneously with the treaty pertaining to the Rio Grande, and the motivations on the part of the negotiators included other factors of international significance beyond a simple division of the water between the two nations. The present knowledge indicates that the dependable flow of the river is far less than was anticipated when this treaty was negotiated. These factors, coupled with the prospect of bitter litigation between the Upper and Lower Basins concerning the division of this burden, are ample justification for recognizing that the cost of importing sufficient water into the basin to satisfy the Mexican Treaty burden is a national obligation.

PROVISION NO. 2

In regard to the second suggestion concerning an immediate reconnaissance study of all possible sources of augmentation for the Colorado River, the ultimate solution to the problems of the river depends on developing a substantial additional amount of water to supplement the historic supply. The proposed importation of a sufficient quantity of water to satisfy the Mexican Treaty burden, while a step in the right direction will not be the final solution to the water supply problem in the Colorado River Basin. Consequently, it is imperative that studies be undertaken to determine the most feasible method of augmenting the Colorado River water supply so that future shortages of water in this dynamic and important region of the country are not allowed to develop. We should like to emphasize the importance of properly integrating the first proposal providing for importation to relieve the Mexican Treaty burden, with this proposed broad study of the total problems related to augmentation.

Several of the bills which have been introduced in the 90th Congress concerning the proposed Colorado River Basin project have provided that the augmentation studies should be accomplished by a National Water Commission. Wyoming's feelings about the creation

of a National Water Commission are ambivalent. We clearly see the value of such a commission being created to review existing national policy on water resource development and to suggest needed changes in that policy. We do not agree that such a commission should undertake this particular augmentation study or other studies of the specific water problems of the Western States. While we recognize that the national interest is involved in the solution of these problems, we also recognize that the water problems of the arid West are fundamentally different than those of the remainder of the United States. If such a commission is so created as to undertake studies of the entire Nation, the majority of its members will likely come from the population centers of the Eastern United States with an orientation toward the problems typical of that area, including the riparian doctrine, humid climate and problems related to water pollution. In the West, our orientation relates to the appropriative doctrine, arid climate and interstate compact or court decree apportionment of short water resources.

A study of such great significance to the Western States as this promises to be should be carried out by people who are thoroughly indoctrinated in western water matters. We would prefer the approach outlined in the proposed Western United States Water Investigation Act of 1967, introduced by Senator Moss (S. 1429), to that of the National Water Commission making this particular study.

PROVISION NO. 3

The third suggestion concerning the inclusion of sufficient revenue-producing features to provide for the financing of an augmentation program, is included because of the need to build up a fund which will provide the money to carry out the augmentation program discussed previously. Our fundamental interest in this area is that adequate funds should be available for the augmentation project, and that they should be set aside for that purpose. While Wyoming would prefer to see both Hualapai and Marble Canyon Dams included in this project, we recognize the difficulty involved with Marble Canyon Dam. The suggestion recently presented by the Los Angeles Department of Water and Power to the effect that Hualapai Reservoir be increased in its power generation capacity and changed to adapt it for operation as a combined hydropumped storage peaking project appears to increase the power revenues from Hualapai to the point where Marble Canyon Dam may not be needed. This suggested modification of the power generating facilities connected with the Colorado River Basin project provides an alternative to the construction of both power dams, which has been such a troublesome issue in the past. We support the further study of this proposal, and providing that adequate revenues would be derived from the enlarged generating capacity of Hualapai Reservoir to finance the augmentation program, we would agree that Marble Canyon Dam should be dropped.

The proposal contained in S. 1013 which would provide pumping power for the central Arizona project by prepurchase from a thermal generating plant is not seen as a satisfactory substitute for the power dams. The purpose of the two proposed dams was only partly to provide pumping power for the central Arizona project. More impor-

tantly, their purpose was to provide enough revenue to pay for themselves and other parts of the project in addition to building up a fund to pay for the importation project and later additional augmentation projects. The thermal generating proposal would produce insufficient revenue for these purposes.

PROVISION NO. 4

The fourth suggestion concerning the proposed conditional authorization of three projects in the State of Colorado is included because of our previously expressed concern over the present shortage of water in the Colorado River as compared to the demands which are being placed upon it. If these projects are authorized and construction is deferred as suggested, Colorado will be assured that her projects will ultimately be built, but there is no chance that they will become a burden on the river in excess of Colorado's apportionment of Colorado River water. We reiterate that we cannot be reconciled to the propriety of authorizing Federal projects in excess of apportionments under the Colorado River compacts.

PROVISION NO. 5

In regard to suggestion No. 5, involving the California priority, we have some concern that the language used in some of the bills concerning this proposal could be interpreted to mean that California was being granted a priority which could be effective against the Upper Basin. We suggest that the following sentence should be added to any section of the legislation which grants such a priority:

Nothing in this section shall be construed as creating a priority for California as against the States of the Upper Division.

Several of the bills which propose to authorize a Colorado River Basin project provide that the priority of California for the use of 4.4 million acre-feet per year would cease to be effective when facilities capable of delivering 2.5 million acre-feet per year into the main-stream of the Colorado River from outside sources have been completed. Our first suggestion for concurrent authorization of an importation project to satisfy the Mexican Treaty burden, when fulfilled, would probably terminate the California priority. However, if such an importation project was not included in current legislation, then a time limitation on the priority to California would appear to us to be advisable. In order to provide adequate time for a thorough study of the augmentation question, plus sufficient time to construct such a project, we would suggest that a 35-year limitation be imposed on the California priority. With such a limitation, the possibility of the priority becoming a substitute for California's support of an augmentation project would be lessened.

ADDITIONAL PROVISIONS

In addition to the foregoing fundamentals, there are a number of other provisions which we favor for inclusion in this legislation, many of which have been included in one or more bills introduced in the Congress to date. These include the following:

A. The provisions of title VI of S. 1242 have our general endorsement. However, the operating criteria outlined in section 602 of this bill implies that the Upper Basin may have an obligation for delivery of water to the Lower Basin under article III(c) of the Colorado River compact. We do not agree with such an interpretation of the compact, and would prefer that paragraph 602(a)(1) be deleted from the criteria as stated in the bill.

B. Section 502 of S. 1242, providing for reimbursement of the Upper Colorado River Basin Fund from the Colorado River Development Fund for all expenditures heretofore or hereafter made to meet deficiencies in generation at Hoover Dam during the filling period of storage units of the Colorado River storage project has our complete support.

C. We would favor the inclusion of an amendment to section 2 of the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), wherein reference is made to the Sublette project, to insert after the word "Sublette" the words "including a diversion of water to the North Platte River Basin in Wyoming". It is our desire that this proposal be investigated as rapidly as possible so that Wyoming will have reliable information upon which to base a decision as to our next logical step in the development and utilization of our Colorado River compact apportionment. At present, it appears that the Sublette project, along with the diversion of water from the Green River to the North Platte, is probably the most feasible proposal for us to pursue in the near future and consequently we are desirous of expediting this study and report.

D. Wyoming supports the inclusion of a provision such as appears in S. 1242, section 501(c) to modify the unit size on the Seedskaadee project in Wyoming which is an authorized participating project of the Colorado River Storage Project Act. Climate and elevation are vital factors which must be taken into account when classifying land and establishing farm unit size and the present Seedskaadee formula does not make adequate provision for these factors. Our basic concern is to create opportunities for a stable and adequate family living and for community growth through irrigation development. Size of farms must be large enough to attain this objective.

ADEQUACY OF REVENUES IN THE UPPER COLORADO RIVER BASIN FUND

During the recent House hearings on this Colorado River Basin project legislation, an exchange of conversation took place, during which Congressman Aspinall implied that Wyoming and Utah could not authorize new participating projects at this particular time because of the inadequacy of expected funds in the Upper Colorado River Basin Fund. The conversation referred to was as follows:

CONGRESSMAN ASPINALL. Now, the position that Wyoming finds itself in, and the position that the State of Utah finds itself in at the present time, is that they cannot have any additional project authorized, other than those which are presently authorized, until it is possible to see that there is going to be a sufficient amount of money from the basin fund to pay off that part that the users cannot pay within the 50-year period after the development period is allowed and after construction is finished. Is that right, Governor?

Governor HATHAWAY. That is right, Sir.

Mr. ASPINALL. Is that right, Senator.

Senator HANSEN. Yes.

Mr. ASPINALL. Of course, that is what is holding up some of these projects in these two States. Now it so happens that our sister State, New Mexico, has been able, with the work that it has done and within its entitlement—not only of water but also of monies from the basin fund—to practically use all of its share of water from the Upper Basin by its present development as far as presently concerned. Will you agree with that?

Governor HATHAWAY. I believe that is right. New Mexico is close to that point.

Mr. ASPINALL. And is it not also true, when you consider LaBarge and Seedskadee and Lyman and Wyoming's share of the Savery-Pot Hook, that Wyoming has used its share of revenues in the basin account for the next 50 years or more, as far as that is concerned, because the construction period has not yet taken place. Wyoming cannot look, under the present situation, for any additional authorizations for construction, or least for construction, for a few years hence. Is that not true?

Governor HATHAWAY. I cannot answer that, sir; I do not know.

In an effort to clarify this matter, the Bureau of Reclamation was requested to explain the situation regarding the Upper Colorado River Basin Fund and the commitments which have been made in the individual States against that fund, as well as any limitations concerning the authorization of additional projects within the State of Wyoming. In order that the record might be clear regarding this matter, we are attaching hereto a copy of a letter dated April 17, 1967, from Mr. Floyd E. Dominy, Commissioner of the Bureau of Reclamation, to Mr. Floyd A. Bishop, Wyoming State Engineer. This letter clarifies the matter raised by Congressman Aspinall referred to previously. From Mr. Dominy's reply, it appears that revenues apportioned to the State of Wyoming in the Upper Colorado River Basin Fund are expected to be available for repayment or irrigation costs of additional participating projects beginning in the year 2003 and by the year 2049 about \$160 million would be available providing that no additional Wyoming projects had been authorized in the meantime. In view of the traditional 10-year development period and 50-year repayment period for reclamation projects, if a new Wyoming project were to be authorized in 1967, the repayment period would not terminate until 2027, at which time Wyoming's share of the fund would amount to something like \$75 million. From this it seems obvious that there are no limitations due to the inadequacy of expected funds in the Upper Colorado River Basin Fund apportioned to Wyoming which would prohibit the authorization of additional projects in Wyoming at the present time or in the future. It is our desire that the record of this hearing should correctly reflect the fact that such a limitation as was implied during the House hearings does not in reality exist.

CONCLUSION

Wyoming has continually faced a difficult choice on this Colorado River Basin legislation. We are reluctant to oppose a project which makes it possible for Arizona to utilize her apportionment of Colorado River Basin waters. However, as a fundamental precept, we think it unwise to authorize Federal projects which require a greater amount of water than is apportioned to the various entities by interstate compact agreements. We believe that these compacts state the supreme and only method of allocating the waters of the Colorado River. We think it is wrong to authorize Federal projects which will utilize in the Lower Basin a greater apportionment of water than the Lower Basin entitlement, and we have the same reservation as it applies to

the authorization of Federal projects in the Upper Basin for any State in excess of its apportionment.

We must emphasize again our regret that we cannot support Arizona in her project as matters now stand. However, the authorization of a Colorado River Basin project without the inclusion of the basic provisions which have been outlined herein to protect the interests of all the Colorado River Basin States poses a serious jeopardy to Wyoming's future. We seek to eliminate these threats so we can support the legislation.

Thank you, Mr. Chairman.

Senator ANDERSON. Thank you, Mr. Bishop.

(The letters referred to follow:)

STATE OF WYOMING,
STATE ENGINEER'S OFFICE,
Cheyenne, March 24, 1967.

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Longworth House Office Building,
Washington, D.C.
(Attention, Hon. Harold T. Johnson, Chairman).

DEAR CHAIRMAN JOHNSON: In testimony before your Subcommittee on March 16, 1967, Governor Hathaway of Wyoming expressed concern over the proposed authorization of the San Miguel Project, West Divide Project, and Dallas Creek Project in Colorado. Our analysis of the available water supply indicates that Colorado may be in excess of her Compact apportionment of Colorado River water if these three projects are constructed. In an effort to provide your Subcommittee with the facts which are the basis for Wyoming's concern in this regard, we are submitting herewith a detailed analysis of the situation. The figures used in this analysis are taken from a letter dated March 11, 1966, from Mr. Ival Goslin, Executive Director of the Upper Colorado River Commission, to Mr. Floyd Bishop, Wyoming State Engineer. Appropriate modifications have been made in Mr. Goslin's figures to reflect changes suggested by Mr. Felix L. Sparks, Director of the Colorado Water Conservation Board, in a letter to Mr. Jay Bingham dated March 15, 1966. Copies of each of the above-mentioned letters are attached hereto and made a part hereof.

In view of the fact that the information which we are submitting herewith appears to be pertinent to the subject at hand, request is hereby made that all of this information be included in the hearing record.

The analysis referred to above follows:

1. Present Colorado Depletions:	1,000 acre-feet
Yampa and Green Rivers.....	65
Hayden steam plant.....	4
White River.....	34
Gunnison River.....	407
Smith Fork project.....	6
Paonia project.....	10
Colorado River—Main stream.....	481
Collbran project.....	7
Pueblo-Eagle River division.....	8
Colorado-Big Thompson project.....	260
Small ditches.....	1
Colorado Springs-Blue River.....	45
Denver-Blue River.....	15
Denver-Moffat Tunnel.....	65
Denver-Williams Fork.....	10
Busk-Ivanhoe Tunnel.....	5
Independence Pass Tunnel.....	38
Grand River ditch.....	20
San Juan and Dolores Rivers.....	289
Florida project.....	16
Total present depletions.....	<u>1,786</u>

2. Estimated depletions of Federal projects already authorized in Colorado:

Savery-Pot Hook	26
Bostwick Park	4
Fruitland Mesa	28
Fryingpan-Arkansas	70
Ruedi Reservoir, municipal and industrial	6
Silt	6
Total depletions from presently authorized Federal projects	140

3. Probable future depletions:

Hayden steamplant	12
Homestake Creek diversion	74
Pueblo-Eagle River	3
Denver-Blue River	215
Denver-Moffat Tunnel	
Denver-William Fork	
Denver-Eagle and Piney Rivers	
Englewood-Moffat Tunnel	10
Independence Pass Tunnel	14
Colorado Springs-Blue River	6
Municipal and industrial from Green Mountain Reservoir	12
Total probable future depletions	346

4. Proposed authorizations by H.R. 3300:

Animas-LaPlata	106
Dolores	74
Dallas Creek	37
West Divide	76
San Miguel	85

Total depletions due to projects proposed to be authorized by H.R. 3300

378

5. Recapitulation of total Colorado depletions of Colorado River water:

Present depletions	1,786
Depletions due to presently authorized Federal projects	140
Probable future depletions	346
Depletions due to projects proposed to be authorized by H.R. 3300	378

Total Colorado depletions

2,650

NOTE.—The concurrence of Mr. Sparks to the foregoing figures as indicated in his letter of Mar. 15, 1966, referred to previously, lends special credence to these figures. It should also be noted that for several of the Federal projects involved, the depletions shown herein are less than those cited by the chairman of the full committee in testimony before the subcommittee on Mar. 17, 1967.

The engineering study of the water supply of the Colorado River prepared by Tipton & Kalmbach, Inc., was filed with your Committee at the time of the hearings pertaining to H.R. 4671 during the 89th Congress. This study was undertaken at the request of the Upper Colorado River Commission to determine on an independent and unbiased basis what the expected yield of the Colorado River system might be, based upon current technology.

While we do not concur in the theory that the Upper Basin is required to deliver an additional 750,000 acre-feet per year to defray a portion of the Mexican Treaty burden nor in the theory that the Upper Basin must deliver an average flow of 7½ million acre-feet per year at Lee Ferry, as advocated by some, we do recognize that these are matters of differing opinion which will probably have to be litigated ultimately unless they are settled in some other manner acceptable to both the Upper and Lower Divisions. Until such a settlement is definite, there appears to be no prudent course to follow in evaluating obligations on the available water supply except to assume that the Upper Division may have to deliver three-fourths of a million acre-feet of water per year in satisfaction of the Mexican Treaty burden, in addition to an average of 7½ million acre-feet per year under Article III (d) of the 1922 Compact.

The Tipton & Kalmbach study concludes that if it is assumed that all reservoirs authorized by the Upper Colorado River Storage Project are constructed and operating with a combined capacity of 29 million acre-feet, and if the delivery

made at Lee Ferry amounts to 8.25 million acre-feet per year, for satisfaction of the Compact and the Mexican Treaty burden, then the limit of the depletions in the states of the Upper Division would be 5.6 million acre-feet per year including reservoir evaporation, or an available 4.7 million acre-feet per annum after reservoir evaporation losses. (See page 21 of Part I, Text, Tipton & Kalmbach Report of July, 1965.)

Under the Compact, Colorado's share of the Upper Basin apportionment amounts to 51.75% of the total amount which is available to the Upper Basin, or 2.43 million acre-feet per year based upon the Tipton & Kalmbach study.

Comparing the estimates of total future Colorado depletions of the Colorado River, amounting to 2.65 million acre-feet per annum, with the figure of 2.43 million acre-feet per year to which Colorado is entitled under the Compact on the basis of the previously cited figures from the Tipton & Kalmbach Report, it can be seen that Colorado will be exceeding her apportionment by about 220,000 acre-feet per year. Deferral of the Dallas Creek Project, West Divide Project, and San Miguel Project would reduce this excess to about 22,000 acre-feet per year.

The key question involved here is whether or not the Upper Basin will be required to deliver water to fulfill the Mexican Treaty burden, and if so, how much. Emphasis should be placed on the fact that we do not agree that the Upper Basin has any obligation to deliver water to fulfill the Mexican Treaty burden, but until this question is resolved, it seems logical that we should assume that such a burden may ultimately be thrust upon us. If we could assume there was no obligation on the Upper Basin to deliver Mexican Treaty water, these three Colorado projects would probably not exceed Colorado's apportionment under the Compacts.

The realities of the yield of this river and the obligations which have been placed upon it cannot be ignored. The original negotiators of the Compact used what have proven to be incorrect figures in dividing the waters of the river. We simply cannot go on using incorrect figures in analyzing additional projects which place a burden on the river. We believe it is unrealistic to be talking about an available water supply to the Upper Basin of anything like 7,500,000 acre-feet per year. The Tipton & Kalmbach figures show nearly two million acre-feet less than this to be available on a long term average. We cannot be reconciled to the propriety of authorizing federal projects in excess of the water supply available to fulfill apportionments made under the Colorado River Compacts. The foregoing analysis shows clearly the reasons for our concern over authorization of the three Colorado projects mentioned.

We appreciate the opportunity of presenting this additional information to the Subcommittee.

Respectfully submitted.

FLOYD A. BISHOP,
State Engineer.

UPPER COLORADO RIVER COMMISSION,
Salt Lake City, Utah, March 11, 1966.

Mr. FLOYD A. BISHOP,
*State Engineer,
State Capitol Building,
Cheyenne, Wyo.*

DEAR FLOYD: In your letter of February 24, 1966 you requested a determination for each of the Upper Division States of the following items:

1. Quantities of water currently being used.
2. Quantities of water which will be used under projects which are currently authorized.
3. Any other commitments of water use for the future.
4. Quantities of water which would be used under projects proposed to be authorized in H.R. 4671.

We have compiled the attached tables in response to your request. The sources of the various figures are indicated.

In order to make the figures more meaningful the following explanation is offered:

1. There is some degree of opinion involved in the compilations. For instance, you will note that we purposely avoided using the term "committed uses" because that term is often interpreted as having an element of legality and finality from which there is little possibility of deviation. Instead, we have used the term "probable future depletions." This term is to be construed as meaning that at this time in our opinion the projects or uses itemized under it are the most likely ones

to occur out of a universe of probabilities. If there were sufficient water many more projects and water uses could and would be materialized, some of which are even now being contemplated and studied, and some of which may not even be presently named.

2. Although we have attempted to list the most probable future depletions, we must admit that some of those on our list are a considerable time in the future either because (a) they will not be needed for an indefinite period, or (b) financial and economic conditions may preclude their development, or (c) changes of uses of water (such as, change from agriculture to municipal and industrial, etc.) may be made to fulfill some of the depletions that we have listed as "probable future," or (d) other uses may develop ahead of those listed.

3. In our figures we have not included a factor for "salvage" of water by use. A "salvage" factor averaging about 4% of the uses, as found in the 1948 Final Report of the Engineering Advisory Committee to the Upper Colorado River Basin Compact Commission, would increase the computed compact allotment to each State, except Arizona, of Table II of the Summary. We have not used a "salvage" factor because many of the depletion figures themselves may not be within the limits of the above percentages (witness the changes in estimated depletions on the same project from one report to another of the USBR), and because there is no real agreement with regard to the amount of water salvaged by use.

4. A copy of this letter with the attached tables is being transmitted to each of the parties to whom you sent a copy of your letter of February 24th. We hope that you and each party will examine the tables closely and let us have the benefit of any of your criticisms, suggestions, or comments.

Sincerely yours,

IVAL V. GOSLIN,
Executive Director.

Colorado

	Units: 1,000 acre-feet accumulated
1. Present depletions:	
Yampa and Green Rivers.....	65
Hayden Steam project.....	4
White River.....	34
Gunnison River.....	407
Smith Fork project.....	6
Paonia project.....	10
Colorado River—Main stream.....	481
Collbran project.....	7
Pueblo—Eagle River division.....	8
Colorado—Big Thompson project.....	260
Small ditches.....	1
Colorado Springs—Blue River.....	45
Denver—Blue River.....	15
Denver—Moffat Tunnel.....	65
Denver—Williams Fork.....	10
Busk—Ivanhoe Tunnel.....	5
Independence Pass Tunnel.....	38
Grand River ditch.....	20
San Juan and Dolores Rivers.....	289
Florida project.....	16
Total	<u><u>1,786</u></u>
2. Authorized Federal projects:	
Savery—Pot Hook.....	26
Bostwick Park.....	4
Fruitland Mesa.....	28
Fryingpan—Arkansas.....	70
Ruedi Reservoir, municipal and industrial.....	² 40
Silt.....	6
Mainstream evaporation.....	342
Total	<u><u>³ 516</u></u>

¹ Colorado Water Conservation Board tabulation, "appendix A."

² Should be only 6 (Sparks, Apr. 15, 1966).

³ From Bureau of Reclamation, January 1966 report, "Summary of Potential Water Resource Developments in the Upper Colorado River Basin of Colorado."

Colorado—Continued

	Units: 1,000 acre-feet accumulated
3. Probable future depletions:	
Hayden Steam Plant.....	12
Homestake Creek diversion.....	74
Pueblo-Eagle River.....	3
Denver-Blue River.....	215
Denver-Moffat Tunnel.....	
Denver-William Fork.....	
Denver-Eagle and Piney Rivers.....	
Eaglewood-Moffat Tunnel.....	10
Independence Pass Tunnel.....	14
Colorado Springs—Blue River.....	6
Four Counties water project.....	40
Municipal and industrial from Green Mountain Reservoir.....	12
Total	386
4. Proposed authorization—H.R. 4671:	
Animas-La Plata.....	106
Dolores.....	87
Dallas Creek.....	37
West Divide.....	76
San Miguel.....	85
Total	391
Grand total.....	3,079
Grand total.....	2,992

⁴ Reduced from 240 to 215 in view of possible conflict of water uses on Eagle and Piney Rivers with expanded Homestake project.

⁵ Should be omitted (Sparks, Apr. 15, 1966).

⁶ March 1966 supplemental report by Bureau of Reclamation.

⁷ November 1963 feasibility report by Bureau of Reclamation.

⁸ Should be 74,000 (Sparks, Apr. 15, 1966).

⁹ February 1966 feasibility report by Bureau of Reclamation.

¹⁰ March 1966 feasibility report by Bureau of Reclamation.

¹¹ With reduction suggested by Sparks.

New Mexico

	Units: 1,000 acre-feet accumulated
1. Present depletions:	
Utah construction.....	15
Navajo Reservoir evaporation.....	20
Hammond.....	10
Other existing uses.....	100
Total	145
2. Authorized Federal projects:	
San Juan-Chama.....	110
Navajo Indian irrigation.....	250
Mainstream evaporation.....	74
Navajo Reservoir evaporation.....	10
Total	444
3. Probable future depletions:	
Town of Farmington.....	5
Utah construction.....	25
Navajo Reservoir contracts.....	100
Navajo Indian Hogback.....	10
Total	140

¹ From data submitted by New Mexico for R. J. Tipton report, July 1965.

New Mexico—Continued

	Units: 1,000 acre-feet accumulated
4. Proposed authorizations—H.R. 4671:	
Animas-La Platta.....	34
Total	² 34
Grand total.....	763

¹ March 1966 supplemental report by Bureau of Reclamation.

	Units: 1,000 acre-feet accumulated
Utah	
1. Present depletions:	
Depletions as of 1952.....	407
Subsequent Utah Water & Power Board projects.....	25
Municipal and industrial uses not included elsewhere.....	4
Private developments.....	3
Miscellaneous exports.....	108
Central Utah project Vernal unit.....	10
Miscellaneous evaporation.....	22
Total	¹ 579
2. Authorized Federal projects:	
Central Utah project:	
Bonneville unit.....	166
Upalco unit.....	20
Jensen unit.....	10
Emery County project.....	17
Mainstream evaporation.....	152
Total	² 365
3. Probable future depletions:	
Uintah Unit central Utah project.....	20
Kaiparowits power development.....	102
Total	³ 122
4. Proposed authorizations—H.R. 4671.....	0
Grand total.....	1,066

¹ From Utah data furnished for R. J. Tipton report, July 1965.² From Bureau of Reclamation report, January 1966, "Summary of Potential Water Resources in the Upper Colorado River Basin in Utah."

	Units: 1,000 acre-feet accumulated
Wyoming	
1. Present depletions.....	¹ 267
Total	267
2. Authorized Federal projects:	
Seedskaadee	165
Lyman	10
Savery-Pot Hook.....	12
Mainstream evaporation.....	92
Total	¹ 279
3. Probable future depletions:	
Westvaco Industrial.....	41
Cheyenne and Laramie Division.....	30
Total	¹ 71
4. Proposed authorizations—H.R. 4671.....	0
Grand total.....	617

¹ From Bureau of Reclamation report, January 1966, "Summary of Potential Water Resource Developments in the Upper Colorado River Basin of Wyoming."

SUMMARY

TABLE I.—Upper Colorado River Basin depletions

[1,000 acre-feet]

	Arizona	Colorado	New Mexico	Utah	Wyoming	Total
1. Present.....	11	1,786	145	579	267	2,788
2. Authorized Federal projects.....		482	444	365	279	1,604
3. Probable future.....	39	346	140	122	71	758
4. Proposed authorizations, H. R. 4671.....		378	34			428
Total.....	50	2,992	763	1,066	617	5,575

TABLE II.—Computed compact allotments based on various assumed water supplies

[In thousands of acre-feet]

	Arizona	Colorado	New Mexico	Utah	Wyoming	Total
7,500,000 acre-feet available.....	50	3,855	838	1,714	1,043	7,500
6,300,000 acre-feet available.....	50	3,234	703	1,438	875	6,300
5,600,000 acre-feet available.....	50	2,872	624	1,277	777	5,600
5,800,000 acre-feet available.....	50	2,976	647	1,322	806	5,800

¹ Based on full compact amount being available.² Amount from Tipton report limited by historic flow and 7,500,000 acre-foot Lee Ferry delivery.³ Amount from Tipton report limited by historic flow and 8,250,000 acre-foot Lee Ferry delivery.⁴ Amount available as estimated by U.S. Bureau of Reclamation.

DENVER, COLO., March 15, 1966.

MR. JAY R. BINGHAM,
 Director, Utah Power & Water Board,
 State Capitol, Salt Lake City, Utah.

DEAR JAY: I have not been able to find the memorandum which you said you addressed to me after the Cheyenne meeting. However, we recently received a copy of a water supply study from the Upper Colorado River Commission which is directed to Floyd Bishop. It may be that that memorandum will answer your purposes.

I think we are at substantial concurrence with the Colorado portion of the Upper Colorado River Commission memorandum with three exceptions. In paragraph 2 with the heading "Authorized Federal Projects" the memorandum shows 40,000 acre-feet of water from Ruedi Reservoir for municipal and industrial purposes. The only information we have at this time is that 6,000 acre-feet has been allocated for M & I purposes. I have no idea where the figure 40,000 acre-feet came from. Under paragraph 3 entitled "Probable Future Depletions" we take exception to the inclusion of the item of 40,000 acre-feet for the Four Counties water project. Such a project is not now in existence or under construction and we have some doubt that it ever will be. It occupies a last priority under our depletion tables and should be omitted from the Upper Colorado River Commission memorandum. Under paragraph 4 entitled "Proposed Authorization—H.R. 4671" the depletion for the Dolores Project is shown at 87,000 feet. We do not agree with this depletion figure as we believe the Bureau made some error in their studies. The depletion figure which we are using for that project is 74,000 acre-feet.

If there is further information I can furnish, please advise.

Sincerely,

FELIX L. SPARKS,
 Director.

U.S. DEPARTMENT OF THE INTERIOR,
 BUREAU OF RECLAMATION,
 Washington, D.C., April 17, 1967.

MR. FLOYD A. BISHOP,
 State Engineer,
 Cheyenne, Wyo.

DEAR MR. BISHOP: This is in reply to your letter of March 20, 1967, to Regional Director D. L. Crandall. You inquired concerning the status of Wyoming's share of Upper Colorado River Basin Fund revenues.

The basic procedures and guidelines for financing the Colorado River Storage Project and participating projects are set forth in Section 5 of the authorizing Act of April 11, 1956 (Public Law 84-485, 70 Stat. 105). In substance, the section provides that all funds appropriated for the purposes of carrying out the provisions of the act (except those appropriated for the construction and operation of specific recreation and fish and wildlife facilities which are covered in Section 8) and all revenues collected in the operation of the Colorado River Storage Project and participating projects will be credited to a separate fund in the Treasury of the United States known as the Upper Colorado River Basin Fund and used to repay the reimbursable costs of the authorized developments. Within this fund, separate accounts will be kept for the Colorado River Storage Project and for each participating project or unit thereof.

In general, revenues credited to the basin fund from a participating project will be used to pay costs pertaining to that project and to the project purpose from which the revenues were derived. Power revenues from the storage project and participating projects will be used to repay costs of the storage project and participating projects allocated to power and the costs of the storage project allocated to irrigation. The storage project revenues remaining will then be used to repay irrigation costs of participating projects that are beyond the repayment ability of the project irrigators. Surplus revenues accruing from consumptive uses of water from storage units are apportioned to the state which is charged with the depletions.

Surplus power revenues are apportioned as follows:

	Percent		Percent
Colorado -----	46.0	Wyoming -----	15.5
Utah -----	21.5	New Mexico -----	17.0

The reimbursable costs of the storage project and participating projects are to be repaid within 50 years following completion of construction and appropriate development period of each unit, project, or separable feature. The Congress in Section 6 of the authorizing act requires the Secretary of the Interior to submit annually to the Congress a report showing the status of revenues from, and the cost of constructing, operating, and maintaining, the storage project and participating projects.

Revenues apportioned to the State of Wyoming are expected to be available for repayment of irrigation costs of participating projects beginning in year 2003, and by year 2049 about \$160 million would be available. The tabulation below shows Wyoming's presently committed utilization of these revenues.

Utilization of apportioned revenues, Colorado River storage project and participating projects

(Dollars amounts in thousands)

Project or unit (in order of construction)	Assistance required	End of repayment period
Eden.....	\$13,400	2028-30
Seedskadee.....	30,804	2033-37
Lyman.....	7,435	2023
Savery-Pot Hook.....	4,181	2028-34
Subtotal.....	55,770	-----
Through 2049.....	55,770	-----

Apportioned revenue requirements for the three authorized participating projects and the Eden Project are estimated to total about \$56 million. It is estimated that by the year 2020, Wyoming's share of available basin fund revenues will have accumulated to a total of \$57 million and therefore will have provided for these commitments. Thereafter, Wyoming's uncommitted balance of basin fund revenues will accumulate at the rate of nearly \$4 million annually. By year 2049, Wyoming's apportioned revenues would exceed present commitments by about \$104 million.

As you know, construction of the authorized storage project and participating projects is still in progress and some changes in the estimates shown should be expected.

Sincerely yours,

FLOYD E. DOMINY, *Commissioner.*

Senator ANDERSON. Since we are meeting this afternoon at 2 o'clock, I think we had better delay the questions until this afternoon. We will reconvene at 2 o'clock.

(Whereupon, at 12:30 p.m., a recess was taken until 2 p.m. the same day.)

AFTERNOON SESSION

Senator ALLOTT (presiding). At the request of the chairman, who has to preside over another committee this afternoon, I have been asked to proceed with this matter at this time.

Mr. Bishop, I was very interested in your statement which has drawn some conclusions with which I cannot agree, of course, and I made some notes as you were going through it this morning, even though it was at the tail end of the morning session.

I would say this, first of all. I agree wholeheartedly with the statement that you make at the bottom of page 1 and the top of page 2 in that I do think that it is very vital that we see that the provisions of these compacts are not modified or circumvented by legislation currently being considered by this committee or subsequent legislation.

Now, on page 3, you get into the matter of excess compact apportionments, and I will come to that a little bit later. I must say that I agree with the statement which you make on page 4 that "particularly with respect to Colorado," some of the Upper Basin States, some of the others, that the Colorado compact does include and encompass the Gila River water as well as other waters of the lower basin which are tributary to the Colorado.

You discussed that very adequately and continuously through your statement through page 7, which also includes I note the diversions from the lower basin.

I suppose basically what I want to discuss with you mostly is the situation with respect to Colorado, and I must say we are not completely surprised because we do have telephones, get letters, and so forth, from you, but we in Colorado are a little astounded at the position that Wyoming has taken with respect to the Colorado projects.

Let me ask you first did you in your official position participate in the many, many conferences between the seven basin States which led up to the introduction of the Udall bill, H.R. 4671, last year?

STATEMENT OF FLOYD BISHOP; ACCOMPANIED BY JOHN BEREMAN, THOMAS CAHILL, AND C. J. KUIPER—Resumed

Mr. BISHOP. Yes, sir, Senator, I participated in as many of those as time would permit.

Senator ALLOTT. I presume that this is what everybody else who is representing a State did as much as their time would permit.

Mr. BISHOP. The only thing, we in Wyoming are fewer, and our personnel limitations, I think, are a little greater than the other States, and consequently we were not quite as active as some of the others.

Senator ALLOTT. Mr. Bishop, would you mind pulling that microphone toward you just a little? Thank you.

Now, what was your position on that bill when you testified in the House of Representatives last year?

Mr. BISHOP. At which hearing?

Senator ALLOTT. On H.R. 4671.

Mr. BISHOP. During the 1966 hearings?

Senator ALLOTT. In 1966 and 1965.

Mr. BISHOP. I think I can safely say that it was fundamentally the same as it is today. We advocated the concurrent authorization of an importation project, and we placed heavy emphasis on the need for augmentation of the water supply of the Colorado River in order to protect Wyoming's interest.

Senator ALLOTT. Did you or did you not support that bill?

Mr. BISHOP. Initially, Senator, we supported H.R. 4671, and as the various negotiating meetings went on, we felt that the basic principles which were important to Wyoming progressively eroded through these negotiation processes, and there was a point where we ultimately withdrew our support from H.R. 4671 because of this progressive erosion of those principles.

Senator ALLOTT. Did you do that at public hearings?

Mr. BISHOP. It was done by Governor Hansen through a letter to the President of the United States with copies to the Governors of the other seven Colorado Basin States.

Senator ALLOTT. When was that letter written?

Mr. BISHOP. August 16 I believe was the date.

Senator ALLOTT. That was after conclusions of hearings in the House?

Mr. BISHOP. I believe it was.

Senator ALLOTT. So as far as the advice of Congress was concerned with respect to the views of Wyoming, the hearings were closed in the House upon that bill with generally the support of Wyoming.

Mr. BISHOP. With some very definite provisions, sir. We supported the bill providing that the basic principles which we had advocated were included in the bill.

I should perhaps state, Senator Allott, that the bill that we supported was modified after it came out of the committee hearings.

Senator ALLOTT. It was not modified with respect to the Colorado projects, was it, the five Colorado projects?

Mr. BISHOP. I think it was not. However, we did, during those hearings, express reservations concerning three of the five Colorado projects as we have today.

Senator ALLOTT. I do not suppose you would be able to refer me to that testimony on hand.

Mr. BISHOP. I am sure we could find it very shortly, sir.

Senator ALLOTT. If you could refer me to it at a later point, that will be entirely satisfactory.

Mr. BISHOP. All right, sir.

Senator ALLOTT. Mr. Chairman, I have some notes here that I have not been able to lay my hands on. If you do not mind, I would just as soon defer for a moment until I can lay my hands on those notes.

Senator CHURCH. Certainly, Senator.

Senator KUCHEL, have you had a chance to question?

Senator KUCHEL. This appears to be a very scholarly paper, Mr. Bishop, and I want you to know that both the Democratic members of the Senate and the members of the Republican Party over here are

honored to have as a member of this committee your former Governor Cliff Hansen, whom we esteem highly, and whom I am sure represents the best interests of your State.

I think there are some technical questions, which I shall not ask but which do occur to me as I have run through your statement, relative to legal interpretations which might be put on the Colorado compact.

Would it be your testimony, however, on matters of policy, that the people of Wyoming would look with favor on any congressional action which would increase the amount of water in the river which could be placed to the beneficial use of the States in both basins?

Mr. BISHOP. I think I could say that; yes, sir. We feel that the cornerstone of our whole statement is the need for augmentation of the water supply of the whole Colorado River system.

Senator KUCHEL. I could not agree with you more. It seems to me that all of us are more or less in the same boat with respect to the growing problem of a water shortage.

Mr. BISHOP. Yes, sir.

Senator KUCHEL. It is not going to be solved, as someone said, by shuffling around shortages, taking a shortage away from one and giving it to another. Does that not make sense to you?

Mr. BISHOP. That is quite true.

Senator KUCHEL. Thank you, Mr. Chairman.

Senator ALLOTT. I think I am ready to proceed now, Mr. Bishop.

Senator CHURCH. Very well, Senator.

Mr. BISHOP. Would you like an answer, Senator Allott, to your previous question?

Senator ALLOTT. Yes; if you have the reference.

Mr. BISHOP. Mr. Bereman has it at hand.

Mr. BEREMAN. Senator Allott, in the hearings of the House committee in 1966, our Upper Colorado River commissioner, H. T. Person, presented the statement of the Governor and it appears beginning on page 1190.

Senator ALLOTT. Page 1190?

Mr. BEREMAN. Yes, sir; and I would read a pertinent line or two from it if you will bear with me.

Beginning at the very last sentence on page 1190 it says:

In view of these very serious limitations in the estimated amount of water available to the Upper Basin, we feel that a thorough study should be made of anticipated future depletions. The preliminary estimates of present use along with the anticipated future depletions which have been compiled by the Upper Colorado River Commission would indicate that Colorado could be using more than her apportionment of water under the two Colorado River compacts, if these five reclamation projects were to be constructed and placed in operation.

Then near the end of the statement on page 1192 he ends up with this statement:

Other than as set forth herein before, we are in substantial agreement with the provisions included in this new version of H.R. 4671.

Senator ALLOTT. Thank you for that. Now we had better understand what figures we are talking about when we are talking about apportionment of waters of the Upper Colorado. If the Upper Basin's apportionment entitlement under the study of the last 35 years of the river's flow would be 6.3, would you agree on that amount?

Mr. BISHOP. Yes, sir; I think I would. I believe it is reflected in the Tipton report.

Senator ALLOTT. The Tipton report said 6.3, and others have used the figure 6.2. I do not suppose we can ever get it down any finer than that. And so there would be taken from that approximately 700,000 acre-feet of water by reason of evaporation, is that correct?

Mr. BISHOP. That sounds about right; yes, sir.

Senator ALLOTT. And then that would leave approximately 5.5 million acre-feet to be used by the Upper Basin States; Colorado under the compact to receive 51.75 percent, Utah 23, Wyoming 14, and New Mexico 11.25; is that right?

Mr. BISHOP. It sounds reasonable; yes, sir.

Senator ALLOTT. Those are the figures of the compact, are they not?

Mr. BISHOP. Yes, sir. The main difference we have with the figures that you are quoting and those that are stated in our statement is the Mexican Treaty obligation of 750,000 acre-feet.

Senator ALLOTT. And you are figuring the Mexican Treaty obligation as the sole responsibility of the lower river then.

Mr. BISHOP. Sir, I think we made the point in our—

Senator ALLOTT. In arriving at your figures as to the amount of water available.

Mr. BISHOP. I think we made the point in our statement that we do not concur that this is an obligation of the Upper Basin. However, we feel, to be realistic and to be prudent in our analysis of the water supplies available, that we should consider possibly that the Upper Basin will ultimately be required to deliver water in satisfaction of the Mexican Treaty burden, and therefore we adopted that approach in this analysis.

Senator ALLOTT. Using the Tipton figure and subtracting from that the evaporation figure, which you agree is approximately correct, then Colorado under its percentage would be entitled to 2,846,250 acre-feet of total development, would it not?

Mr. BISHOP. I think that sounds about right.

Senator ALLOTT. And Colorado's prestorage act development is I believe about 1.7 million feet.

Mr. BISHOP. I think our tabulation shows it to be 1,786,000 acre-feet; yes, sir.

Senator ALLOTT. That is the exact figure.

Mr. BISHOP. Yes, sir.

Senator ALLOTT. Now, in discussing this with your Mr. Budd yesterday I referred to a letter of March 11, 1966, addressed to you by the Upper Colorado River Commission.

Mr. BISHOP. Yes, sir.

Senator ALLOTT. And you received that letter, and you have it and it is available to you there, is it?

Mr. BISHOP. I have it in front of me; yes.

Senator ALLOTT. That shows that, based upon 6.3 million acre-feet total, without deducting the evaporation first, Colorado's share of 6.3 million would be 3,234,375 acre-feet. It does not show it on that, but a little bit of arithmetic will give you that figure.

Now, in your particular item there, you have already testified there are present depletions of 1,786,000 feet. There are some corrections to

authorized Federal projects which do not show in your letter and I will give them to you now.

One is the figure for the Rudai Reservoir which is shown as 40,000 acre-feet and which should be only 6,000 acre-feet. So the total use under the authorized Federal projects to that point on the letter down through silt is 180,000 acre-feet. The main stream evaporation added to that is 342,000 feet. This results in 482,000 acre-feet of authorized Federal projects, including the main stream reservoir evaporation, instead of the 516,000 which is shown in the letter sent to you.

That brings the cumulative total of the present depletions, including the authorized projects and the main stream evaporation, to 2,268,000 acre-feet.

Mr. BEREMAN. Would you give me that figure again, sir, the total figure?

Senator ALLOTT. 2,268,000.

Then turning over to the next page for a moment, you find the proposed authorization in this bill, you would correct the Dolores from 87,000 to 74,000 acre-feet and that would give you a total for these five projects of 378,000 acre-feet.

Mr. BISHOP. Yes, sir.

I think, Senator Allott, you will find that if you refer to the tabulation in the letter which I believe you have in front of you which I submitted to Congressman Johnson during the House hearings, that these adjustments have been made as you suggest here.

Senator ALLOTT. They were not made in this letter which you received and which was discussed with Mr. Budd yesterday.

Mr. BISHOP. That is correct. They were made by me as a result of suggestions from —

Senator ALLOTT. I just wanted to be sure we were talking about the same thing.

Mr. BISHOP. Yes, sir.

Senator ALLOTT. I cannot see any chance of ever arriving anywhere in a situation when people are talking about two separate sets of figures. The probable future depletions of Colorado under item 3 of this letter, would amount to 346,000 acre-feet. So that the total of all of these items, as corrected, would be 2,992,000 acre-feet, which also debits to Colorado the amount of the main stream, the proportionate amount of main stream evaporation.

Now, based upon the 6.3 million acre-feet, Colorado's share on a 51.75 percent basis would be 3,234,375 acre-feet, which leaves us approximately 250,000 under net and below Colorado's share.

Mr. BISHOP. Senator, I really have not been able to follow your detailed figures. I think that the tabulations that we have presented here speak pretty well for themselves, and the concurrence that Mr. Sparks gave us with these figures, I think, indicates that they are reasonable at least.

I recognize the fact that there are perhaps minor inaccuracies and areas for possible disagreement in any set of figures that might be presented. I think the only point we are trying to make here is that Colorado, through the authorization of all five of these projects, would be very near if not in excess of her allocation of water under the compact, considering the historic water supply conditions, and under

those circumstances we feel that it would be only prudent to delay the actual construction of those three.

I would want to emphasize the fact that we support the authorization of all five Colorado projects with a condition that the three be delayed until the Mexican Treaty problem has been solved.

Senator ALLOTT. Continuing to refer to the same letter, Wyoming's proportion of 14 percent of the 6.3 million acre-feet would give you 875,000 acre-feet without any consideration of main stream evaporation.

Mr. BISHOP. That sounds about right; yes, sir.

Senator ALLOTT. That would be your full entitlement.

Now, present depletions are 267,000. The Savery-Pot Hook, of course, is one of the authorized Federal projects. Also authorized Federal projects for Wyoming are the Seedskadee, with 165,000 acre-feet; the Liman, with 10,000; Savery-Pot Hook with 12,000 and add mainstream evaporation of 92 on that and you get up to 279,000 acre-feet.

You have no present proposed authorizations, but probable future depletions would be Westvaco and other municipal and industrial uses of 41,000, the Cheyenne and Laramie division of 30,000, which together add up to 71,000. This would bring the Wyoming total up to 617,000 acre-feet.

Mr. BISHOP. Yes, sir.

Senator ALLOTT. Is that correct?

Mr. BISHOP. Yes, sir, that is what is shown in the tabulation from the Upper Colorado River Commission.

Senator ALLOTT. So the combined authorizations of the Colorado Storage Act and those since its passage are as follows to date: Colorado, 166,200 acre-feet; Utah, 225,000 acre-feet; Wyoming, 199,000 acre-feet; New Mexico, 374,000 acre-feet, and this despite the fact that Colorado's share is 51.75, and that of Wyoming is 14.

In other words, the authorizations under the Colorado Storage Act and those since, and I do not like to compare two States but I think we have to do it, authorized Wyoming 199,000 acre-feet and Colorado has had only authorized to date 166,200.

Mr. BISHOP. Yes, sir. You are speaking now, of course, of authorizations for Federal projects. I think Colorado is to be admired for the fact that much of their development on the Colorado River Basin has been carried on through private development, and, as a matter of fact, Wyoming is in a similar position in that regard.

Senator ALLOTT. I am talking about the authorization under the Colorado River Storage Act and those since under it, and it is pretty hard to escape that of the four Upper Basin States Colorado is the low man on the totem pole, even though its entitlement is the largest; in fact it is more than all the rest of them combined.

Mr. BISHOP. Yes, sir. You might say that is why we agree with your present authorization of two projects without any limitation. The only question we raise is with regard to water supply available, and I think it is a valid point as far as the water supply considerations are involved.

Senator ALLOTT. With the correction that we have gone over in the hearing, between the letter you received from the Upper River Com-

mission and the figures I gave you, there is no question but all of these added together, which includes mainstream evaporation, would only come to 2,992,000.

Mr. BISHOP. There is still a serious question in my mind, sir, about whether or not Colorado is in excess of her compact apportionment, if you can accept the basis on which we predicated our conclusion, and perhaps it would be helpful if I read from the Tipton report the basis that we used in arriving at that.

Senator ALLOTT. What page, please?

Mr. BISHOP. It is on page 21 of the text, part 1 of the Tipton report. Starting at the top of the page it says:

If it is assumed that the operating capacity of the Upper Colorado River storage project is 29 million acre-feet and if the delivery at Lee Ferry amounted to 7.5 million acre-feet per year, the depletions, beneficial consumptive use that is, in the States of the upper division of the Colorado River Basin would be limited to 6.3 million acre-feet per annum.

The net depletion excluding evaporation for the reservoirs of the Upper Colorado River storage project would be 5.6 million acre-feet.

If deliveries at Lee Ferry were 8.25 million acre-feet per year, the limit of depletions in the States of the upper division would be 5.6 million acre-feet including reservoir evaporation and a net of 4.7 million acre-feet excluding reservoir evaporation.

I think therein lies the main source of difference between our figures.

Senator ALLOTT. Let me ask you this. Has there ever been a year in which the lower Colorado has not received 7.5 million acre-feet?

Mr. BISHOP. Yes, sir.

Senator ALLOTT. Which years are they?

Mr. BISHOP. I think the last several years—the last 3 years I believe have been below. I do not recall the exact figures.

Senator ALLOTT. When 7.5 million have not been delivered?

Mr. BISHOP. I may be mistaken in that, but that is my recollection, that during the filling period of the upper Colorado River storage project reservoirs—

Senator ALLOTT. So that over a period of years, without any fence in the river, which is basically what Glen Canyon Dam is—

Mr. BISHOP. Yes, sir.

Senator ALLOTT. And except for the storage in the dam during the filling, they have received in the Lower Basin 7.5 million acre-feet. Now, there is not any real question in your mind, is there, Mr. Bishop, that with the Glen Canyon storage, that the Upper Basin will be able to deliver the 7.5 million acre-feet?

Mr. BISHOP. No, sir, I do not think there is any question but what we will be able to, if that was your question.

Senator ALLOTT. So the rather narrow course or path you have taken out of this first paragraph of Mr. Tipton's conclusion is based upon a rather extreme situation.

Mr. BISHOP. No, sir. It is based upon the Mexican Treaty obligation and whether or not the Upper Basin has an obligation in that regard.

Senator ALLOTT. Do you think there is any doubt that, if we take the extreme situation that Colorado and the upper States would not deliver one-half of the Mexican Treaty obligation if we so decided that we had to?

Mr. BISHOP. I think we could; yes, sir, but it would certainly limit the amount of water available for beneficial use in the upper States.

Senator ALLOTT. Without impairing the 6.3.

Mr. BISHOP. The Tipton report would indicate that it would reduce it to 4.7 or 5.6 if you include reservoir evaporation.

Senator ALLOTT. 5.6. But I have been including reservoir evaporation in every figure I have given you.

Mr. BISHOP. That is another source of confusion; yes, sir. We have excluded it and you have included it. I think we are both considering it, sir. It is just a matter of a different approach.

Senator ALLOTT. And at 5.6 million, using your figure, Colorado would still be entitled to 2,898,000 on a 51.75 basis, if that is the way you want to figure it.

Mr. BISHOP. Yes, sir; I think that is the correct figure if the evaporation losses are included in your figure.

Senator ALLOTT. In item 3 of your letter under Colorado, you have probable future depletions for Colorado which are not authorized. So that you could deduct from the 2,992,000 acre-feet another 346,000 acre-feet which is included in probable future depletions for which there is no present authorization.

Mr. BISHOP. Yes, sir. It is my understanding that these are private developments, and I am sure you know in much more detail than I would what is involved in these probable future depletions, but it was my understanding when they were presented that they are fairly firm as future developments in the State of Colorado.

Senator ALLOTT. For example, let us take one of them. One was the Hayden steamplant. You have 4,000 acre-feet in the present stream depletions under item 1, and you have 12,000 acre-feet under probable future depletions for this plant. I am sure you are just as aware as I am what the situation is with the Hayden plant as far as the Supreme Court is concerned.

I think it is very probable that that could be considered. But if you deduct the 346,000 acre-feet of probable future depletions from the 2,992,000, you still end up with a complete total of only 2,646,000 acre-feet depletions for Colorado present, authorized, and asked-for in this bill.

Mr. BISHOP. Yes, sir; that sounds about right.

About the only reply that I could give would be that Mr. Sparks' concurrence to this indicated to me that it was a fairly reasonable approach.

Senator ALLOTT. Mr. Sparks was in the room a minute ago, but he probably will be speaking for himself tomorrow with the Governor, but I am sure he never indicated to you that Colorado did not think it had every right to ask for the authorization of these five projects and still have what is left which it could develop.

Mr. BISHOP. I would not take issue with that, sir.

Senator ALLOTT. I think that is about all, except I would say one thing more, Mr. Bishop, about your statement. I have shared your concern, which you expressed on page 19, about the National Water Commission. As a matter of fact, I offered an amendment in the committee at the time that bill was being considered by the Senate to put certain classifications and categories of professional skills in that bill.

As you know, it came out with a general statement about people of broad experience, and so forth and so on, and particularly in view of the statement of the chairman of the Columbia River Basin Committee, which I inserted in the record yesterday, I share some of the skepticism which you state about it.

I also would say this. I share completely your point of view about the purposes of the dam. It would be my hope that you in conjunction with the Colorado people agree upon these figures, because I think when you do examine them, you will find that there is room for these five projects and still more future development for Colorado in the river.

That is all I have, Mr. Chairman.

Senator JACKSON. Thank you, Senator Allott.

Senator FANNIN?

Senator FANNIN. Thank you, Mr. Chairman.

Mr. Bishop, gentlemen, first of all I want to thank you for your recognition of Arizona's urgent need for water.

On the second page of your statement you say:

We realize that the struggle to have a central Arizona project approved has been long and hard. We recognize the demonstrated need for the project and the intimate connection between this project and Arizona's future growth and prosperity.

I assure you, gentlemen, that it is even beyond that, but I do thank you for that recognition. But I would appreciate, Mr. Bishop, knowing why you are using figures beyond the obligation of the compact and the Mexican Treaty. These figures show a very severe penalty to Arizona. For instance, on the Mexican Treaty you show 1,850,400 acre-feet. I am sure you realize that the Mexican Treaty imposes an obligation of 1.5 million acre-feet; is that right?

Mr. BISHOP. Yes, sir. These figures only reflect the actual deliveries to Mexico during the past 5-year period as reported in the Colorado report.

Senator FANNIN. But I am sure you use this to illustrate future estimates because you say, "The computed net losses of Hoover Dam to Mexico."

Mr. BISHOP. No, sir; these are not presented as future estimates.

Senator FANNIN. You say, "We would like to present some facts on Lower Basin use at the present time," and you are using this to illustrate what the flow of the river would be in the future.

Mr. BISHOP. Yes, sir; but I would stress the fact that we do say "use at the present time."

Senator FANNIN. That is right, but what value does it have? Your figures show that Arizona would only have 976,400 acre-feet. You know that there is channelization going on at the present time.

Mr. BISHOP. Yes, sir.

Senator FANNIN. And more is planned for the future. It is estimated that this would save perhaps 200,000 acre-feet. There is a total salvage river program which could save as much as 670,000 acre-feet. This program is approximately 50 percent authorized, so I think that all of these matters must be taken into consideration; especially am I concerned, too, when your figures provide California with 4,989,400 acre-feet. These figures in your statement tend to confuse the facts.

Mr. BISHOP. Senator Fannin, this appeared to be the best source that we could find for these particular things. The figure for California appeared to us to be low as well as the figure for Arizona.

I think you will recall that Commissioner Dominy, in his testimony on Tuesday, quoted the figure for Arizona of 1.13 million acre-feet. I think both figures are perhaps a little low, but they are quoted from—

Senator FANNIN. My point is, Mr. Bishop, that in using these figures, you are certainly not placing in the record any evidence that would be beneficial in our analysis of the future.

Mr. BISHOP. It seems to me that past use, for the past 5 years, is pretty good indication of what we can expect as far as the future might be.

Senator FANNIN. But you know that we will not be obligated to furnish Mexico 1,850,400 acre-feet.

Mr. BISHOP. Yes, sir; I certainly acknowledge that. However, the other factors more than compensate for that difference, the difference between the California use and the Arizona use.

Senator FANNIN. What other factors?

Mr. BISHOP. Well, the fact that we had quoted low figures for both Arizona and California.

Senator FANNIN. Do you figure that 4,989,400 acre-feet is low for California?

Mr. BISHOP. Yes, sir. The commonly quoted figure for California is 5.1 million, as I understand it.

Senator FANNIN. Do you feel that the Upper Basin is obligated to furnish California 4,989,400 acre-feet?

Mr. BISHOP. No, sir.

Senator FANNIN. Out of the 7.5 million the Upper Basin is to deliver, how much do you feel the Upper Basin is obligated to deliver for California?

Mr. BISHOP. Sir, we do not want to interject ourselves into the allocation of water between the Lower Basin States. We acknowledge our burden as far as the Upper Basin is concerned for delivery of water to Lee Ferry.

Senator FANNIN. I appreciate that.

Mr. BISHOP. Of course the Supreme Court decree says California is 4.4, yes, sir.

Senator FANNIN. That is what I wanted to establish here.

Mr. BISHOP. Yes, sir.

Senator FANNIN. On page 8, Mr. Bishop, and understand I am trying to correct the record—

Mr. BISHOP. Yes, sir.

Senator FANNIN (continuing). Because I do not think it is fair for the record to have figures that are not accurate.

Mr. BISHOP. Yes, sir.

Senator FANNIN. You say on page 8 in the last sentence:

We think it is both legally and morally wrong to authorize expensive federal projects for the lower basin which depend on availability of a greater portion of what isn't lower basin entitlement.

Using your figures, is it legally and morally right to compel Arizona to limit her usage to less than 1 million acre-feet? You are talking about what is legally and morally wrong. What is legally and morally right when you feel that we should make all the sacrifices?

Mr. BISHOP. Certainly we did not intend to imply, Senator Fannin, that Arizona should be limited to 1 million acre-feet or any other figure.

Senator FANNIN. Of course. You know that Arizona is suffering more than any other area for water. We are drastically in need of water.

Mr. BISHOP. Yes, sir; I surely agree with that.

Senator FANNIN. Do you think that the State that is most in the need of water should be the victim of the greatest penalty?

Mr. BISHOP. No; I do not think they should be penalized.

Senator FANNIN. Then you agree that Arizona should be given more consideration than you indicate in your statement.

Mr. BISHOP. All we ask is that the rights of the State of Wyoming be protected and that the Lower Basin as a whole live within their compact apportionments.

Senator FANNIN. But the figures in your statement would require Arizona to take far less than her compact allocation, is that not correct?

Mr. BISHOP. I do not follow the question, sir.

Senator FANNIN. Well, your figures list Arizona to receive only 976,400 acre-feet, and of course, this figure would be highly improper if it is out of a total Lower Basin delivery of 7.5 million acre-feet.

Mr. BISHOP. The Supreme Court decree certainly grants to Arizona the right to the use of more water.

Senator FANNIN. 2,800,000 acre-feet, is that not right?

Mr. BISHOP. Yes, sir; that is correct.

Senator FANNIN. Thank you for permitting me to correct the record. Thank you very much.

Senator JACKSON. Senator Hansen.

Senator HANSEN. Thank you very much, Mr. Chairman.

I think it would be out of order to emphasize one more time Wyoming's position and concern in these hearings. We certainly are being misunderstood if anyone assumes that Wyoming seeks to hurt Arizona, seeks to hurt California, or Colorado. These are all of our good neighbors, and we recognize the merit in working with and not against these States.

Our presentation here today—and I want to compliment our State engineer for having made a very able one—is not intended to do injury or to do disservice to our sister States—but rather to emphasize a problem which I think is common to the arid Pacific Southwest, and only if we are aware of the problem I think will best be able to take steps now to meet that problem and to resolve it before it becomes a major crisis as I am certain it will in the future.

I want to refer, if I may, to the difficulty that a witness has in trying to respond to questions from this side of the table. I refer to the questions that Senator Allott posed to our State engineer. He said at one point—and I think the record will disclose this—he spoke about the hypothetical figure or rather assumed figure of there being 6.3 million acre-feet of water available for the Upper Basin. Then he asked the State engineer now on the witness stand if 14 percent—which reflects Wyoming's share of that water—would not give Wyoming 875,000 acre-feet.

I am sure Mr. Bishop did not have time to check it out, but if my arithmetic is correct, when you multiply 14 percent by 6.3 million

acre-feet, you do not get 875,000 acre-feet. You get 882,000 acre-feet, and I emphasize this just to illustrate the problem that I think a witness has in trying to respond meaningfully to questions that involve detailed arithmetic problems when he does not have the opportunity of having those figures before him.

The difficulty that we have in trying to discuss on a common basis this problem that is before us comes about because at the time of the negotiation for the Colorado River compact back in 1922 it was assumed that there was a certain amount of water in the river. Mr. Bishop, I think, referred at one point in his testimony to the inaccurate figures, and I am certain that that point was clarified for the record.

You did not mean to question the integrity or the accuracy of the figures at the time they were made by the persons who had then surveyed the river. What he was seeking to do was to reflect the fact that since these early hydrologic studies have been made, generally speaking the flow in the river has been on a downward plane so that today we do not have the amount of water that was contemplated in the river back in 1922 nor the amount of water that we had reason to believe might have been in the river in 1946.

I was interested in listening to the representative of the State of Utah yesterday, Jay Bingham, make a presentation on behalf of the Governor of that State, the Honorable Calvin L. Rampton, and I would like to refer for the benefit of the record, if I may, to a chart that was included in his testimony. It follows page 9, and it depicts a four-bar graph which indicates the present depletion by the four Upper Basin States of the water in the Colorado River and probable future depletions, and I call this fact to the attention of the record in order that I might emphasize the point that the State engineer made.

I want to call attention to the testimony presented yesterday by the State of Utah.

Our State engineer, Mr. Bishop, made the point that Colorado has developed a number of privately financed reclamation projects, and according to the testimony of the representative of Utah yesterday, as disclosed in his statement, Colorado presently is depleting its share or is using, I should say, of its total share, some 46 percent, whereas Wyoming, according to the figures that Utah presented yesterday, is using only 26 percent, and I think for people to leave this room assuming that Colorado has developed the least percentage of its potential, the least percentage of its entitlement, does not reflect the fact that much of the development in the State of Colorado has been financed, and I just want to emphasize that.

Now, I am sorry that we are not able to move forward as Colorado has done, to develop projects with private capital to the extent that our sister State has been able to, but nevertheless the thing that concerns us is that of the total entitlement of water to the two States. There has been far less total development of the water to which Wyoming is entitled than has been true with the State of Colorado.

I was quite interested in the questions that were posed by the Senator from Arizona, my good friend Senator Fannin. He spoke about referring to the testimony presented by Mr. Bishop that Mexico has been using 1,850,400 feet, and he called attention to the discrepancy between that figure and the treaty or the amount of our treaty obligation which is 1,500,000 acre-feet.

I want to refer to this failure of these two figures to jibe by pointing out that despite the fact that the nation of Mexico has been getting 1,854,000 acre-feet of water, she is still faced with a very critical and increasingly difficult problem of salt in that water, and no one that I have talked to, certainly no one in the State Department nor anyone else, supposes that we ought to cut back the delivery of water to Mexico. All of the conversation that I have heard is that we ought to increase it, that we ought to try to dilute the accumulation of salt in that water.

Now, if this is done, let us be practical and realistic. Are we to assume that we can cut back from this figure of actual use the amount of water that has gone down to Mexico, or is it more likely, as I think it is, to assume that we will not cut back, but rather we will add to that water.

I know in this same chart that Mr. Bishop uses on page 7 of his testimony it reflects the fact that the State of California for the years between 1961 and 1963 inclusive has been receiving 4,989,400 acre-feet of water, and in that same chart the State of Arizona is using or has used for that period of time 976,400 acre-feet of water.

I think there is reason to believe—and this is the nub of Wyoming's concern—there is reason to believe that if we are to be able to develop our potential, if we are to be able to use at some time in the future—and I hope not too long in the future—the water to which Wyoming is rightly entitled under the terms of the compact, that we will have to deny some of the present use that exists, and we are going to have to go before the Congress if we seek Federal authorization and appropriation for funds for these projects—we are going to have to go before the Congress and say despite the fact that California and Arizona have demonstrated their ability to use this water, we would ask you to build projects which would certainly turn some of the projects in these Lower Basin States into less feasible projects than they are now, if we were to deny them and to take from them the water that they have demonstrated an ability to use and water the commitment of which is important and imperative to their projects.

This, as nearly as I can say, expresses our concern.

I should like to ask you, Mr. Bishop, have I stated fairly well the concerns of the State of Wyoming?

MR. BISHOP. Yes, sir, Senator Hansen, I think you have stated our concerns very well. Our fundamental concern is the overall shortage of water supply within the Colorado River system to satisfy the demands that are being made upon that river.

SENATOR FANNIN. Would the Senator yield for one explanation?

SENATOR HANSEN. Yes, indeed.

SENATOR FANNIN. I think the distinguished Senator should be reminded that we have constructed bypasses to cure the salinity problem. We have worked out a program with Mexico. Also the reason that the actual amount of water, very much of it, was released to Mexico was because Senator Wash Reservoir had not then been completed. It is now completed. Now with the Senator Reservoir, that will not happen.

SENATOR HANSEN. I want to thank my distinguished colleague, the Senator from Arizona, for calling my attention to what has been done in order to minimize a problem that this country recognizes and must

face with the Republic of Mexico. I think that his observation has been helpful.

In my mind it demonstrates once more the difficulty of finding a common language about which we can discuss this problem, because every State can have its own set of figures. And I say this certainly in full recognition of the fact that I know the representatives of the several States within the Colorado River Basin are trying to present as accurately and as impartially as they can the situation as they see it, as they view it, and I do not think there has been a single witness testify here in the last couple of days whose statement at some point or another could not be challenged.

I make the point once more that we have tried as best we can to present a realistic picture of the situation. I know that if we each had time we could probably nit-pick the testimony of every other person who has appeared before this committee, and yet the overall consideration I think that we should not lose sight of is the fact that we do have a serious shortage of water.

There is not now the amount of water in the river that was presumed to be there when the first compact was negotiated in 1922. There is not the water that was presumed to be in the river in 1948, and I hope this cycle will change. I hope that we will have increasingly heavy winters, but all I can say is that we would be very foolish indeed, in my judgment, to ignore what has been taking place and to lay plans which contemplate the appropriation of millions of dollars to construct projects which if done could do serious damage to other States that are signatory to these compacts within the Colorado River Basin without taking the added step that I think is indicated to look at the real problem, the real nub of the problem, the problem of getting more water into the basin.

If we do not meet with that one, then I say most regretfully that I am afraid Wyoming is going to have to oppose this project, and I hate so much to do that because we recognize that we ought to be working together and we have worked together.

We have supported every one of our sister States down through the years in encouraging the appropriation of funds for authorized projects.

But to be left out, as I believe we would be, residing at the head of the creek, as we do, and to make no attempt now to come to grips with the problem of water importation, seems to me to be a most unrealistic position for Wyoming's representatives to take.

I have no further questions, Mr. Chairman. Thank you.

Senator JACKSON. Thank you, Senator.

Senator HANSEN. If I may have a second, Mr. Chairman, I do have one little footnote to add here. When I called attention to the difficulty that a witness has in trying to agree or to take exception to a presentation of figures, I referred to the question by Senator Allott wherein he spoke about Wyoming's 14 percent of the 6.3 million acre-feet of water as being 875,000 acre-feet, and I said that according to my arithmetic it would be 882,000 acre-feet instead of 875,000 acre-feet. My attention has just been called to the fact that if you subtract from that figure, as I do not believe Senator Allott said, but as I am sure he would have said if I could have discussed it with him, if

you subtract from that the 50,000 acre-feet that is included in the formula here, then you would indeed come up with the 875,000, and I assume that is what you meant.

Senator ALLOTT. That is correct.

Senator HANSEN. Thank you, Mr. Chairman.

Senator JACKSON. Your question, Senator Hansen, I am sure has been helpful in trying to clarify this long and voluminous record. I appreciate your very able questioning of your people from Wyoming.

Senator KUCHEL?

Senator KUCHEL. Mr. Bishop, I invite your attention to the comments you made on page 23 concerning the position which the State of California has taken, urging that any legislation protect California's prior use to the reduced extent of 4.4 million acre-feet per year from that which it is actually using as you earlier suggested, 5.1 million-plus.

Mr. BISHOP. Yes, sir.

Senator KUCHEL. Mr. Bishop, with the type of directive to the Secretary of the Interior to determine the feasibility of importation, as was present in last year's House bill by Representative Udall, coupled with the provision that that 4.4 protection would remain in force until the President determined that the augmentation or importation of waters to the extent of 2.5 million acre-feet were in the Lower Basin, with that kind of provision in last year's bill, was it the position of your State and of yourself that the 4.4 position of California was correct?

Mr. BISHOP. Senator Kuchel, we do not feel that the 4.4 priority to California is really any concern of the State of Wyoming as long as it has no adverse effect on us.

We did bring out a point here that we thought was valid, that it should definitely be provided that this priority would not apply against the Upper Basin.

Insofar as I have any authority to speak for the State of Wyoming, I would be inclined to say that if we have a really meaningful provision for importation in the bill that is passed, that this would certainly make Wyoming much more receptive to support of this legislation.

Senator KUCHEL. Thank you.

And with respect to your suggestions that in the absence of any provisions for importation, a time limit of 35 years be placed on the reduced California priority, are you steadfast in that view, Mr. Bishop, or is it your intention merely to suggest—what is your intention in suggesting the 35-year limitation?

Mr. BISHOP. Our only desire is to maintain California on our side in wanting an augmentation of the water supply of the Colorado River, and we feel that through some kind of a time limitation that California would be more likely to be on our side in this particular fight, and we feel that it is absolutely necessary that we have California's support in this regard.

Senator KUCHEL. Is it not absolutely necessary that all of the States work together for an importation or an augmentation program?

Mr. BISHOP. Yes, sir.

Senator KUCHEL. And when you used 35 years as a limitation in the absence of any importation provision, is that simply a generalization on your part, or do you have some reason to suggest 35 years?

Mr. BISHOP. Well, to some extent you can say it is a generalization, but it seems to us that 35 years is adequate time within which this problem should have been worked out.

I would say that if we do not have an augmentation of the water supply in 35 years, we are all in real serious trouble.

Senator KUCHEL. You are acquainted with the fact that before Hoover Dam was built Congress said to California, "You limit yourself," and California did, and in the intervening years the people of California, as you know, expended several hundreds of millions of dollars to build an aqueduct, over a half billion, as a matter of fact.

Do you not concede that there are some elements of equity on the side of California feeling that 4.4 million was an irreducible minimum by reason of first in time, first in right, plus what Congress told her to do?

Mr. BISHOP. Frankly, Senator, I do not feel well qualified to comment on that. I am not an attorney. I would rather not.

Senator KUCHEL. I would rather not have you comment that you believe it should be 35 years.

Is it fair to say that you do believe there is merit and justification in a priority right to any State, yours, mine, or any other, for existing uses of Colorado River water over new uses of Colorado River water in times of scarcity?

Mr. BISHOP. Frankly that concept frightens me a little, because if it is applied to the situation between the Upper and the Lower Basin, Wyoming would be in real trouble.

We feel that the provisions of the compact guaranteed us the right to future use of water, regardless of the priority situation. There may be some implications in this priority concept that would be dangerous to Wyoming.

Senator KUCHEL. You are talking about an interpretation of the compact. You are talking about what the Upper Basin may be required to do with respect to the Lower Basin. Is that what gives rise to your use of the word "frightened"?

Mr. BISHOP. Yes, sir. I am not particularly frightened by the priority between California and Arizona as long as it is limited to that.

Senator KUCHEL. I think, Mr. Chairman, if I may, I would like to take 30 more seconds.

My colleague from California, Congressman Hosmer, a very able and dedicated Representative, who sits on the same side of the aisle that I do, embellished the House record with a letter from a young high school student in the State of Oregon. I would like to enshrine it in the Senate record. It is not very long. I take this from page 171 of the House hearings this year. This is wonderful.

DEAR MR. HOSMER: I want to thank you very much for the information on the Oregon water diversion. Our debate team was defending the statement that Oregon should send water to California and yours was the only information we had to go on.

We sent a letter to an Oregon representative, but we have yet to receive an answer. I must admit that when I was put on the defending team I felt Oregon should not have to give up its water, but now I have the facts on the subject, I have reversed my thinking.

While gathering data on the subject I talked to a lot of people, and the general feeling is this: "I don't think California has any right to Oregon water."

Then when they are asked why California shouldn't take any of Oregon's water, they mumbled something to the effect "Because it is our water, that's why. Besides, those damn Californians use too much water anyway."

I think if these people could get the facts on the subject, they might change their minds. I sincerely hope California gets some much needed Columbia River surplus water. About all I can offer you though is my support and prayers. Good luck and thanks once again. Sincerely.

Mr. Chairman, Representative Hosmer thoughtfully refused to give the name of the young high school student, fearing perhaps that he might be sent to reform school, but I invite your attention to that.

Senator JACKSON. It is obvious that this is an organized program of subversion of our youth. I did not think the California situation was quite that desperate. They appeared so hopeful all week. This is Thursday.

Senator FANNIN. Mr. Chairman, Mr. Bishop was most gracious not to enter into the Arizona-California controversy.

If we are just referring to sympathy, of course, I would say I wish California well, too, as long as they guarantee us 2.8 million acre-feet of water.

So I do feel, Mr. Bishop, that with the corrections that I request that you accept, that you will have a different picture of just what Arizona is up against.

Senator JACKSON. Thank you, Mr. Bishop. We appreciate having your testimony and your views regarding this matter.

Mr. BISHOP. Thank you, Mr. Chairman.

Senator JACKSON. Our next witness is Mr. David Brower, executive director of the Sierra Club of San Francisco. Mr. Brower, we are pleased to welcome you once again before the committee. You have a prepared statement which we have received copies of. You may proceed to read the entire statement or place the entire statement in the record and hit the high points, whichever you see fit.

STATEMENT OF DAVID R. BROWER, EXECUTIVE DIRECTOR, SIERRA CLUB, SAN FRANCISCO, CALIF.; ACCOMPANIED BY JEFFREY INGRAM, SOUTHWEST REPRESENTATIVE, SIERRA CLUB, ALBUQUERQUE, N. MEX.

Mr. BROWER. It is a rather brief statement and I might read it, Mr. Chairman, and then answer questions.

Senator JACKSON. Go ahead, sir.

Mr. BROWER. My name is David Brower. I am executive director of the Sierra Club, and am pleased to appear before you today to present the position of the club on Colorado River Basin legislation.

We believe that the highest purpose to which the United States can dedicate the Grand Canyon, the whole entity, is to preserve it as it is, for all people, for all time. We believe that the entire Grand Canyon, from Lee Ferry to Grand Wash Cliffs, should be given park status within the national park system.

This is a bold proposal. It deserves careful study. Of course, like the many conservation organizations and individual citizens with whom we are proud to be associated in this crucial conservation issue, we would like to see an expanded, complete Grand Canyon National

Park immediately; but we realize that if this is to come about, we still have much work to do, many people to educate about the universe that the Grand Canyon is, and the river and canyon bottom that are the ecological heart of it.

The administration, with legislation introduced by Senator Jackson, has our grateful recognition for supporting the upstream extension of the national park to include the Marble Gorge of the Grand Canyon. This step is, we hope, the first; the second, of course, would be the downstream extension to Grand Wash Cliffs, such as has been advocated by Representative Saylor and others. We are happy to learn that Senator Case has introduced a bill today to accomplish this.

THE EXPERTS AND THE GRAND CANYON DAMS

Unfortunately, advocating the creation of a complete Grand Canyon National Park requires more at this time than describing the canyon's beauties. Proposals to build hydroelectric dams in the Grand Canyon by Federal, State, and municipal agencies have made us aware that saving the Grand Canyon requires expert analysis in many fields, some not obviously related to establishment of a national park.

Once the need became clear, such experts did come forward, donating their time and energy to studying the proposed Grand Canyon dams. Economists, engineers, physicists, and mathematicians; biologists, and archeologists; hydrologists, photographers, lawyers, geographers, and specialists in recreation, have all contributed; some anonymously, some coming forward at public hearings. We are impressed by their efforts, and heartened by their conclusions. I would like to summarize their findings in a broad way, then refer briefly to some of this work in more detail.

The major conclusions are that the Grand Canyon dams, or either of them, would be—

- (1) wasteful of needed water, while lowering the quality of the remainder;
- (2) an uneconomic investment of public funds;
- (3) inconsistent with the concept of an independent, objective National Water Commission which would be uncommitted to regional or bureaucratic biases;
- (4) generators of electric power that could be furnished in other, less destructive ways;
- (5) financially unnecessary for the solution of present and future Southwest water problems;
- (6) based on geologic data which are at present inadequate to give full confidence that the dams can serve their purpose;
- (7) ecologically, destructive of rare species and a unique succession of habitats;
- (8) archeologically, shortsighted in not allowing deliberate study and correlations of prehistoric materials;
- (9) geologically, a loss of volcanic, sedimentary, and metamorphic records of activity that may hold answers to questions about the earth's history that we don't yet know enough to ask; and further, a truncation of the world's greatest natural laboratory;
- (10) superfluous for reservoir recreation, and a forfeit of yet undeveloped experiences ranging from rim viewing to river touring;

- (11) scenically disastrous;
- (12) a first step in the dismantling of the national park system for limited, single-purpose, commercial uses.

The full exposition of these points would take many hours; their development has taken many people many months. Much of the material leading to the above conclusions is scattered. One place in which we brought it together was in a supplement to our petition to the Federal Power Commission to appear on the application of the Arizona Power Authority for Marble Canyon Dam. I ask that this document, prepared by Frederic Fisher and David Sive, be placed in the record after my statement for consideration by the subcommittee. Another source of material, of course, is the collection of hearings before the House Subcommittee on Reclamation and Irrigation, 1965, 1966, and 1967. From this I would like to present what we believe to be some of the most significant documentation of our position.

HOW CAN YOU DESCRIBE THE GRAND CANYON TO PEOPLE?

We are most concerned with the case for the Grand Canyon, and for elevating it all to national park status. The exhibit that you see in this room is one way we are trying to bring the Grand Canyon to the public. Photographs from this exhibit by Ernest Braun are being used in a new book on the canyon, an inexpensive book by the way. It will be only \$4.95.

Copies of this will be made available next month. Finally, we have just completed a new film, and if the subcommittee wishes, we are prepared to show it at the committee's convenience. The exhibit, book, and film all show a different Grand Canyon from the one we are all used to, for it tells the canyon's story from river level. Too few people know what is down there; too few understand our concern over what will be lost; too few realize what we mean when we say that the river and canyon bottom constitute the living heart of the Grand Canyon. The film, book, and exhibit will, we hope, correct this. They will help describe a largely unknown experience, which should be familiar to all, and may be, if the canyon is left unimpaired.

INVASION OF THE WILDERNESS PRESERVATION SYSTEM IN COLORADO RIVER LEGISLATION

The efforts to dam the Grand Canyon, and invade the national monument and park, have a parallel in another part of the Colorado River Basin legislation in which a dam is proposed, one suggested site of which would invade a unit of the wilderness preservation system.

As a leader of the conservation movement—a leadership recognized by the Sierra Club when it made him an honorary life member (see notice below)—Senator Anderson well knows the depth of feeling held by all who fought with him for the wilderness system. We feel that if in these early years of operation of legislatively protected wilderness, there are breaches in protection of the system, then in later years these breaches will widen without check.

One such threat is the plan of Kennecott Copper Corp. to gouge an open-pit mine out of the Glacier Peak Wilderness. This threat worries

us, as does the encroachment on the Gila Wilderness. We are worried because of the precedents, a very natural worry in this risky endeavor we call conservation.

I urge that so long as it is not absolutely essential, so long as an alternative can be found, that the principles of the Wilderness Act, as of the National Park Act, be upheld.

SENATOR ANDERSON HONORED BY RIO GRANDE CHAPTER

Two years ago, Senator Clinton Anderson of New Mexico was made an honorary life member of the Sierra Club. Last month, the Rio Grande Chapter presented a complete set of Exhibit Format books to the Senator with a parchment certificate of lifetime membership in the chapter. The certificate expressed "respect and appreciation for the most enduring among your many services to your fellow man: Your leadership in what you have aptly called 'the long struggle to save wilderness America.'"

SIERRA CLUB BULLETIN.

THE GRAND CANYON DAMS: A FEW DEFICIENCIES

No brief summary of the many technical contributions can convey to the subcommittee the thoroughness and detail of the various reports. I would, nevertheless, like to note work in six special areas of particular significance.

(1) Drs. Alan Carlin and William Hoehn of the Rand Corp.—both economists—analyzed the evaluation procedures and data which led to the claim that the Grand Canyon dams were economically justified. Their findings are that, properly computed, the benefit-cost ratios for the 1,500-megawatt Hualapai-Bridge Canyon Dam and for Marble Canyon Dam are both below one, and that therefore both dams would not be a sound investment of public funds. Mr. Laurence Moss is well acquainted with the work of Carlin and Hoehn, and will review it in his own testimony, as well as being ready to answer questions.

(2) The question of the necessity of the Grand Canyon dams has been a tangled one. The final answer came from the Secretary of the Interior, speaking for the administration, when he stated that there were feasible alternatives to the dams which would do the jobs that the dams were thought necessary for. The administration plan as written into S. 1004 and S. 1013 answers our objective. However, it is not the only possible plan, and I bring the analysis prepared by Jeffrey Ingram, Southwest representative of the Sierra Club, under which revenues from Hoover Dam after payout would be borrowed by central Arizona project users to aid in repayment of the project, and then returned. Mr. Ingram is here to answer any questions.

(3) Mr. Ingram has also found that, rather than being a step toward sound water planning, authorization of a Grand Canyon dam would actually undermine the work of the National Water Commission. The dam's authorization would precommit an important area for study, precluding an unbiased study by the Commission.

(4) Even more complex and open to conjecture is the question of silt life of the reservoirs on the Colorado River. Without question, the basic problem is the lack of records over any significant length of time. With the information now available, it is possible to come up with a wide range of figures. To predict a silt life for the Colorado River dams now is the same as if the Colorado's flow for the next

hundred years were predicted based on water flow for the years 1906 through 1922. We have been forced to conclude that the Grand Canyon dams are uneconomic, unnecessary, and risky.

Incidentally, my statement on the sediment life on the reservoirs was commented upon by Mr. Dominy, I see, in the House hearings, and I would like to comment on his comments in your own Senate record, if I may have that permission, as soon as I have had a chance to refer it to some of our people who know sediment business.

I have here the full text of the papers on these four points, and request that they be entered in the record following our FPC statement.

Senator JACKSON. Without objection that will be included.

Mr. BROWER. Two more points for the canyon.

(5) Evidence for a complete Grand Canyon National Park has been presented by the Department of the Interior, as well as by conservationists, as indicated by the administration bill for extending the park upstream. Reports by the Park Service and Bureau of Outdoor Recreation in the appendix to the August 1963 Pacific Southwest water plan, and material summarized by Mr. Hugh Nash in the March House hearings, page 438 and following pages, support the administration position on park expansion, while indicating that the second step—extending the national park downstream to Grand Wash Cliffs—is just as important.

(6) One new collection of evidence for protecting the Grand Canyon will be presented at these hearings by Dr. Paul Martin for the Arizona Academy of Science. The value of the canyon for geology, archeology, and biology is described. We certainly agree with the recommendation for a broad-scale, scientific reconnaissance of the Grand Canyon. We know that this can be done well only if the canyon is left as it is. Can this be done?

Can the people of this country, through their selected representatives, resolve that the Grand Canyon be protected as a national park? We hope so; we think now is the time. With one stroke, this Congress can create a national park, extending from Lee Ferry to Grand Wash Cliffs, that will preserve for all the world this world's wonder.

Can it be done? Why not? After all, it is the Grand Canyon.

I would like also if I could to put in, as I mentioned, Senator Case's bill, the statement that his office released today.

Senator JACKSON. Without objection that will be included at the end of your oral statement.

The Chair wishes to state that he received a request from Dr. Carlin in connection with the study that he had made, along with William Hoehn of the Rand Corp. that it be included in the record. That study will be concluded at the conclusion of your statement, together with the analysis prepared by Jeffrey Ingram.

Mr. BROWER. Yes, we have all those here.

Senator ANDERSON. Does your material also include Carlin and Hoehn?

Mr. BROWER. Yes.

Senator JACKSON. Let the record show that Dr. Carlin had written to the chairman requesting that that be included in addition to the request being made here. Is that an analysis of the brief submitted by Mr. Ingram? We want to include in the record of course pertinent in-

formation, but if it gets to be pretty lengthy, then we have to treat it as an exhibit and refer to it by reference, because of the sheer volume of material. I will ask the staff to check this over, and we will have to make a judgment, treating everybody of course equally, Mr. Brower, as you understand, as to how it should be handled. If it is of great length, it will have to be included by reference. We can identify in the record and then that is a document that is available, so that it can be readily identified, you see.

Mr. BROWER. Yes, I understand, Mr. Chairman.

Senator JACKSON. Thank you very much.

Senator KUCHEL. Mr. Brower, I am not at all unacquainted with the reputation of the Sierra Club, which you represent here today, or its worthiness, and for the innumerable acts which it has performed in the public interest, nor am I insensitive to the grandeur which has remained through the centuries in the Grand Canyon.

I am of the belief that the State that you and I both call our home requires an inordinate increase in available water for consumptive use in our lifetime and beyond, but that does not make us unique, because most American States will be in the same boat with us. That will be particularly true, however, of the semiarid desert States in the Southwest part of our country.

I have been led to believe that part of the water shortage in the States which comprise the Colorado River Basin might come from other areas of the Nation outside the Pacific Southwest deficiency areas. I have been led to believe that if the importation of waters into the Lower Colorado River Basin was to be effective, it would take an inordinate amount of money at a time when our budget grows, when we are engaged in war, and when every section of the country is interested in Federal assistance in one type of Federal project or another.

Is the position of the Sierra Club that it not only opposes the construction of the dam at Hualapai, or Marble, but that it affirmatively endorses the scheme or plan in the administration bill this year for the prepayment by the Federal Government of 50 years of electricity from a group of utilities called WEST, or do you have any position on the administration's recommendation?

Mr. BROWER. We do have a position on the administration's recommendation. That is, we are essentially in support of it. We think that the proposal to prepay is an imaginative approach. It is one of the possible ways to handle the water development. Our testimony goes into some detail in showing other ways, and Mr. Ingram, who did quite a bit of work on this, can comment on it if you would like.

Senator KUCHEL. I think it would be helpful to develop some of that testimony. Does the Sierra Club distinguish between the proposal for a dam at Hualapai and the proposal for a dam at Marble, or does it consider them from its point of view equally offensive?

Mr. BROWER. They are both in the Grand Canyon, and they are both, to our point of view, equally offensive and both unnecessary.

Senator KUCHEL. I do want to enter into the record the resolution which was passed, Mr. Chairman, by the National Wildlife Federation at its very first annual convention in San Francisco, held last March 10-12, on the general subject of that which Mr. Brower has testified. I ask consent that the entire resolution be included.

Senator JACKSON. Without objection the entire resolution will be included at this point.

(The resolution follows:)

COLORADO RIVER BASIN PROJECT ACT

Whereas the program of the National Wildlife Federation is firmly based on principles of conservation which recognize a reasonable balance between the preservation and prudent use and development of natural resources for several beneficial purposes, including fish and wildlife management and outdoor recreation; and

Whereas this Federation exerts a leadership role in the development and protection of sound conservation practices, bringing matters in this vital area of American life to the attention of the public; and

Whereas various proposals would authorize a high dam at the Hualapai (Bridge Canyon) site for the purpose of providing revenues to help finance the Central Arizona Project, whereby badly needed supplies of water would be brought into the interior of Arizona; and

Whereas construction of Hualapai Dam would create new fish and wildlife and outdoor recreational opportunities in the lower Colorado River Basin and enhance properties owned by the Hualapai and Havasupai Indian tribes; and

Whereas water salvage programs in some proposals recognize "a reasonable degree of undistributed habitat for fish and wildlife;" and

Whereas specific provisions are made in some proposals for conservation of scenic, historical, natural, wildlife and archeological features, as well as for the public use and enjoyment of included lands, facilities, and water areas; and

Whereas any Lower Colorado River development should consider this Federation's policy of protecting the integrity of national parks and monuments: Now, therefore, be it

Resolved, That the National Wildlife Federation, in annual convention assembled March 11, 1967, in San Francisco, California, hereby supports these principles: (1) that power for pumping for the Central Arizona Project should be provided through thermal generation; (2) that, if the Congress will not adopt the thermal generation concept, then a dam at the Hualapai site should be favorably considered with Grand Canyon National Monument being incorporated into Grand Canyon National Park and its boundaries adjusted to: create a narrow Park corridor northward along the west boundary of the Colorado River, including the least amount of wildlife habitat, from the Park's present eastern boundary to the southern boundary of the Glen Canyon National Recreation area, thereby pre-empting construction of Marble Canyon Dam by any agency; and, (3) create a national recreation area adjacent to the proposed Hualapai reservoir in such a manner that the Reservoir will not invade either Grand Canyon National Monument or Grand Canyon National Park.

Senator KUCHEL. I read the resolving clause:

Now, therefore, be it resolved, That the National Wildlife Federation at annual convention hereby support these principles:

1, that power for pumping for the Central Arizona Project should be provided through thermal generation;

2, that if the Congress will not adopt the thermal generation concept, then a dam at the Hualapai site should be favorably considered, with Grand Canyon National Monument being incorporated into Grand Canyon National Park, and its boundaries adjusted to create a narrow park corridor northward along the west boundary of the Colorado River including the least amount of wildlife habitat from the park's present eastern boundary to the southern boundary of the Glen Canyon National Recreation Area, thereby pre-empting construction of Marble Canyon Dam by any agency; and

3, create a national recreation area adjacent to the proposed Hualapai Reservoir in such a manner that the reservoir will not invade either Grand Canyon National Monument or Grand Canyon National Park.

I take it that the Sierra Club would disagree with that resolution except for the first point on which it passes its judgment.

Mr. BROWER. Yes. The conclusion reached there I think the Sierra Club and most of the national conservation organizations would disagree with.

Senator KUCHEL. Is the National Wildlife Federation in your opinion a respected conservation group?

Mr. BROWER. The situation here is about like asking a Senator if his colleague is respected. We work together a great deal and we respect each other, and we sometimes must disagree, and this is one place where we must.

Senator KUCHEL. We call the Senate a club, and the conservation groups have a club more or less. At any rate I take it that the Sierra Club would not wish to advise this committee of any views which it might have on this general subject other than to oppose in any fashion the construction of a dam at either Hualapai or Marble?

Mr. BROWER. I would like to put it positively, Mr. Kuchel. We are for the Grand Canyon. We will support the Grand Canyon.

Senator KUCHEL. I am not so sure that that is wholly responsive, but at any rate we understand each other. Does the Sierra Club have any recommendations as to how the power should be produced other than to endorse the provisions of the administration bill this year?

Mr. BROWER. We agree quite thoroughly I believe with what Secretary Udall said.

Senator KUCHEL. This year.

Mr. BROWER. Yes, this year, in his modification of the position once the administration had taken its position and the administration was always against Hualapai or Bridge Canyon. We believe with him that the construction of this dam would be a gun pointed at the Columbia Basin; that it is entirely unnecessary for the development of water in the Southwest.

It is necessary presumably only for the development of the basin fund. We believe there are other ways of developing a basin fund when and if it is determined that there is a feasible, an economically feasible, a socially feasible, biologically and politically feasible method of using that development fund. This we would like to see the National Commission apply itself to.

Senator KUCHEL. What would be an example of the kind of revenues which you have in mind in the future creation of a development fund for the basin?

Mr. BROWER. I wish Mr. Ingram would answer this, because it was he who brought the administration Bureau of Reclamation to the admission that they were not ready for about a year.

Mr. INGRAM. My name is Jeff Ingram. I am the Southwest representative of the Sierra Club.

If the basin account was set up using the revenues from Hoover, Parker, and Davis Dams, and the provisions of the legislation as it stands were applied to their most beneficial, that is in terms of producing revenue for the basin, the beneficial manner, then I would say that by the year 2047, this 75-year period, the development fund would have in it somewhere around \$1.1 or \$1.2 billion. This is to be compared with about \$2 billion of Hualapai.

Senator KUCHEL. I want you to go over that. Would you repeat that, please, so that I can understand it.

Mr. INGRAM. All right. If you have a development fund——

Senator KUCHEL. Created.

Mr. INGRAM. Created at this time, in this legislation, but Hualapai Dam is never authorized, is never built, it never supplies revenues, and you put into this development fund the revenues from Hoover, Parker, and Davis Dams——

Senator KUCHEL. As of what date?

Mr. INGRAM. After they have paid out.

Senator KUCHEL. Hoover, Parker, and Davis.

Mr. INGRAM. And plus the revenues——

Senator KUCHEL. And what?

Mr. INGRAM. Plus the revenues of course that come from the features of the administration plans, that is the central Arizona project water revenues and so on, this kind of thing, just taking the administration——

Senator JACKSON. The thermal.

Mr. INGRAM. Right, the prepurchase of power.

Senator KUCHEL. This is where you begin to lose me.

Mr. INGRAM. Let me start off again and just take it this way. If you take the administration plan as it is in S. 1004 and S. 1013, and in addition to this you create a basin development fund into which you put the revenues from Hoover, Parker, and Davis, after they have paid themselves out, then by the year——

Senator KUCHEL. That would be 1987, if I recall correctly.

Mr. INGRAM. 1991 is the figure for Hoover that is usually used.

Senator KUCHEL. 1991. OK.

Mr. INGRAM. 2004 for Parker and Davis.

Senator KUCHEL. All right.

Mr. INGRAM. Then by the year 2047, which is the 75-year period that was talked about the other day when the Secretary testified, the development fund would have in it a total of something like \$1.1 or \$1.2 billion as compared with \$2 billion if Hualapai were built. Those are rough figures, and the exact number can be worked out.

Senator KUCHEL. Did you add to the revenues the moneys which you stated would accumulate under the Federal Government's purchase of power from WEST? That is where I did not understand.

Mr. INGRAM. I just assumed that the administration plan as it is in S. 1004 was enacted.

Senator KUCHEL. Would provide revenues.

Mr. INGRAM. Well, after a certain period of years, due to the fact that the amount of water being pumped in the central Arizona project declines, there becomes a certain amount of water available for commercial sale. This is under the administration plan.

Senator KUCHEL. But how would that feed the Federal fund if the power were produced by a group of private utilities?

Mr. INGRAM. Well, the administration plan prepurchases this power.

Senator KUCHEL. But not the physical equipment.

Mr. INGRAM. No.

Senator KUCHEL. So how would the Federal Government participate in any revenues?

Mr. INGRAM. If you buy power, then you have this at your disposal. You bought a product. You can apply it to pumping water, but if you don't need it for applying to pumping water you can sell it for commercial——

Senator KUCHEL. What is the period of purchase, 50 years?

Mr. INGRAM. As I understand the Secretary's statement, they are thinking of this \$92 million as applying to a 50-year period.

Senator KUCHEL. It would be your testimony, Mr. Ingram, that within the 50-year period the Federal Government might be in a position of selling something that it had prepurchased 50 years before.

Mr. INGRAM. It is not my position. It is the Secretary's position.

Senator KUCHEL. I think that ought to be tested very carefully, Mr. Ingram. I think the staff ought to be instructed to give us the benefit of its analysis. At any rate I understand the position of the Sierra Club.

I must say, gentlemen, that the Sierra Club has a little muscle. A year ago when Secretary Udall came here with a different kind of proposal, you opposed it, but I do believe the public interest would be served by considering in this committee both proposals of the Secretary, last year's and this year's. Incidentally, I would like to see that film. How long does it take?

Mr. BROWER. It is a 25-minute film.

Senator KUCHEL. Will you be here tomorrow?

Mr. BROWER. Yes.

Senator KUCHEL. Maybe we can take 25 minutes.

Mr. BROWER. I hope all Senators will look carefully at the exhibit now that they know what it is, and they should know that the spirit of everything you see in those photographs will be gone if the dams are built.

Senator JACKSON. Senator Allott?

Senator ALLOTT. Are you including in that statement, Mr. Brower, the picture of the muddy feet back there?

Mr. BROWER. The owner of those muddy feet is in the audience at the moment, so I won't say anything about him.

Senator ALLOTT. Is there any particular ecological advantage to having the picture of those muddy feet?

Mr. BROWER. It is nice to be able to take your footprints with you.

Senator ALLOTT. They won't stay in that sand very long, I'll tell you that, at least the sand they are standing on.

Mr. Brower, we have met before, and it is a fact, of course, that there are certain examples of invasion of national parks by manmade dams is it not?

Mr. BROWER. There have been no invasions of national parks by manmade dams since the National Park Act, or the establishment of a given park. There were invasions which were incorporated in parks subsequently set out, even as the lower 40 miles of Grand Canyon, which include Lake Mead's headwaters would be included in the enlarged Grand Canyon National Park we espouse.

Senator ALLOTT. Just to get it into the record, there are several instances in which there are manmade dams that have been included in parks; Jackson Lake Dam, Grand Teton, Reclamation Reservoir behind Sherburn Dam, Wynn Glacier, the lower two Medicines Dams.

Mr. BROWER. These all antedated the park.

Senator ALLOTT. Montana Lake and the Great Smoky Mountains National Park as an example. Mr. Ingram said that the administration bills did not include a basin fund. They do not, but it is his presumption here that this is a logical thing, is that true? Is that your presumption and conclusion?

Mr. INGRAM. No. The point I am trying to make is that if it is desired to build the basin development fund, this is one way to do it. The administration said it had no objection, for instance, to including the basin development fund.

Senator ALLOTT. Now, it is not included in the bills, is it?

Mr. INGRAM. No. The provision has been written for it, however.

Senator ALLOTT. So in neither one of those bills, is there a provision for a basin fund, there is no provision in this legislation for future planning or future development or for the augmentation of the—

Mr. INGRAM. Except that the National Water Commission bill has already been passed by the Senate.

Senator ALLOTT. You keep talking and so does Mr. Brower about the National Water Commission. Where is this National Water Commission? It isn't in existence, is it?

Mr. INGRAM. No, sir.

Senator ALLOTT. And do you think, Mr. Brower, that a National Water Commission could do a better job of planning a development of water basin than some 200 or 300 very qualified and experienced people in this room who have spent their lifetimes at just this job?

Mr. BROWER. I would like to answer that in two parts. First, I think it could, and I would like to pass it on to Mr. Ingram, who has done most of the analysis of the potential of the Water Commission in this respect and made I think a very valuable suggestion with respect to it, and what the House might do with it.

But I think in the first place that this is after all one country, and I think such major decisions as we are facing in our crowded future need to be made with the one-nation aspect in mind. They need to be decisions made for the society by the various professions that are most interested in the society.

Senator ALLOTT. By the various what? I couldn't hear you.

Mr. BROWER. Professions of society, and not an overinordinate emphasis on engineering, and I think that is the main point. But Mr. Ingram, I think, can comment on this and add to it the concept that he was thinking of in his analysis of the National Water Commission for us.

Mr. INGRAM. Our feeling about the National Water Commission is that it is an opportunity to plan for one of the most perhaps you could say, after air, the second most important resource we have.

Senator ALLOTT. Before I hear your opinions, Mr. Ingram, on this, I would like to know a little bit about your own background. Would you state that for us?

Mr. INGRAM. I am a mathematician. I graduated from MIT in 1958, and I have worked for the Sierra Club for about a year and a half.

Senator ALLOTT. Have you ever had any work in water resource or electric power?

Mr. INGRAM. No, sir.

Senator ALLOTT. Or any of those fields?

Mr. INGRAM. No, sir.

Senator ALLOTT. Before going to work for the Sierra Club?

Mr. INGRAM. No.

Senator ALLOTT. Let's talk about the administration bill a moment, Mr. Brower. It provides for an electric plant at or near the vicinity of

Page, Ariz. Now, what would be the source of heat for this electric plant?

Mr. BROWER. So far as I know, it will be coal, Navajo coal.

Senator ALLOTT. And of course if the coal were mined, it would be strip mining, or do you know?

Mr. BROWER. It probably would be according to the present methods, and I would hope that it would be less destructive strip mining than has already been illustrated in the other body in the hearings on the same point. But at least this kind of improvement is coming about.

Senator ALLOTT. You wouldn't think of desecrating the beautiful desert of northeastern Arizona with strip mining, would you?

Mr. BROWER. We are not an advocate of strip mining at the present time, but something is going to be lost. You have to weigh the kind of value you are going to lose. Now it may not be necessary to fuel this alternate source of power with coal. It may not be necessary to have such a plant at all, if as has been suggested, the basin account is determined to be necessary and is set up so that the Hoover, Parker, and Davis revenues themselves go into it.

So that if you put all these hypotheses in and say that it must be coal or it must be strip mining, I would say still, even though the desert is fine country there, it is not a world famous desert in the sense that the Grand Canyon is a world famous canyon, and I would say that that would be the lesser of two evils. I hope we can find a still lesser evil before we are through, because the country has to last us a long time.

Senator ALLOTT. I think we have found a lesser evil. How many persons do you suppose, Mr. Brower, visit that area of the Colorado River in a year which would be inundated by the Hualapai Dam?

Mr. BROWER. There are two sources of travel. One, of course, is the river running, and this exhibit you see in front of you was taken on a river trip that I was on last September. The other is hiking down into the canyon.

The use of the river for river running is expanding at an extraordinary rate. The insertion we have in the FPC evidence shows those figures from the National Park Service. They total over the last 11 years, 2,990. That is a rounded figure. I know it doesn't include me because I took a shortcut. In any event that is a very rapidly growing use.

There are uncounted thousands of people who go down the trails to the canyon at the various points, and there are the unnumbered millions who, if this place is left unimpaired, will be able to do this on down the generations, whereas that would be brought to a quick halt if either of the dams was built.

Senator ALLOTT. There are no roads into this area at the present time, are there?

Mr. BROWER. Yes, there are.

Senator ALLOTT. They don't show on the Arizona highway map.

Mr. BROWER. The Arizona highway map then is, I guess, a little out of date. There is a road to Torraweep Overlook. There is a road down Diamond Creek. I have not gone down the road, but I have driven up.

Senator ALLOTT. One jeep trail into a 93-mile area.

Mr. BROWER. It is more than a jeep trail, sir. It is graded. You can take an ordinary car on it.

Senator ALLOTT. What do you think of the potentiality of this area for recreation to millions of people if the dam were constructed?

Mr. BROWER. I think that it would be, as was said in the statement here, a duplicate of the kind of recreation we have already in great abundance.

We have 600 miles of reservoirs and many times that of shoreline now in the existing reservoirs behind Hoover, Parker-Davis, Glen Canyon, Flaming Gorge, and Navaho Dams. That kind of recreation is available now. If people want to go up into Grand Canyon to see it by powerboat, they may now go into 40 miles of it at the head of Lake Mead if they can get through the mud.

The thing that is unique is what you can do in the Grand Canyon and can do on through time as long as man is on the planet, if the Grand Canyon is left alone as the Sierra Club asks that it be left alone, and there is an extra balance, I think, in favor of the future.

If you build either dam or both dams, my testimony endeavors to show, out of the few rather primitive data available, certainly inadequate, how rapidly the reservoirs we are counting on, the Bureau is counting on, for recreation will become wall-to-wall jungles. The figures run somewhere between 100 and 200 years, possible a little more, but in that time the power generation will have ceased, the damsite will have been gone against the day when it might be of much greater importance conceivably, and the Grand Canyon as it is will have been gone beyond recall in our civilization. That would be, I think, a bad—

Senator ALLOTT. On whose figures do you base your sedimentation?

Mr. BROWER. I base my figures on such sedimentation data as I can get from the Bureau of Reclamation and the various agencies who have cooperated in the sediment studies of Lake Mead and the U.S. Geological Survey itself and various people that I know who are in the field.

Senator ALLOTT. If this is true, then the Bureau of Reclamation and the Secretary of the Interior certainly have made an awful mistake in the last 2 or 3 years, haven't they?

Mr. BROWER. It is unfortunate that there was not an earlier sincere, not sincere but detailed, attention given to this all-important study on a river system that has so many flash-flood areas in its drainage, because the reservoirs on the Colorado are about as short-lived reservoirs as you will find, and this is a very vital point, if there is ever to be any serious consideration of these dams, and I hope that there won't be much longer, that they will just not be built.

Then certainly there should be a very detailed objective study, not a self-serving study, but an objective study of the sedimentation data of that stream. I think that you would be shocked at the results of such a study.

Senator ALLOTT. What do you mean by "self-serving"? You are not implying, certainly, Mr. Brower, that I am serving as the senior Senator from Colorado alone in this. Surely you wouldn't imply that all these people who have come here from all over the Western States and sat here through these long and tedious hearings all week are purely motivated by self-serving situations.

They represent responsibility for 2,800,000 people, I think, in the Los Angeles area alone, plus Arizona, plus Colorado, plus Utah, plus

Wyoming, plus New Mexico, plus Nevada. I think you arrogate to yourself a virtue which you do not accord to others.

Mr. BROWER. No, I don't quite think so, Mr. Allott. When I speak of a self-serving study, I don't believe very many of the people you have just listed conducted any sedimentation studies, and I don't think that the U.S. Geological Survey, when it conducts one with its professional background and no purpose to serve except the general purpose, would conduct a self-serving study.

I think that the Bureau of Reclamation would be inclined to want its project to look good, and I think that that is why, for example, Mr. Dominy in Albuquerque debate I had with him said he didn't think Grand Canyon Dam would ever fill up with silt. It won't for a long time, but the point is there is not the inclination to seek, you might say, self-defeating data about a project.

We are glad that there can be other agencies, other individuals who are free of this specific goal. It is the goal of self-interest. I have one myself. We all do. But this is, you might say, a particular Bureau's interest in its own work, its own projects. It looks upon its projects. It finds them good, just the way I feel about our books.

Senator ALLOTT. Well, we now have your opinion of the Bureau of Reclamation.

Mr. BROWER. It likes its projects.

Senator ALLOTT. Let me ask you a question, Mr. Brower. I am concerned about the people in this room who have such a concern for their responsibilities for millions of people in the Southwest. Have you ever been in an elected position where you were responsible for the daily water needs or power needs of a great number of people?

Mr. BROWER. I think, in a roundabout way, yes. It was not a very big position, but at one point I served as an elected member of the Sierra Club's board of directors. Now I am appointed. I am a bureaucrat. But at that time I think there was a certain large—

Senator ALLOTT. Your answer to my question, then, would be "No."

Mr. BROWER. No, it would not be "No," begging your pardon, sir. It would be "Yes," because the concern in the conservation organizations is primarily for the daily needs for water and other necessities of life, for a good many people, almost none of whom are now voting or alive yet, because conservation is really looking down into the future, and there are millions of people, and their needs, that must be thought about as well as the needs of those who are aboard the planet at the moment.

Senator ALLOTT. The answer to my question would be "No," then. You have never served in an elected position where you were responsible for looking down the road and seeing that millions of people yet unborn as well as those who are here now were supplied with water and power to meet the expanding technology of this century.

Mr. BROWER. No, Mr. Allott, my answer is still "Yes." We have to disagree.

Senator ALLOTT. Your answer is "No" unless you have been elected to some position or filled some public position where you were responsible for this. Your answer would be "No," as a director of the Sierra Club.

Mr. BROWER. That is a quasi-public position.

Senator ALLOTT. The Sierra Club is not responsible to anybody but itself.

Mr. BROWER. I can't agree.

Senator ALLOTT. You are certainly not responsible to the public in any accountable sense, are you?

Mr. BROWER. We are every day, and we have to account to the public. We have to be responsible in everything we do.

Senator ALLOTT. Not in the sense that a public official is.

Mr. BROWER. All right, I will grant there is a difference. A quasi-public official and a public official have a different sense.

Senator ALLOTT. So you may take the position you have taken on this and on other projects, and then you can put the full burden on somebody else, like some of these people who are here, when the water or the electricity is not available for the oncoming people in the future population.

Mr. BROWER. Not quite, Mr. Allott. I think we go in quite a different direction. We have sought as hard as we could and have presented our evidence. I hope you have time to study it all. It is rather voluminous, it is contributions of a good many people who think they are responsible to the public that there are ways to get the water and the power without any destruction of the Grand Canyon. That is our point. I hope you will observe that in going over the data they have presented.

Senator ALLOTT. They may feel responsible, but they are not directly accountable, and this is where the difference lies, Mr. Brower.

Mr. BROWER. It depends on whether a man keeps his conscience, and I think we are accountable.

Senator ALLOTT. I don't know where you keep yours, but I think mine is as good as yours.

Mr. BROWER. I think it is.

Senator ALLOTT. I am not concerned about that. The Lord will make that decision someday. As I recall, the Sierra Club was opposed to the building of Glen Canyon Dam, also; was it not?

Mr. BROWER. Rather late in the game we saw that it was unnecessary, but it was too late at that point to find out about it. I, myself, was in a position early in the Echo Park battle of thinking that a reasonable alternative to the building of Echo Park Dam was building of a higher Glen Canyon Dam. That was the most disastrous mistake I ever made.

I have learned a great deal more now. I came to that conclusion before I had seen the country and I am a lot more careful now about drawing conclusions before I have seen what my conclusions would damage.

Senator ALLOTT. Didn't you or the Sierra Club issue a pamphlet or a brochure called *The Canyon No One Knew*?

Mr. BROWER. It is a \$25 pamphlet. The book is "*The Place No One Knew, Glen Canyon on the Colorado*."

Senator ALLOTT. You can understand why a poor Senator from Colorado doesn't have possession of that book.

Mr. BROWER. Somebody on your staff must have shortstopped it.

Senator ALLOTT. But I have before me a very, very lush—it is almost of the quality that the Sierra Club puts out—brochure by the Department of the Interior called *The Third Wave*, and I read from page 51 of that with respect to Lake Powell. It says:

The pyramiding popularity of two fairly new lakes on the Colorado River, Lake Powell behind Glen Canyon Dam and the Utah-Arizona border, Flaming Gorge Lake bounded by the dam by the same name on the tributary Green River on the Utah-Wyoming border continued last year to lure hundreds of thousands of visitors. Boaters on Lake Powell venturing up small side canyons saw and preserved on camera film the steep, breath-taking colorful rock walls heretofore seen by only a handful of hardy hikers. They also fished and swam and skied. The scene was duplicated at fabulous Flaming Gorge where thousands witnessed the grandeur of what was once an isolated outlaw hideout deep in virtually inaccessible wilderness. Flaming Gorge dam and power plant were opened to the public for tours for the first time on Memorial Day in 1966, when large groups of sidewalk engineers inspected the two impressive installations.

Then, on page 29 of the same periodical, I read, alongside of a beautiful picture which is entitled "Canyon Walls Mirrored in the Waters of Lake Powell Behind Glen Canyon Dam" this statement:

To me the appealing genius of conservation is that it combines energetic feats of technology with the gentle humility that leaves some corners of nature alone, free of technology, to be a spiritual touchstone and recreation asset. As I look around at this incredibly beautiful and creative work, it occurs to me that this is a new kind of writing on the walls, a kind that says proudly and beautifully "Man was here." Mrs. Lyndon B. Johnson, Glen Canyon Dedication, Page, Arizona, September 22, 1966.

I think with that I will retire.

Mr. BROWER. May I comment?

Senator ALLOTT. You may comment if you wish. I think this expresses pretty well my point of view.

Mr. BROWER. There is no doubt that there is some fine reservoir recreation, and Lake Powell is of its kind one of the most beautiful reservoirs on earth when it is on the way up. Had Mrs. Johnson been there last Easter she would have had a different story to tell.

Had she seen our own film on Glen Canyon or our Glen Canyon book, I don't think she would have said that. She had not, so she did not know what was gone.

I do know what is gone. I do know what it looks like now and I would like to include in the committee file, I will bring it tomorrow, 16 black and white photographs of what Lake Powell is like now that it has a 34-foot drawdown, and what the road to Rainbow is like, and what the walls are like, that she thought were so beautiful.

The writing on the walls now is quite different. When Lake Powell has finally filled, if it does, and then is drawn down its maximum amount, at that maximum drawdown it will reveal 100,000 acres, that is as big as a major wilderness area, of badly impaired terrain. The pictures look good on the way up. I think the judgment of how beautiful it is is premature at this point.

I like it myself when it is going. I have been in there on several of the side canyons. I know what is down underneath and what should never have gone underneath and never need to have gone underneath. It was available for children on the lowest budgets there were. Scouts could go down for something like \$1 a day. You can go on Lake Powell now if you have \$30 a day. It is quite a different story.

The recreation story is only half told. I think if you inquire around the town of Page, you will find that it is a town that is on the down-grade, that it is losing out.

Reservoir recreation is fine. We have a fine example of it at Lake Mead, Lake Mohave, Lake Havasu. Certainly Flaming Gorge is beau-

tiful, but there can come an end to that kind of thing, and we don't need to keep piling on more and more reservoirs because some are good.

There is only one Grand Canyon, and I don't see why we can't do just as Theodore Roosevelt cautioned Arizonans back in 1906.

Senator ALLOTT. Except for a very limited amount along the western end of the Grand Canyon National Park, no park would be invaded—

Mr. BROWER. Thirteen miles, not just the edge that goes into it and all the national monument—

Senator ALLOTT. I beg your pardon, I have examined the Bureau's maps on this and I don't find, except as it would deviate from the normal river line, where it does invade the park.

Mr. BROWER. There is an invasion certainly of the park and of the monument.

Senator ALLOTT. As a matter of fact, I do deeply resent the material which was put out by your club, and I can only testify as to the reaction of the people that I talked with in Colorado that were led to believe that the entire Grand Canyon was going to be filled with water.

Mr. BROWER. They were not led, sir, by us to that conclusion. I think they were led to that conclusion by the constant and repeated denial of statements we never made.

Senator ALLOTT. They constantly quoted Sierra Club material and I can only judge by that.

One other thing I almost forgot. You skipped over it very rapidly in your statement. Knowing your position about wilderness areas, how do you feel really about the Hooker Dam?

Mr. BROWER. I have given this in the statement there, that we are hoping as I said, that alternatives will be sought, that this is a wilderness invasion. We think that it is important early in these days of the wilderness bill after the anguish we all went through getting it, and that includes you, that we not take out after the first invasions into the wilderness. Quite often these reservoirs, wherever they are, although they might seem statistically a very small part of an area, they are usually at the very heart, the heart of the living space, the important part that you start out from to experience in these places.

We would rather see all sorts of alternatives sought. We would like to see man go back over the country he has already used, and use it better, than to continue to hope he can continue in the wilderness his old habits of growth and exploitation.

Senator ALLOTT. I hope I can figure out your answer after I read the record.

Mr. BROWER. I hope you do.

Senator JACKSON. Senator Fannin.

Senator FANNIN. Mr. Chairman, in order to save time, I will just take a moment. Mr. Brower, as long as you are talking about clear conscience, and you brought it up, do you have a clear conscience regarding our fine Indian citizens when you oppose Hualapai Dam?

Mr. BROWER. I didn't quite understand the latter part of the question.

Senator FANNIN. I just asked if you have a clear conscience in opposing Hualapai Dam. Do you consider the dependency of our Indian citizens in that particular area?

Mr. BROWER. Yes, I do have a clear conscience.

Senator FANNIN. Have you talked to the Hualapai Indian people?

Mr. BROWER. I haven't talked to them. I have talked to one on the occasion of a TV broadcast in southern California. I have written. We have had some correspondence, but it is rather spotty.

Senator FANNIN. You say you recognize the tremendous importance it is to them and yet you haven't contacted them.

Mr. BROWER. I don't at all believe that it is tremendously important to them. I think that if there is going to be a major Federal subsidy to the Hualapai there are much better ways to apply it than to put on about a 100- or a 200-year basis one of the best parts of their terrain.

Senator FANNIN. Don't you think that should be their decision?

Mr. BROWER. It is a decision I think that must be taken by all of us, because you cannot build a one-sided reservoir.

Senator FANNIN. This is certainly a consideration that you should show to them. You realize that Hualapai is not, and need not be, relevant to water import. It could conceivably finance that, but not necessarily so; isn't that right?

Mr. BROWER. I agree quite clearly with Secretary Udall on that, that there is no other need for that big a development fund, except to bring amounts of water like the Columbia down to the Southwest primarily for irrigation.

Senator FANNIN. Mr. Ingram brought out all the things that could be done with the basin account. Naturally, that would pertain to the Hualapai Dam. Is it not true that the excess Hualapai revenues could go for canal lining and salvage. It could be used to construct needed projects in the Lower Basin to better work the available water, pay for importation from northern California and provide funds for extensive weather modification.

There are so many different uses for a basin fund, so when you say that this revenue is needed for importing Columbia River water I think that is very narrow——

Mr. BROWER. Could we respond to that?

Senator FANNIN. I don't want to prolong this. Time is running short.

Mr. INGRAM. Just let me say here the key word here is "necessity."

Senator FANNIN. You have covered this with me many times and I have let you know my viewpoint, and I don't want to prolong the testimony.

Mr. BROWER. But may we respond to that one point.

Senator FANNIN. Certainly, if you will make it concise.

Mr. INGRAM. The key word is "necessity." What is the dam necessary for? What are revenues necessary for? The answer to this is given in a letter that I wrote to Felix Sparks, which is included in this material, which I have offered for the record.

Senator FANNIN. I think that I have listed many necessities.

Mr. INGRAM. They are not necessary. You could use the money for it but the money is not necessary for that. You can get the money from other sources.

Senator FANNIN. Let me tell you that it is not available.

Senator HAYDEN. Mr. Ingram, do you have a statement you desire to file?

Mr. INGRAM. I have the statement of Dean Ewing of the Save the Grand Canyon Committee. I would like to read two excerpts from the statement if I could.

Senator HAYDEN. It is getting late. Make it brief if you will.

Mr. INGRAM. Yes, this is a statement of the Save the Grand Canyon Committee of Albuquerque, N. Mex., which is a steering organization composed of representatives from many organizations. I would like to read two excerpts, one the list of organizations, and the other a press release from the Governor of New Mexico on his stand on the Grand Canyon dams.

The list of organizations which support the Grand Canyon committee is the Wilderness Society, Wildlife and Conservation Association—which I might add is the State affiliate of Life, which disagrees with the position of the Hualapai Dam—the New Mexico Ornithological Society, Rio Grande Chapter of the Sierra Club, New Mexico Mountain Club, the University of New Mexico Mountaineering Club, the Los Alamos Outdoor Association, the Albuquerque Veterinary Association, the Humanist Association of Albuquerque, the Thunderbird Trailer Club, the Albuquerque White Water Club, Sportsman's Legislative Action Committee, Isaac Walton League.

All of these organizations have taken a firm position endorsing extension of the boundaries of the present Grand Canyon National Park and opposing dams in the Grand Canyon.

Then, I would like to read, if I could, the press release from Governor David F. Cargo of New Mexico, which he released last month, April 17, 1967:

Governor David Cargo today met with spokesmen for the Save Grand Canyon Committee and again expressed his opposition to the dams in the Grand Canyon. Today's meeting was held as a result of the continuing threat presented by bills in Congress which would authorize Hualapai Dam in the lower Grand Canyon.

Cargo stated: "Conservation of natural resources is one of the major concerns of my administration. Development of water resources and preservation of scenic natural areas are of special concern to New Mexico and all of the Southwest."

Regional and national water problems require cooperation between the states for solutions. Agreements on the upper Gila and Animas-La Plata are examples of such cooperation. These agreements have been jeopardized by proposals which have included construction of unnecessary dams in the Grand Canyon. Last year, inclusion of dams blocked legislation that would have given effect to these and other agreements among the basin states. This year, studies by the Bureau of Reclamation and outside independent sources prove that these dams are not needed now and should be deleted, and indicate that the question of any future need can be studied by the National Water Commission. Cargo said, "I believe that this kind of approach represents the route for resolving long-standing disputes among the basin states and provides an opportunity to restudy the question of the Grand Canyon's highest purpose."

Cargo concluded with "As Governor of New Mexico, as a conservationist and as an American citizen, I am proud of the position I have taken on the Grand Canyon during the campaign and since becoming Governor. I believe all of the Grand Canyon is worthy of being protected within a National Park."

That concludes the excerpts I would like to make from that statement.

(The full statement referred to follows:)

STATEMENT OF DEAN EWING, SAVE THE GRAND CANYON COMMITTEE

My name is Dean Ewing. I represent the Save Grand Canyon Committee, based in Albuquerque, New Mexico. This committee is a steering committee composed of representatives from well known organizations. I would like to name these organizations because it is this list that constitutes my chief credential for ap-

pearing before your Subcommittee. They are The Wilderness Society, Wildlife and Conservation Association, New Mexico Ornithological Society, Rio Grande Chapter of the Sierra Club, New Mexico Mountain Club, The University of New Mexico Mountaineering Club, The Los Alamos Outdoor Association, The Albuquerque Veterinary Association, The Humanist Association of Albuquerque, The Thunderbird Trailer Club, The Albuquerque White Water Club, Sportsman's Legislative Action Committee, and the Isaac Walton League.

All of these organizations have taken a firm position endorsing extension of the boundaries of the present Grand Canyon National Park and opposing dams in the Grand Canyon.

A typical statement follows: "The Board of the New Mexico Ornithological Society, on advisement from its statewide membership, is on the record as unanimously opposing the building of dams in the Grand Canyon area, and supporting the extension of the Grand Canyon Park to include Marble Canyon."

I submit that this group of organizations and the people they represent amount to a considerable body of opinion in New Mexico to the effect that this country must preserve the Canyon as it is.

But the question of preserving the Grand Canyon has aroused not only these organizations; it has evoked considerable notice in state government. During last fall's election campaign, both political parties in New Mexico passed similar resolutions in their party platform conventions.

The following statement is quoted from the resolution of the Bernalillo County Democratic Party. A virtually identical resolution was adopted at the State Democratic Platform Convention.

"Resolution No. 9 Conservation Paragraph 2—Bridge and Marble Canyon Dams

Since the Bureau of Reclamation proposes to build two dams in the Grand Canyon of the Colorado, and since these dams would not provide water for irrigation but would waste water through seepage and evaporation, and since the proposed dams are not necessary to the Central Arizona Project or other irrigation water works, and since cheaper power could be generated from fossil and nuclear fuels, and since construction of these dams would forever destroy natural features of the Grand Canyon it is hereby resolved that the Bridge and Marble Canyon dams are a needless waste of our precious natural resources. Alternate means of financing the Central Arizona Project should be instituted. The Grand Canyon National Park boundaries should be expanded to provide protection to portions of the Grand Canyon outside of the Park boundaries. Further, no private utilities should be allowed to build hydroelectric power plants at dam sites which would destroy the wonders of the Grand Canyon."

Also following is a key statement from the resolution adopted unanimously by some 1,200 delegates at the State Platform Convention of the Republican Party.

"Resolution: Whereas The Bureau of Reclamation proposes to build two dams in the Grand Canyon of The Colorado, and Whereas these dams would not provide water for irrigation but would waste water, and whereas the proposed dams are not necessary to the Central Arizona Project or other irrigation waterworks in the Lower Colorado River Basin, and Whereas lower power costs would result from fossil fueled or nuclear power plants, and Whereas construction of these dams would do irreparable harm to the natural features of the Grand Canyon. It is Hereby Resolved that the Bridge Canyon and Marble Canyon Dams are a needless waste of taxpayer's money. It is further resolved that alternate means of financing the Central Arizona Project should be pursued and that favorable action be taken on proposals which would increase the size of the Grand National Park to provide needed protection to portions of the Grand Canyon presently outside of the National Park boundaries."

Furthermore, Governor David F. Cargo of New Mexico, after meeting the Save Grand Canyon Committee on April 17, 1967, authorized the following press release:

"Governor David Cargo today met with spokesmen for the Save Grand Canyon Committee and again expressed his opposition to the dams in the Grand Canyon. Today's meeting was held as a result of the continuing threat presented by bills in Congress which would authorize Hualapai Dam in the lower Grand Canyon.

"Cargo stated: 'Conservation of natural resources is one of the major concerns of my administration. Development of water resources and preservation of scenic natural areas are of special concern to New Mexico and all of the Southwest.'

"Regional and national water problems require cooperation between the states for solutions. Agreements on the upper Gila and Animas-La Plata are examples of such cooperation. These agreements have been jeopardized by proposals which have included construction of unnecessary dams in the Grand Canyon. Last year, inclusion of dams blocked legislation that would have given effect to these and other agreements among the basin states. This year, studies by the Bureau of Reclamation and outside independent sources prove that these dams are not needed now and should be deleted, and indicate that the question of any future need can be studied by the National Water Commission. Cargo said, 'I believe that this kind of approach represents the route for resolving long-standing disputes among the basin states and provides an opportunity to restudy the question of the Grand Canyon's highest purpose.'

"Cargo concluded with 'As Governor of New Mexico, as a conservationist and as an American Citizen, I am proud of the position I have taken on the Grand Canyon during the campaign and since becoming Governor. I believe all of the Grand Canyon is worthy of being protected within a National Park.'

"The Save Grand Canyon Committee is an Albuquerque organization working to inform the public about the threat of dams in the Grand Canyon. Members of the Committee meeting today with Governor Cargo were: Dr. Dean Ewing, Coordinator; Dr. Donald Peterson, Jeffrey Ingram, Max Linn, and Stanley Logan."

Other witnesses before this Subcommittee have raised technical questions about the dams and the Central Arizona Project and have questioned the economic arguments which have been used to support construction of dams. I am not here to do that, but I am authorized by my committee to make this concluding statement:

We continually hear from government and state officials and from commercial lobbyists that we must wisely *use* our priceless natural resources. They, of course, refer to consumptive use. I wish to state that there is another wise use we must consider in this problem and that is the non-consumptive use of natural resources, use which is necessary for man's physical, mental, and spiritual wellbeing and yet leaves the resources unchanged for its similar perpetual use by those who follow.

We continually hear discussion centering on economics—the economics of consumptive use of resources. We put dollar signs on our natural areas. But these areas are priceless. Their fate must not be decided solely in dollars and cents. Surely we are wealthy enough in money and scientific talent to find other ways to solve our pressing water and power problems.

New Mexico is a neighbor state of Arizona, the Grand Canyon State, but we feel that the Grand Canyon is a possession of our nation, not of Arizona, nor even of the Southwest; and we remain unconvinced that regional, industrial, or agricultural development should always have priority over considerations of national interest.

Mr. INGRAM. I would like to make one thing clear. This morning Senator Montoya made the statement that I was here to oppose Hooker Dam on behalf of the Save the Grand Canyon Committee. At that time I responded, and I would just like to repeat that again, that I am here to make the statement of the Save the Grand Canyon Committee on the Grand Canyon only and not with any reference to Hooker Dam.

(The attachments referred to follow:)

SANTA MONICA, CALIF., April 28, 1967.

HON. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs
U.S. Senate, Washington, D.C.

DEAR SENATOR JACKSON: Thank you for your letter of April 13 stating that you have added my name to the witness list for your hearings on S. 1013 and related bills next week.

As indicated in my original letter of April 4, I was not entirely certain that I would be able to come to Washington for the hearings. Unfortunately, this has turned out to be the case.

I am, however, enclosing a joint statement by my colleague, Dr. William E. Hoehn, and myself on the economics of the proposed Grand Canyon dams. This represents our most recent research on the subject and is based on many months of work dating back as far as August 1965. I believe that it is most important that

your Committee give careful and consideration to the strong economic case against the dams and therefore hope that you will arrange to include our statement in the hearing record, despite the fact that neither of us can be present in person.

Sincerely yours,

ALAN CABLIN.

ECONOMIC FEASIBILITY OF THE PROPOSED GRAND CANYON DAMS

(By Alan P. Carlin and William E. Hoehn, Economists)

We are residents of Santa Monica, California, and submit this statement as private citizens not representing any organization. We have made extensive studies of the economic justification for the proposed Marble Canyon and Hualapai Projects and wish to present the results of our latest research to the Committee. We have not received financial compensation in any form for our work. Our qualifications in the field of economics include, in one case, a doctorate from the Massachusetts Institute of Technology and experience in project analysis, particularly in the water, power, and transportation fields, and in the other case, a doctorate in economics from Northwestern University and research over the last several years on the nuclear power industry. We both currently hold positions as Economists with The RAND Corporation, Santa Monica, California, although the views presented here do not necessarily represent those of the Corporation.

Our most recent research falls into two general categories. First we reviewed the various arguments presented by all parties in 1966 to pick out the issues of basic economic interest and to relate these to the present guidelines used for evaluating Federal water resource projects. Secondly, we undertook a re-evaluation of the economic feasibility of both the Marble Canyon and Hualapai projects to bring our analysis up to date in light of changing costs and to reflect the increased importance of the Hualapai Project.

RECLAMATION'S QUESTIONABLE BENEFIT-COST PRACTICES

Our research on the first area suggested that the differences between the Bureau of Reclamation's analysis (and that of some other dam proponents, such as Representative Morris Udall) and our 1966 analyses resulted from a number of economically questionable procedures the Bureau had used in computing its benefit-cost ratios. Of these the most important from an economic standpoint were found to be as follows:

(1) Choice of the alleged "most likely" alternative rather than the least cost alternative in evaluating the power benefits from the proposed dams

(2) Use of higher interest rates and taxes in evaluating the alternatives than the projects

(3) Insistence that any alternative must distribute energy to exactly the same customers as would allegedly be served by the projects, without regard to the objectives of minimizing the cost of meeting demand in a regional power system.

In addition, although our 1966 analyses did not make a major issue of it, we nevertheless objected to:

(4) The use of a rate of interest below even current costs of borrowing by the Federal Government and with no allowance for the economic risks of the projects.

Perhaps the easiest way to explain these differences is by turning directly to the paper written as a result of this research effort.

[The Carlin paper of February 1967]

EVEN LOWER BENEFIT-COST RATIOS DEMONSTRATED FOR BOTH PROJECTS

This paper of February 1967 serves as a good introduction to the second area of research that we have pursued since the May 1966 hearings in that among other things it summarizes most of the 1966 arguments. There have, however, been some changes in the last year. To take these as well as some refinements in our own techniques into account, we have calculated entirely new benefit-cost ratios for both projects. This time, however, we have undertaken these calculations at both $3\frac{1}{2}$ percent and 5 percent so as to show the effects of higher, more realistic interest rates on the benefit-cost ratios.

The results are even more unfavorable to the dams than those printed in the May 1966 hearings. At the Bureau of Reclamation's $3\frac{1}{2}$ percent interest rate,

the Hualapai project is found to have a benefit-to-cost ratio of only 0.61 to one while Marble Canyon has a ratio of 0.76 to one. And at a more realistic 5 percent rate, the ratios are 0.52 to one for Hualapai and 0.61 to one for Marble. It is our conclusion that in each case these represent overestimates of the ratios because of some assumptions made which are favorable to the dams.

In addition, it is pointed out that the benefit-cost ratios at 3½ percent interest would still be less than one-to-one *even* if the Bureau of Reclamation's alleged \$6 per kw-year transmission costs were added to the cost of the nuclear alternatives. There would therefore appear to be little possible doubt that either dam is anything except economically unjustified. To show how these conclusions were derived we now turn to the Carlin-Hoehn paper of March 1967.

[The March 1967 paper]

SUMMARY

In closing perhaps it would be useful to summarize briefly, with the help of charts, what at times has necessarily been a somewhat technical argument.

First we have reviewed the arguments made last year by all parties to pick out the issues of greatest importance from the standpoint of economic theory and to relate these issues to the basic guidelines used for evaluating Federal water resource projects. Chart 1 enumerates the four major differences found between the cost-benefit practices of the Bureau of Reclamation in their evaluation of the dams and those dictated by prevailing economic theory. Our 1966 analyses corrected for the first three of these.

With regard to the first item, we should like to point out that it is quite possible to justify any hydroelectric project by choosing a sufficiently high cost alternative. But only the least cost alternative provides any information as to the economics of such a project. The second item, the use of a higher interest rate for the alternatives, can be compared to the use of say the price of common brick in costing one brick building and face brick in costing an alternative. Naturally the latter looks worse than it really is. And the results are even more meaningless in the case of the hydroelectric projects under consideration since the price differences are greater. The third item, transmission costs, deserves some amplification. What the Bureau maintains here is that an alternative must distribute energy to precisely the same customers as would the project, rather than seeking to minimize the total delivered energy cost through an appropriate redistribution of loads among the region's existing and planned generating facilities. The fourth item concerns the Bureau's use of a rate of interest below even that at which the Treasury can currently borrow, and with no allowance for the economic risks associated with projects of this type.

CHART 1.—RECLAMATION'S ECONOMICALLY UNJUSTIFIED BENEFIT-COST PRACTICES IN EVALUATING GRAND CANYON DAMS (ISSUES OF ECONOMIC INTEREST)

- Choice of "most likely" rather than least cost alternatives.
- Use of higher interest rates and taxes in evaluating alternatives.
- Insistence on same transmission costs for alternatives at load centers.
- Use of unrealistically low interest rate for dams.

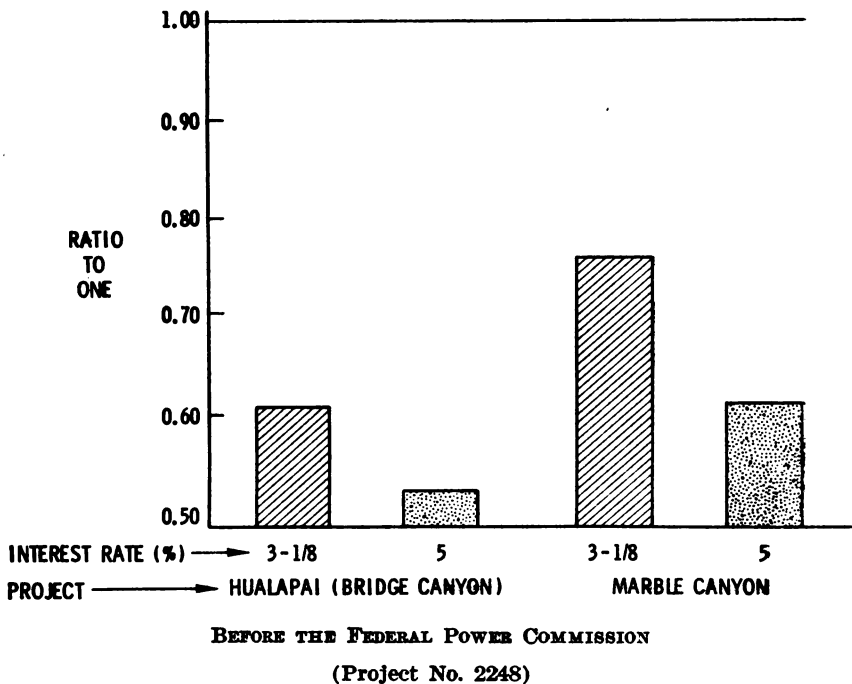
This brings us to the second line of inquiry—the revision of our 1966 benefit-cost ratios. Although we used the same low rate of interest used by the Bureau for the projects in evaluating both the projects and the alternatives in these earlier studies, our new analysis, the results of which are shown in Chart 2, also evaluates the projects at five percent to show the marked sensitivity of the benefit-cost ratios to changes in the assumed interest rate. This new analysis was necessitated by changes in nuclear costs in the last year—a year which has seen nuclear plants gain unprecedented acceptance by both public and private utilities—and reflects the increased interest in the Hualapai or Bridge Canyon Project. The analysis also incorporates some added refinements recommended by a Federal Power Commission technical memorandum.

The new ratios shown in Chart 2, which we believe to be overstated for reasons enumerated earlier, are quite substantially below one-to-one. In fact, they are so far below one-to-one that the dams would not be economically justified even if the Bureau of Reclamation's alleged \$6 per kilowatt-year transmission costs were added to the cost of our nuclear alternatives.

Thus, even giving the benefit of doubt on several items to the Bureau, and using their procedures and data insofar as possible, we find that the benefit-cost ratio of the Hualapai Project—proposed in some of the legislation pending before this Committee—is no better than 0.61 to one. This deficit is unlikely to be overturned by further analysis, and we trust that the Committee will afford this Project the decent burial it pungently deserves. We further hope that the Committee will soon consider revisions of Senate Document 97 so that in the future similar projects will undergo better economic analyses before reaching Congress.

Chart 2

BENEFIT-COST RATIOS USING NUCLEAR ALTERNATIVES



IN THE MATTER OF ARIZONA POWER AUTHORITY

SUPPLEMENT TO PETITION OF THE SIERRA CLUB FOR LEAVE TO INTERVENE PURSUANT TO RULE 1.8(d)

R. Frederic Fisher: Lillick, McHose, Wheat, Adams & Charles, 1625 K Street, N.W., Washington, D.C. 20006. David Sive: Winer, Neuburger & Sive, Chrysler Tower East, 161 East 42nd Street, New York, N.Y. Attorneys for Petitioner Sierra Club.

Dated: January 30, 1967.

PRELIMINARY STATEMENT

On December 9, 1966, the Sierra Club filed its petition for leave to intervene. Of the fourteen parties to these proceedings, two have interposed Answers opposing the Sierra Club's petition: Applicant Arizona Power Authority (hereinafter referred to as the "Applicant") and Commission Staff Counsel (hereinafter referred to as "Staff").

The following additional proceedings have been had since December 9, 1966:

1. On December 27, 1966, Applicant moved for an immediate decision with regard to the Marble Canyon project, and issuance immediately thereafter of a license to construct and operate the Marble Canyon project.

2. On January 9, 1967, the State of California and other California agencies (hereinafter referred to as the "California Intervenor") filed their Answer to the Applicant's motion of December 27, 1966. They also moved for a suspension of action by the Commission with respect to the Marble Canyon project until the close of the 90th Congress.

3. On January 10, 1967, the Navajo Tribe Indians (hereinafter the "Navajo Tribe"), the Secretary of the Interior (hereinafter the "Secretary"), and the City of Los Angeles and its Department of Water and Power (hereinafter "Los Angeles") filed answers to Applicant's motion of December 27, 1966.

4. The Secretary submits in his Answer that Congress has "failed to complete its consideration of the relevant issues . . . because of the intensity of competing viewpoints, the broadening circle of political concerns and the historical implications for national resources policy extending far beyond the narrow considerations of any single hydroelectric project." (Answer of Secretary dated Jan. 10, 1967 at p. 3).

5. The Secretary points out that hearings before the House of Representatives' Committee on Interior and Insular Affairs have revealed "major issues of national resources policy," one of which is, according to the Secretary, himself once a proponent of Grand Canyon dams, : "*whether scenic considerations preclude the construction of any dams on the reach of the river between Lake Mead and Glen Canyon Dam*, an issue which took up more time of the House Interior Committee than all others combined." (Id. at p. 5)

6. The California Intervenor, the Navajo Tribe and Los Angeles, who, with the Secretary, are parties to this proceeding, urge that the record should not be deemed closed. The California Intervenor, particularly, emphasize the importance of the "conservation issue." (See Answer of California Intervenor dated January 9, 1967, at pp. 2, 3).

7. The importance of the "issues of national resources policy [which] are at stake" has been demonstrated by the 90th Congress. Several bills have been introduced in the 90th Congress which would resolve, by legislation, one or more of the principal issues before the Commission in these proceedings. (e.g. H.R. 1272 (January 10, 1967)).

These events bear materially upon the petition of the Sierra Club to intervene, and justify this supplemental filing. In addition, this supplemental petition sets forth additional and detailed facts supporting petitioner's application to intervene.

I. Purpose of Petition and Position of the Sierra Club.—The purposes of the Club in seeking intervention are: 1) to enable it to answer Applicants' motion for an immediate grant of a license to construct the Marble Canyon Project and to seek stay of the proceedings pending Congressional resolution of the paramount issue of proper development of the Lower Colorado River Basin including the site proposed by Applicant; 2) to enable the Club to petition the Commission, pursuant to Rule 1.33(c) for limited reopening of this proceeding at such time as the Commission determines that it is appropriate to act on the Application.

Upon reopening of the proceedings, the Club would present witnesses and evidence respecting present economic feasibility of the project as compared with present alternatives. It would also offer new evidence pursuant to the standards set down by the Court of Appeals for the Second Circuit (*Scenic Hudson Preservation Conference v. Federal Power Comm'n*, 354 F. 2d 608, 612-14, 624-25 (2d Cir. 1965)), respecting effects of the project on the scenic and recreational value of this last and most spectacularly beautiful stretch of remaining natural canyon.

In the present posture of this case it is obvious that satisfaction of Rule 1.8 (d)'s requirement that "extraordinary circumstances" exist and that "good cause" be shown for intervention suggests preservation of some of the same grounds that will also be urged to justify stay of proceedings and, particularly, reopening thereof. Accordingly, many of the allegations which follow will overlap the grounds given in the Motion to Stay and Petition for Reopening which the Club will file within a few days.

II. Petitioner's Unique Right and Interest.—A. The Club's membership includes a large number of those individuals whose present and future use and enjoyment

of the Colorado River for navigation, recreation and other purposes would be destroyed if the license in question were granted.

B. As a result of the Club's long-term interest in and its expertise respecting that part of the public interest which concerns conservation and scenic and recreational uses of the Colorado River and of the Marble Gorge of the Grand Canyon, the Club is uniquely qualified to present evidence, comments and expert judgments respecting such issues.

C. In 1965, after close of Hearings in this case, the Commission was directed, for the first time, to give great weight to such issues in determining whether to issue licenses. (*Scenic Hudson Preservation Conference v. Federal Power Comm'n*, *supra*.) Much evidence demonstrating serious harm to recreational, archeological, and scenic values has newly come to light, as will be shown. Both this new evidence and significant evidence that might have been presented earlier, but whose singular relevance and importance were newly articulated in the *Scenic Hudson* decision, are in the Club's hands and should be received.

This is no ordinary case. It is of paramount importance that the location of the proposed project is the Grand Canyon of the Colorado River, one of the major wonders of the world and perhaps the single most valuable, even priceless, scenic resource this country possesses.

D. Petitioner has devoted great amounts of time and energy and has made use of highly qualified experts to study (1) the Southwest Water Resources Plan as it bears on the instant application; (2) the now outdated material of record in this proceeding respecting cost data and economic feasibility of the project; (3) the significant and compelling new evidence and material available since the close of Hearings in 1961 relating to cost and economic feasibility of the project and its alternatives; (4) a comparison of the old data of record with up-to-date economic evidence; (5) data respecting aspects of the proposed project which the Examiner deemed relevant but regarding which no significant evidence was available at the Hearings that would enable a cost to be assigned thereto.

Data in the last category include, by way of example, the physical effects of the proposed project on the Grand Canyon National Park itself, data relating to the cost and necessity of a reregulating dam below the proposed project, and data relating to cost factors involved in compensating the Government for impairment of the power potential of its Glen Canyon facility.

The Club was permitted to present some of such materials to the Congress of the United States, although not with opportunity to question or cross-examine proponents of the instant project with respect to the current validity of their data. (See Hearings on H.R. 4671 Before the House Subcommittee on irrigation and Reclamation of the Committee on Interior and Insular Affairs, "Lower Colorado River Basin Project," 89th Cong., 1st Sess. 1965.) (Hereinafter "Congressional Hearings".) The Congress thus recognized not only the Club's vital interest in regard to projects in the Marble Gorge of Grand Canyon and elsewhere therein, but its competence to testify respecting technical as well as recreational and aesthetic aspects of the Canyon's use.

E. The Club, in the event of grant of this petition, will come closer, with one exception, to presenting the heretofore unrepresented public interest as regards this project than do the present parties. All present parties, with the exception of the National Parks Association, whose intervention has been limited, are in this case defending or asserting what they believe to be their economic interests.² With the exception of the National Parks Association, all present Intervenor advocates *some* dam in the Marble Gorge of the Grand Canyon.³ Hence, in presenting arguments against the proposed license the parties necessarily had to couch their arguments and data carefully to avoid presentation of data leading to the conclusion that *no* hydroelectric project at the proposed site is either economically feasible or in the public interest.

The Club's wide and diverse membership, and its concern with an expertise respecting the issues deemed of overriding public importance in *Scenic Hudson* make the Club's participation herein important to a proper determination of the public interest by the Commission. The Applicant, as well as the Secretary and other parties in these proceedings, credit the Sierra Club with principal responsibility for raising the "conservation issue."

² Los Angeles and the Department of the Interior (at least in 1961) wished to build their own projects.

³ The Navajo Tribe has since changed its position and now opposes any Marble Gorge Dam. (H. Rep. #1849, 89th Cong., 2d Sess. (1966) at 139-40.)

III. *Posture of Proceedings.*—Applicant submitted its application and supporting exhibits nearly nine years ago—on July 15, 1958. Obviously, its fundamental decision to place a hydro power development in the spectacular Marble Gorge of the Grand Canyon of the Colorado was based on economic data available in 1957–58. Hearings were held during 1961, during which data relating to cost and economic feasibility and other features of the project were presented. Cost data were based on January 1960 (i.e., basically, 1959) prices. (Examiner's Decision at 9.) (Hereinafter cited Ex.) The staff's cost data were based on the same price levels. (Ex. at 10.) After a substantial portion of those hearings had been completed, the Southern California Edison Co. was permitted to intervene to "establish relevant and material facts and law alleged in the petition respecting an alternate plan . . ." (Commission Order of August 31, 1961).

On September 10, 1962, the Examiner issued his decision ordering, subject to Commission review, issuance of a license under section 4(e) of the Federal Power Act (16 U.S.C. § 797(e)). Subsequently, on October 1, 1962, the Secretary of the Interior petitioned to intervene. This petition was granted on the grounds that although it was late-filed, intervention should be granted in the public interest "although the petition . . . does not set forth any material change of fact since the conclusion of the hearing" nor state the nature of evidence to be introduced upon reopening. (Commission Order of November 2, 1962.) Limited intervention was ordered. (Ibid.)

Oral argument was presented to the Commission in February of 1963. On August 27, 1964, Public Law 88–491 (78 Stat. 607) suspended the authority of the Commission to issue licenses or permits with respect to Grand Canyon dams until December 31, 1966. The statute also provided that the rights and positions of the various parties relative to each other were not to be changed by passage of the statute. It saved "the present status, equities, position, rights or priorities of any parties to applications pending" at the date of the statute's enactment.

Following oral argument, the Department of the Interior, in January of 1964, submitted its Pacific Southwest Water Plan, which included detailed proposals of the Bureau of Reclamation for building a comparable dam and power facility at the Marble Gorge site. This proposal, which was never before the trier of fact—the Examiner—contained detailed economic data that are at variance with the data on which the Examiner relied in this proceeding. The Bureau's proposal therefore raises serious questions respecting the instant project. The variance was caused in major part by the fact that the prices relied upon were those prevailing as of October 1963. These data, discussed below, raise the question whether reconsideration of the decision *by the trier of fact* is necessary to reconcile the varying estimates of economic feasibility and the significant difference between the 1959–60 costs on which the Examiner's findings were premised and those found by the Bureau to prevail in 1963. Further, the change in economic data between 1959–60 and the Bureau's figures three years later strongly suggest that the additional three years that have elapsed (i.e., 1963 to 1966–67) have wrought still more drastic changes in economic feasibility.

In 1965 lengthy Congressional Hearings were held on the Bureau of Reclamation's proposals for, among other things, its Marble Gorge dam and power facility. Two points of importance were developed at these Hearings that bear on the posture of the instant case and on this petition for intervention.

First, extensive data were developed which, at a minimum, raised the most serious questions regarding the Bureau's Marble Gorge project and its economic feasibility in view of alternative sources of power. (e.g., Congressional Hearings, *supra*, at 1468–1563 (statements and testimony by, and counterstatements to Messrs. Ingram, Carlin, Hoehn, and Moss).) In turn the data raise questions of major importance regarding the economic feasibility of the instant project and show the necessity of a new and updated economic analysis of the project.

Second, although the Congressional Hearings were themselves wholly inadequate on the subject, they brought forth for the first time the realization and the fact that: (a) the reservoir of the proposed project would flood out and despoil a major remaining section of the most breathtakingly spectacular and beautiful scenic and recreational sites in the entire United States. This alone may be sufficient to prevent issuance of the license under the new standard set forth in the *Scenic Hudson* case, *supra*; (b) operation of the project would necessarily utilize and have a direct effect upon the river and its flow in the *Grand Canyon National Park and Monument themselves* and on abutting lands in the Park and Monument. This results from the massive surging of waters shown by the Congressional

Hearings to be an unavoidable by-product of operation of the dam in question for peaking-power purposes. (See H.R. Rep. 1849, 89th Cong., 2d Sess. at 130). This factor was not brought forth by the Examiner other than inferentially in the suggestion—but not requirement—of a reregulating dam (Ex. at 11, 39, 41, 46.).

(c) The Congressional Hearings brought out that not just a few hardy, wealthy adventurers, but a great and rapidly increasing stream of persons, ranging in age from 12-61 are making use of the natural river and trails in the Marble Gorge for recreational purposes. (e.g., Congressional Hearings at 823, 829, 851.)

Also, in 1965, the Court of Appeals for the Second Circuit articulated a new standard for determining the public interest in licensing projects of this nature. This standard was not applied by the Examiner in his 1962 decision.

On December 27, 1966, Applicant moved for an immediate issuance of the license based on the record of 1961 and the 1959-60 data therein. The curious theory was advanced that Public Law 88-491 (which was intended to *prevent* the Commission from issuing a license while Congress itself resolved the disposition of the Grand Canyon and its spectacular Marble Gorge) *required* the Commission to issue a decision on the old record immediately upon expiration of the statute. This theory assumed that Congress must have intended to forfeit all chance of legislating respecting the Marble Gorge project in the fully foreseeable event that it was not able to act before the moratorium expired.

IV. *Petitioner's offer of evidence.*—Normally, a detailed offer of proof is inappropriate for a petition to intervene. Section 1.8(d) of the Commission's Rules, however, requires "extraordinary circumstances" and "good cause" for late intervention. It would seem that the posture of this case, described in the preceding section, and particularly the unsuitability of 1960 economic data to support issuance of a license in 1967, itself provides the "extraordinary circumstances" required. "Good cause" for allowing the Club's intervention at this stage is also shown by the following material. The Club has consulted its experts and is in a position to set forth in detail the evidence which, it submits, is vital to proper determination of the pending application.

A. Project 2248 Not Economically Feasible

1. Data Relied Upon by Trier of Fact

Based on Applicant's 1959 data regarding costs of constructing and operating a gas-fired steam plant and its January, 1960, data regarding costs of constructing and operating the proposed project, the Examiner concluded that the project was "economically feasible" (Ex. at 31), and that the project could be successfully financed by "issuance of revenue bonds in the amount of \$195,500,000." (Ibid.)

The data on which this conclusion was based are referred to in the Examiner's opinion. Total construction costs based on January 1960 prices were estimated at \$154,700,000 (Ex. at 9). As the Examiner stated, "The testimony is that the project would be financially feasible *conditioned upon*: . . . (3) The actual costs of the project to not greatly exceed the estimates." (emphasis supplied) (Ex. at 10)

The total cost, according to the Examiner, "would vary from \$168,000,000 at four percent annual interest to \$172,000,000 at five percent annual interest." The "presently estimated interest rate" was stated as "4.6 percent." (Ibid.) The Examiner also found financial feasibility "conditioned upon": "(4) The net interest cost bid for the bonds is not such as would prevent the procurement of the contracts described above." (Ibid.) The contracts referred to were long-term, firm contracts for substantially all the power "at rates which would yield the annual costs." (Ibid.)

The annual charges of the project (operating costs and debt service) were \$10,208,000 at four percent interest, \$10,978,000 at four and one-half percent interest and \$11,794,000 at five percent interest. The dollar figure of the interest was, of course, calculated with respect to the 1959-60 estimated cost figures. The interest rates assumed were, equally obviously, rates which appeared realistic at the time.

The gas-fired alternative project on which the benefit-cost ratio was calculated was based on a study submitted in 1959 respecting costs of construction and operation of such plants. The estimated cost of producing energy at the alternate plant and delivering it to load centers was "found to be 3.30 mills per kilowatt-hour." Capacity costs at market were \$12.38 per kw/hr. at four percent interest and \$13.57 at five percent. Construction costs were estimated at \$138/kw at four percent. (Ex. at 9.) The staff studies estimated the value of Marble

Gorge power at market as 3.27 mills per kilowatt hour and capacity costs of \$12.27, \$12.90 and \$13.54, per kilowatt year at 4.0, 4.5 and 5 percent interest respectively. (Ex. at 10.)

Annual benefits of the Marble Gorge project compared with the alternate gas-fired steam project, net benefits, and benefit-cost ratios were expressed as follows (Ex. at 9-10) :

Interest rate	Annual benefits	Annual costs	Net annual benefits	Applicant's benefit-cost ratio	Staff benefit-cost ratio
2.5 -----	\$13, 578	\$8, 226	\$5, 352	1. 65	-----
3.0 -----	13, 868	8, 858	5, 010	1. 56	-----
4.0 -----	14, 475	10, 238	4, 237	1. 42	1. 31
4.5 -----					1. 26
5.0 -----	15, 169	11, 744	3, 425	1. 29	1. 21

Significant escalation in hydro costs, and in interest rates and radiacly more economic alternative sources of power—all new developments—make the finding of economic feasibility of the project proposed here as obsolete as the good ship *Mayflower* and as mistaken a basis for issuance of the license in question as an assumption that the world is flat.

2. Revised Calculation of Benefit-Cost Ratio of Project.

(a) Extraordinary Circumstances in Economics of Power Generation : There have been extraordinary developments in the economics of power generation in the years since the Commission's staff study⁴ and the Examiner's decision. These extraordinary—even historic—circumstances are such that under present conditions it seems safe to say that the Examiner would have refused to license the Marble Gorge project because the value of its power and energy would be less than its cost.

(b) Dramatic Decrease in Estimated Costs of Nuclear Power Alternative : The trend in the estimated costs of nuclear power from 1958 to 1966 is shown in Table 1.

TABLE 1.—Trend in estimated costs of nuclear power (1958-66)

[From Lane, Annual Review of Nuclear Science, p. 362 (1966)]

Year of estimate	Station type	Station capacity (mega-watts electrical)	Energy costs (mills per kilowatt-hour)				Competitive coal costs (cents per thousand British thermal units)
			Capital	Fuel	Operation plus maintenance	Total	
1958.....	BWR.....	190	4. 8	3. 3	0. 9	9. 0	49
1958.....	BWR.....	580	4. 2	3. 3	. 6	8. 1	46
1960.....	Light water.....	300	4. 35	2. 42	. 84	7. 61	41
1962.....	1966 light water ¹	500	3. 2	1. 9	. 5	5. 6	33
1962.....	1970 light water.....	500	2. 9	1. 5	. 4	4. 8	26
1962.....	1975 light water.....	500	2. 7	1. 1	. 4	4. 2	20
1964.....	BWR.....	620	1. 75	1. 27	. 48	3. 50	24
1964.....	BWR.....	605	2. 88	1. 45	. 35	4. 68	27
1966.....	BWR.....	800	2. 2	1. 8	. 4	4. 4	24
1966.....	1970 light water.....	800	1. 89	1. 47-1. 95	. 36	3. 72-4. 20	20-24
1966.....	1975 light water.....	1, 000	1. 63	1. 29-1. 90	. 30	3. 22-3. 83	13-20

¹ Costs based on 5 years after startup of plant.

The cost data in Table 1 are based on a capital charge rate of 12 percent, typical of the rates for investor-owned utilities, and are thus higher than would be expected for a municipal (tax-exempt) utility. Nevertheless, the costs at a lower capital charge rate would have the same downward trend as that shown in the

⁴ Prepared Testimony of Commission Staff, Project 2248 (March 6, 1961).

table. This downtrend has been so dramatic that the estimated cost of nuclear power is now only half of the estimated cost at the time the Arizona Power Authority and the FPC staff performed the economic analyses of the Marble Gorge project.

The result of this decrease in the costs of nuclear power is that the value of the capacity and energy of the Marble Gorge project must now be measured against the costs of providing capacity and energy from nuclear plants.

(c) Dramatic Increase in Orders for Nuclear Plants: Six years ago only a few, relatively small, nuclear plants existed. The first two nuclear plants to generate energy at costs comparable to those of fossil-fuel-burning plants (Dresden-1 and Yankee) were just beginning operation. Their reliability, dependability, and cost of operation were as yet unknown.

The successful and economic operation of these reactors and other water reactors which followed confirmed the estimates that had been made. Improvements in design, standardization of components, and the economics inherent in building units of larger generating capacities have further reduced costs.

The result has been a dramatic increase in orders for nuclear plants. In less than two years—beginning in February 1965—nuclear generating capacity of more than 25,000 Mw has been ordered. It should be noted that this is about 50 times the generating capacity of the Marble project. Well over half of all thermal generating capacity ordered by utilities in 1966 was for nuclear capacity.

The projected growth of nuclear capacity is shown in Table 2.

TABLE 2.—Nuclear growth projection [from Lane, "Annual Review of Nuclear Science," p. 365 (1966)]

Year end:	Installed nuclear capacity, MWe net
1969	¹ 6,300
1975	² 37,000
1980	² 92,000
1990	³ 295,000
2000	⁴ 734,000
2010	⁵ 1,380,000
2020	⁵ 2,200,000

¹ Estimate based on plants now operable or under construction.

² Source: WASH-1055 shows following ranges of installed capacity as of year end: 1975—21,000–37,000 MWe; 1980—61,000–92,000 MWe. The values in the Table are maximum values.

³ From curve fitted to other six points.

⁴ Source: Appendix IV of "Civilian Nuclear Power . . . A Report to the President—1962," Table 16.

⁵ Source: "Civilian Nuclear Power . . . A Report to the President—1962," Figure 3.

There can be little doubt that nuclear power will occupy a pace-setting role in meeting the energy needs of the future.

(d) Capital Costs of Nuclear Plants: The reported capital costs of nuclear plants ordered from February 1965 to May 1966 are shown in Table 3.

TABLE 3.—Capital costs of nuclear plants ordered in 1965 and 1966 [from Lane "Annual Review of Nuclear Science," p. 359 (1966)]

Station	Reactor type	Vendor	Net capacity (megawatts)		Unit cost (dollars per kilowatt)	
			Initial	Stretch	Initial	Stretch
Dresden 2	BWR	G.E.	715	793	106	96
Fort St. Vrain	HTGR	G.A.	330		260	
Brookwood	PWR	West.	420	450	+119	+111
Millstone Point	BWR	G.E.	549	650	118	100
Indian Point 2	PWR	West.	873	983	123	109
Turkey Point 3, 4	PWR	West.	691	721	143	138
Dresden 3	BWR	G.E.	715	793	110	100
Hartsville	PWR	West.	663	731	113	102
Palisades	PWR	Cornb.	710	810	141	123
West Shore, Lake Michigan	PWR	West.	454	480	132	125
Quad Cities	BWR	G.E.	715	809	112	99

Capital costs of these new nuclear plants are very close to \$100/kw when operating at stretch capacities.

There is no longer a significant capital cost differential between nuclear and fossil fuel plants. TVA recently conducted a detailed comparison of a nuclear vs. a coal-burning plant and concluded that the capital cost of the nuclear plant was lower than that of the coal plant.⁵

(e) Nuclear Fuel Cycle Costs: TVA estimated that the nuclear fuel cycle costs for the plant under study would be less than 11 cents per million Btu during the initial 12-year period of operation. They obtained price and performance guarantees from the reactor manufacturer (General Electric) to support this estimate.

The fuel cycle costs depend to a certain extent on the financing charges for working capital. That is why the TVA estimates are at the low end of the usual range of estimated fuel cycle costs. Since the Arizona Power Authority would be expected to have similar financing charges, the TVA estimate is an appropriate one to use. Nevertheless, a moderate increase to 12 cents per million Btu may be somewhat more correct because of the probable smaller unit size of an Arizona Power Authority nuclear plant.

(f) Escalation of Project Costs: The project cost estimates are based on January 1960 prices. From that date to October 1966 there has been a 10.2% increase in the U.S. Bureau of Reclamation's Composite Cost Index for hydroelectric projects.⁶ This increase must be applied to the fixed charge components of the cost of the project in recalculating the benefit-cost ratio on the basis of 1966 prices. The results of the normalization are presented in Table 4.

TABLE 4.—*Normalization of Marble Project Costs to 1966 Prices (10.2% escalation applied to fixed charge components)*

Percent interest rate	Annual cost of project power at load, January 1960 prices ¹	Recalculated annual cost of project power, at load, October 1966 prices
4.0	\$11,064,200	\$11,937,200
4.5	11,796,000	12,743,000
5.0	12,570,200	13,595,400

¹ From exhibit 300-19.

(g) Value of Project Capacity and Energy: The value of the project capacity and energy is defined (by the Commission) to be equal to the cost of capacity and energy from the lowest-cost alternative. Both the Authority and the staff chose a gas-fired steam plant located near Phoenix as that alternative. Depending on the assumed interest rate, the staff calculated the capacity cost to be 12.27 (4.0%) 12.90 (4.5%), or 13.54 (5.0%) dollars/ky-yr. (See FPC Staff Exhibit No. 300-24). The energy cost was calculated to be 3.27 mills/kwh. These capacity and energy costs were taken to be equal to the value of capacity and energy for the project.

The results of a recalculation of these values based on the cost of power from a nuclear plant alternative (also located near Phoenix) is presented in Table 5. The component costs are based on the considerations developed in the preceding discussion and indicated in the footnotes to the table. The capacity cost is now significantly lower. The energy cost, 1.39 mills/kwh, is less than half its previous value.

⁵ *Comparison of Coal-Fired and Nuclear Power Plants for the TVA System*, Office of Power, TVA (June 1966).

⁶ *Engineering News Record*, March 18, 1965, p. 97, and Dec. 15, 1966, p. 101.

TABLE 5.—*Estimated value of power output from Marble Canyon powerplant (based on cost of power from alternative nuclear source)*

	Annual interest rate		
	4 percent	4.5 percent	5 percent
Capital costs (dollars per kilowatt):			
Nuclear steam-electric plant ¹	129.00	130.00	131.00
Substations ¹	12.57	12.60	12.64
Lines ² (2,230-kv., double-circuit steel tower).....	9.58	9.58	9.60
Annual costs (dollars per kilowatt-year):			
Nuclear steam-electric plant:			
Fixed capital charges ³	8.09	8.62	9.19
Fixed operating costs ³	1.40	1.40	1.40
Nuclear plant, total fixed charges.....	9.49	10.02	10.59
Transmission:			
Fixed capital charges ³	1.21	1.30	1.40
Fixed operating costs ³18	.18	.18
Losses ³36	.38	.40
Transmission, subtotal.....	1.75	1.86	1.96
Capacity cost, at market, total.....	11.24	11.88	12.57

	<i>Mills per kilowatt-hour</i>
Energy cost (variable operating costs):	
Fuel, 10,600 B.t.u.'s, at 12 cents per thousand.....	1.27
Operating and maintenance ⁴10
Energy cost at plant, subtotal.....	1.37
Losses.....	.02
Energy cost at market, total.....	1.39

¹ Same as in exhibit 300-24.² Costs double those in exhibit 300-24 were taken to provide for more remote siting of nuclear plant.³ Fixed charge rates:

	Nuclear plant *		
	Percent	Percent	Percent
Interest.....	4.00	4.50	5.00
Amortization.....	1.36	1.23	1.11
Insurance (conventional).....	.20	.20	.20
Nuclear liability insurance.....	.35	.35	.35
Interim replacements.....	.35	.35	.35
Taxes.....	0	0	0
Total.....	6.26	6.63	7.01

* Adapted from Lane, Annual Review of Nuclear Science, p. 350 (1966).

Fixed charge rates for substations and transmission lines are taken from exhibit 300-24 (FPC staff).

⁴ USAEC, "A Specific Comparison of the Economics of Nuclear Electric Power and Hydro Electric Power—Bridge and Marble Canyon Projects," in hearings, Lower Colorado River Basin project, Reclamation Subcommittee of the House Interior Committee, p. 1373 (May 1966).

NOTE.—The cost of cooling water was not included in exhibit 300-24, perhaps because the quantity needed for a steamplant is approximately equal to the quantity which would be lost by increased evaporation if the Marble Reservoir were created. For this reason it has not been included in the recalculation.

In FPC Technical Memorandum No. 1, *Instructions for Estimating Electrical Power Costs and Values*, Revised March 1960, it is recommended that two adjustments be made to such calculations of value. The first is to apply a factor of 1.05 to the steam plant capacity cost to equate it to the hydro plant capacity value. The second is to apply a correction to the steam plant energy cost to account for the effect of the expected difference in capacity factor from that of the hydro plant. The new steam plant, operating at a high capacity factor, can not only match the energy generated by the hydro project but can also displace higher-production-cost steam plant energy from the system. The result is an

economic gain which can be approximated by the recommended adjustment to the energy cost.

These adjustments are shown in column (3) of Table 6, which is a summary of the calculated values of the output from the Marble project.

The recalculated benefit-cost ratios are also shown in Table 6. The ratio is less than 0.8, for all the cases considered, on the basis of comparing the Marble project with the nuclear plant alternative.

TABLE 6.—Summary of calculated values of output from Marble project

	Interest rate	FPC staff, gas-fired steamplant basis (1961)	Recalculated, nuclear basis (1966)	Recalculated, nuclear basis with FPC recommended adjustments (1966) ¹
		(1)	(2)	(3)
Capacity value (dollars per kilowatt-year)-----	4.0	12.27	11.24	11.80
	4.5	12.90	11.88	12.47
	5.0	13.54	12.57	13.20
Energy value (mills per kilowatt-hour)-----		3.27	1.39	0.60
Capacity value of 547 mw. (dollars)-----	4.0	6,712,000	6,150,000	6,450,000
	4.5	7,056,000	6,500,000	6,820,000
	5.0	7,406,000	6,870,000	7,220,000
Energy value of 2,374,000,000 kw.-hrs. (dollars)-----		7,763,000	3,300,000	1,424,000
Total value of Marble project, capacity plus energy (dollars)-----	4.0	14,475,000	9,450,000	7,874,000
	4.5	14,819,000	9,800,000	8,244,000
	5.0	15,169,000	10,170,000	8,644,000
Benefit-cost ratio of Marble project (Marble costs normalized to 1966 prices) ² -----	4.0	1.21	0.79	0.66
	4.5	1.16	0.77	0.68
	5.0	1.12	0.75	0.64

¹ The formula for calculating the energy value adjustment is $X = \frac{F_p - F_n}{F_p} \cdot \frac{I_p - I_n}{2}$, with symbols as defined in FPC Technical Memorandum No. 1. The production cost I_p of displaced fossil-fuel energy has been estimated at 3.5 mills per kilowatt-hour, since this is an average of the production costs of the 2 most efficient of 6 existing steamplants located in central Arizona (data to 1964 from FPC Report 8-171, March 1953). The capacity factor of the nuclear alternative has been taken as 0.85 for purposes of calculating this adjustment.

² See table 3.

(h) Summary: It is concluded that in all cases the benefits of the Marble project, as determined by the cost of providing capacity and energy by means of the lowest-cost (nuclear) alternative, are less than the costs of providing them by means of the project.

The project is no longer economically justified. If it is built, the national income will be lower than it would be if the project was not built (and the alternative was constructed in its place).

3. Items Not Included in Revised Calculation Cast Further Doubt on Project.

Although it hardly seems necessary to cast further doubt on a project with a benefit-cost ratio of less than 1.0 (indeed, of less than 0.8), it should be noted that there are several items not included in the recalculation which, if included, would further lower the benefit-cost ratio. Two such items will be discussed below.

(a) Differences in Cost Estimates for the Project: The Arizona Power Authority estimated that the total construction cost of the project would be \$154,700,000 (Jan. 1960 prices), exclusive of interest during construction. The Commission staff estimated that the cost would be \$153,061,000 (also Jan. 1960 prices).

In 1963 the Bureau of Reclamation estimated that the cost of construction of a project almost identical to that of the Applicant would be \$238,654,000 (Oct. 1963 prices—also exclusive of interest during construction).¹ The Bureau estimate includes the cost (\$10,670,000) of Paria dam and reservoir. The power plant of the Bureau's project (4-150 Mw turbine-generators) is slightly different from

¹ *Pacific Southwest Water Plan, Supplementary Information Report on Marble Canyon Project*, Bureau of Reclamation, Chapter II, p. 19 (Jan. 1964).

that of the Authority's project (6-85,000 Mw turbine-generators). And, as noted, the Bureau's estimate is based on Oct. 1963 rather than Jan. 1960 prices. Nevertheless, even after correcting for these differences, the Bureau's estimate on the one hand and the Authority's and the Staff's estimates on the other hand do not appear to be consistent.

The Bureau's independent cost estimate represents new evidence which must be evaluated by the Frier of Fact if the probable costs of the project are to be determined.

If it is determined that the Bureau's estimate is more nearly correct, the benefit-cost ratio of the project will be significantly lower than previously calculated (i.e. lower than shown in Table 5).

(b) Increase in Estimated Interest Cost: The Authority estimated (in 1961) that the interest rate on the revenue bonds to be issued to finance the project would be 4.6 per cent. Present money-market conditions are very much different than existed in 1961. It is reasonable to expect that the interest rate would be significantly higher. It is the responsibility of the Frier of Fact to evaluate the effect of these changed conditions on the economics of the project.

Any increase in interest rate would have the effect of further reducing the benefit-cost ratio of the project.

4. Cost of Power from Fossil-Fuel Steam Plants Has Also Decreased Since Examiner's Decision.

Since 1961-2 there have been developments in the technology and economics of fossil-fuel steam plants and EHV transmission which have reduced the cost of power from such sources. Both the capital costs and production costs of such plants are significantly lower.

With respect to a gas-fired steam plant near Phoenix, the cost of gas has been reduced from the 33¢/million Btu used by the staff in their analysis to 30¢/million Btu.^a

With respect to coal-fired plants located near sources of low-cost coal, with power transmitted to load centers by EHV lines, there have been many significant developments. Large plants of this type are existing or are under construction near Farmington, New Mexico and Mohave, Nevada. Other such installations are planned by location near Page, Arizona, and Kaiparowits, Utah.

Even if a nuclear alternative did not exist (and it most certainly does), it would be necessary for the trier of fact to evaluate the effect of these new developments on the economic justification of the project.

5. Suitability of Thermal Generation for Meeting All Peaking Power and Reserve Requirements.

It is perhaps appropriate to comment at this juncture that thermal generation (either nuclear or fossil-fuel) is well suited to meeting all peaking power and reserve requirements. Proponents of hydropower projects, when their projects have been shown not to be economically justified, appear to have a propensity to wax eloquent over the supposed unaccustomed virtues of hydropower as compared with supposed sins of thermal generation in meeting peaking power and reserve requirements. Their acceptance of hydropower, regardless of cost, has a quality bordering on that of mystical revelation.

These proponents are welcome to their illusions, but the Commission must base its judgments on fact. The facts are as expressed by Philip Sporn, Chairman of the System Development Committee, American Electric Power Company, in remarks presented to the New York Society of Security Analysts on April 20, 1966. In commenting on the cause and remedy for the Northeast Power Blackout, Mr. Sporn said: "

"The first statement was made by a major utility executive. He said, 'What it boils down to is this: thermal units cannot respond quickly enough to sudden load demands, such as occurred on November 9th, to avoid a power failure. Nor can they be restarted as quickly as hydroelectric plants, should they shut down the power. This—as we found out the hard way on November 9th—is by no means satisfactory!'

^a Average cost of purchased gas for the six steam plants in central Arizona, from *Steam Electric Plant Construction Cost and Annual Production Expenses*, Seventeenth Annual Supplement—1964, FPC (March 1966).

^b Quoted in prepared testimony of Alexander Kusko, FPC Project No. 2838 (Application of Consolidated Edison Co.), pp. 25-26 (1966).

"Now, my answer to this, and it's not an off-the-cuff answer, is that this is just not so. It's a complete misstatement of the facts. A well-designed thermal system, operated so that the spinning reserve is properly distributed in the generating units at all times, and that is adequately interconnected with its neighboring systems can—and by experience has proven so—be wholly reliable and capable of withstanding all manner of disturbances. It is not necessary to create uneconomic sources of hydropower in order to achieve a high degree of reliability.

"This doesn't mean that hydro capacity cannot or should not be used, if it's economically sound. The two largest cities of the United States—everybody knows which they are—have for a period of 83 years in one case, and close to that in the other (I don't know when the other city really started its electric service, but it cannot have been more than a year or two after 1882) managed to give a high quality of service without any other generation in their system except thermal.

"To condemn thermal generation after that sort of a record is to be unthinkable."

6. *Economic Feasibility of Project Should Include Cost of Additional Features Necessary Thereeto.*

The Examiner stated (p. 11) that: "the Staff contemplates further consideration of a reregulating reservoir below Marble Canyon." Further, the Examiner found that there was space above the Park for such reservoir (Ex. at 39). The Examiner reserved "for future Commission determination the question of whether a reregulator dam should be included in the license." (Ex. at 41.) Recognizing a possible effect on the Park below, the Examiner required applicant to "cooperate with the National Park Service" to study effects on the Park and the National Monument, to modify operations consistently with the purpose of the Park or to "provide a suitable reregulation reservoir." (Ex. at 46.)

In the Congressional Hearings, the Reclamation Commissioner, testifying on a nearly identical dam to be built at the site of the instant project, stated that reregulating might well be necessary because of periodic fifteen-foot walls of water rushing down the canyon below the dam and flooding adjacent lands. (See e.g., H.R. Rep. No. 1849, *supra* at 144.) He later estimated that its cost would be approximately \$86,000,000. (Letter from Reclamation Commissioner Dorniny in the files of the Club.)

There are several reasons why the Club's intervention is justified with respect to this point. First, *Scenic Hudson*, as well as common sense and sound economic analysis, requires that a determination be made by the Examiner regarding the necessity of such a dam. Second, if the foregoing is true, it would seem *ipso facto* that the cost thereof should be included in the cost of the project for purposes of determining economic feasibility. Third, as will be discussed below if such additional dam, virtually on the borders of the National Park is necessary, an entirely new question exists regarding the scenic despoliation to be caused by such a dam. The Club would present evidence on these points at any reopened proceeding.

The Examiner considered Applicant's cost estimates which excluded allowances for headwater benefits, and payments compensating for use of the Navajo reservation. (Ex. at 9, 42, 49.) No such costs were included for purposes of determining economic feasibility. Yet the Examiner ordered coordination of the Project with the Government's Glen Canyon Dam with "an equitable sharing of the benefits." (Ex. at 46.) And he found that "the proposed . . . development would affect lands in the Navajo Reservation in that access roads, the construction corporation, and possibly transmission lines would be located, in part, within the reservation." (Ex. at 39.)

Particularly in view of the time that has elapsed since the Examiner's decision, it would seem requisite that the nature of such payments, which are as much a part of the economic feasibility of the project as is payment for a generator, should be calculated by the trier of fact and weighed as part of the project's economic feasibility.

Finally, the Examiner concluded that there may be "some encroachment upon the tailwater levels of Glen Canyon" which may be "economically justified." Hence, the Examiner pointed out that "the Authority would expect to indemnify the upstream project against the loss of power and energy." Such estimate must be made and made by the trier of fact. The figures should then be used

in determining present economic feasibility of the project. That only an estimate of such costs may now be possible hardly obviates the need for including, at least provisionally, *some* reasonable projection of such costs, no matter how conservatively estimated.

Absence of the above data from the record and absence of determinations of relevant cost data in the Examiner's decision are themselves reasons to allow Petitioner to intervene, for "good cause" shown. Without such data, the project cannot be evaluated realistically.

If allowed to intervene, and further, if the requested reopening is granted, the Club would offer a limited number of highly qualified witnesses who have already done a great deal of work on and study of the economic feasibility of the instant project. Their testimony and the studies they would offer would develop further the data shown above and present additional, more detailed data concerning economic feasibility.

7. Bureau of Power Believes Supplemental Studies Necessary.

In 1966 the Bureau of Power issued its "Planning Status Report: Water Resource Appraisals for Hydroelectric Licensing, Lower Colorado River Basin." This report concludes:

"If the Congress does not approve Federal construction of Bridge Canyon and Marble Canyon projects, as proposed by the Department of the Interior, supplemental Federal Power Commission studies may be required in processing the pending license applications for these two potential developments." (Id. at 20.)

The Club agrees with the Bureau that supplemental studies are needed. Particularly in view of the *Scenic Hudson* decision, however, the Club's studies, too, should be presented and, along with the Commission's proposed studies, considered by the Examiner.

B. Project 2248 Does Not Meet Standard for Projects Affecting Major Scenic and Recreational Resource.

1. Project Would Flood Part of Grand Canyon.

Make no mistake. Applicant asks this Commission to sanction a dam and reservoir in the fabled Grand Canyon of the Colorado River—perhaps the most precious scenic resource possessed by the United States. Above the proposed 400 foot dam (Ex. at 7) a reservoir covering 5,300 acres (480,000 acre feet of water¹⁰) would flood one of the most spectacular sections of the canyon and would destroy the rushing river that is now increasingly used by Americans for boat trips that are the experience of a lifetime for those who have taken them and those who look forward to doing so. (E.g. Congressional Hearings at 850-51). (See H.R. Rept. No. 1849 at 143.)

"But Marble has special demerits. The reservoir 55 miles long, will drown the last remnant of flowing river in Glen Canyon and the first 40 miles of the Colorado's course through Grand Canyon . . . [T]he reservoir nevertheless is more than deep enough to submerge two of Grand Canyon's prime attractions: Red-wall Cavern and Vasey's Paradise." (H.R. Rept. No. 1849) (minority report; the facts are not contradicted in the majority report) at 148).

Scenic Hudson for the first time requires the Commission to "include as a basic concern the preservation of natural beauty . . . keeping in mind that, in our affluent society, the cost of a project is only one of several factors to be considered." (354 F.2d at 624). The Court read section 10(a) of the Act (16 U.S.C. § 803(a)) as requiring the Commission carefully to weigh harm to major scenic and recreational resources against the need for a proposed project in view of reasonable alternatives. Obviously, the more unique, spectacular, and beautiful the area to be despoiled by a project the more careful the Commission must be in authorizing projects that would impair these values.

¹⁰ Alarmingly, the 1963 Bureau of Reclamation figures for a dam of the same height at the same site showed a reservoir capacity of 363,000 acre feet. Applicant's reservoir capacity is 32.2 per cent greater than the Bureau's, a factor which should cause some concern in view of the Examiner's assumption that the reservoir would not be silted up for 104 years. The Bureau estimates that the reservoir would be completely silted up in 71 years, using the rate of silting and capacity that the Bureau developed. (See e.g., Pacific Southwest Water Plan, Suppl. Inf. Rep. on Marble Canyon Project (Jan. 1964) Ch. II, pp. 15-16; compare Ex. at 7, 11 and Amendment to Application for License, Arizona Power Authority, Nov. 1969 at H-10-12.) This brief useful life of the project is presumed to justify spoliation of something that nature took hundreds of thousands of years to create.

2. Record Inadequate Regarding Effect on Marble Gorge Scenic, Recreational and Scientific Values: New Evidence.

(a) Scenic Values: In 1965, after close of the record in this proceeding, Commissioner Ross was able to declare, respecting another proceeding, that the record therein was "one of the most complete records ever developed before this Commission so far as aesthetics are concerned." (Consolidated Edison, Project No. 2338, Opinion #452, March 9, 1965 (dissenting and concurring opinion at 2), *rev'd Scenic Hudson Preservation Conference v. Federal Power Comm'n, supra.*) Nonetheless, the Commission's weighing of interests respecting that license was reversed with the injunction to give great weight to scenic and recreational values in view of available alternatives.

The Commission cannot apply the *Scenic Hudson* rule here without reopening to obtain the very evidence on scenic and recreational values that is necessary to make the determination required by *Scenic Hudson*.

The inadequacy of the record regarding these overriding scenic and recreational values was unintentionally admitted by Applicant in its motion of December 25, 1966: "[N]o conservation issue was raised during the Commission hearings relative to Arizona's Marble Canyon project." (p. 7). Thus, the Examiner never adverted to the unique beauty of the area to be flooded and exhibited an understandable but complete lack of information about the existence and value of recreational uses of the area and of important archeological sites that would be lost.

The Examiner referred to the Marble Gorge as an "isolated rocky wilderness . . . visited only by a few venturesome persons who are able to afford the high price of a boat trip down the river." (Ex. at 12) But the Secretary of the Interior argues that the Commission not license the project in part because "major issues of national resource policy are at stake", which include: "the issue of whether scenic considerations preclude the construction of any dams on the reach of the river between Lake Mead and Glen Canyon Dam, an issue which took up more time of the House Interior Committee than all others combined." (Answer of Secretary of the Interior, dated January 10, 1967, at page 5.) It is significant that extraordinary information developed at the Congressional Hearings on the scenic values at stake has caused the Interior Department apparently to re-think its own position as a former proponent of Grand Canyon dams. This being the case, the Commission cannot simply assume on the basis of the inadequate record of 1961 that it can license the project without careful consideration of the scenic and recreational values required by *Scenic Hudson* to be weighed.

(b) Club's Offering Regarding Scenic Values at Stake: The Club would offer evidence of two kinds: First, dramatic new photographic evidence of the area to be flooded by the project demonstrates conclusively that some of nature's most magnificent works would be lost forever. Exhibit 1, attached hereto, includes color photographs showing but a small part of what will be inundated by the proposed reservoir. This new evidence plus additional photographs that the Club is prepared to present, demonstrates that the project will destroy not a rocky wasteland, as suggested by the Examiner, but of one of the world's scenic wonders. Second, the Club would offer witnesses who have traversed the Marble Gorge many times. These witnesses would describe what scenic marvels await the growing number of visitors to the Marble Gorge. These witnesses would point out to the Commission what values granting of the instant license would destroy.

(c) Inadequacy of Record Regarding Recreational Values at Stake: The Examiner found merely that there would be no encroachment on recreational values of the National Park. (Ex. at 11) Recreational values harmed were thought merely to affect "a few venturesome persons who are able to afford the high price of a boat trip down the river." No one denies that wild river boating, hiking, camping and other access to the present river above the dam would be terminated.

The Examiner found enhancement of recreational values because of creation of a reservoir for fishing and power boating and also because the reservoir would grant access to greater numbers of people, including access to certain scenic vistas, of what was not covered up by water and silt. (Ex. at 12)

The record is bare regarding the present, growing number of persons enjoying the river trip and misleading regarding the costs of such trips. The record is silent regarding the peculiar and unique recreational values of the river in its natural state. The record is also silent respecting the *future* use of the natural

river in Marble Gorge by generation after generation of Americans. Most significant, the record contains no data enabling the Commission to evaluate the need for the forms of recreation to be created by the reservoir (power boating and fishing) in view of the nearby vast expanses of Lakes Mead and Powell.

(d) Club's Offering Regarding Recreational Values at Stake in Marble Gorge: The Club has ascertained from the National Park Service that the number of persons taking the boat trip through the canyon rapidly escalated in recent years and since the 1961 hearings. These figures do not include persons hiking to and enjoying the lower canyon and river via foot trails.

National Park Service statistics on persons taking canyon boat trip

1966	-----	1, 067
1965	-----	547
1964	-----	¹ 38
1963	-----	² 6
1962	-----	372
1961	-----	255
1960	-----	205
1959	-----	120
1958	-----	80
1957	-----	135
1956	-----	95
1955	-----	70

¹ Glen Canyon Dam closed.

² Insufficient water.

Given even a reduced rate of expansion of these numbers, it is obvious that many thousands of persons per year will avail themselves of this unique opportunity, provided the Commission protects their opportunity to do so.

As to the Examiner's reference to a "few venturesome persons", the Congressional Hearings reveal that 12 year old children and 61 year old grandmothers now make this trip. (See *e.g.* Congressional Hearings at 851, 855).

Regarding the alleged "high cost" of the trip, the Club as well as others organize trips down the canyon. The price range, the Club will show, is between \$225-325 for a three week trip including all expenses. This, the Club will show, is perhaps as cheap a vacation as an American can have, short of staying home.

Much of the above material constitutes new evidence and new circumstances regarding the recreational values to be destroyed by the project that was not available in 1961. It is available now and the Club is uniquely qualified to present it.

Another new development since the 1961 hearings has been the opening of the area of Lake Powell to boating and fishing. Therefore, it is proper to raise at this time evidence which shows that the Marble Gorge reservoir cannot be justified on recreational grounds. As the Bureau of Outdoor Recreation reports: "[W]ater-oriented recreation cannot be considered one of the primary purposes for constructing the Bridge Canyon and Marble Canyon Dams because less costly alternatives for expanding recreation facilities in this area are available. The types of water-oriented recreation which could be supplied by the reservoirs are available at Lake Mead and Glen Canyon Recreation Areas. These recreation areas serve the same population centers, and facilities could be added as recreation demand expands." (Quoted in H.R. Rep. No. 1849 at 143.)

The weighing test contemplated by *Scenic Hudson* requires something more than a ritual finding (applicable to any reservoir) that recreational values will be enhanced. The Commission, through its Examiner, in the first instance, must weigh all recreational values in the light of a complete record and in the light of an up-to-date record. The Club is prepared to present such a record through the witnesses referred to above and hereinafter named.

e. Inadequacy of Record on Archeological Values at Stake: The record and the Examiner's report are silent respecting harm to archeological sites from the reservoir.

f. Club's Offering of New Evidence Regarding Archeological Values: In 1963, at a site that will soon be under 250 feet of water and silt if the Commission grants the requested license, a major archeological find was made. Artifacts were discovered indicating the use of Marble Gorge by members of a semi-nomadic culture referred to as "Pinto Hunters." They were present in the Gorge as long

ago as 2145 B.C. The existence of these primitive persons in the Canyon area has been known since 1933, but the 1963 find in the Marble Gorge is the first record of the use of the bottom of the canyon. The new archeological find indicates that these prehistoric peoples used Marble Canyon in connection with religious rites. It hardly needs emphasizing that the new find suggests the existence of additional archeological data in the area. (See Euler, "Willow Figurines from Arizona", *Natural History Magazine*, (1965).)

"The succession of figurine discoveries at Stanton Cave marks this site as probably the most important location for the Split-Twig Figurine Complex in both the Grand Canyon area and its desert approaches. Perhaps clues, if any exist, regarding the identity of the unknown practitioners still lie in the twilight of Stanton Cave. However, this important site is faced with inundation if the Marble Canyon Dam is built.

"One of the fragments was carbon-dated at 4095 ± 100 years, which is the earliest date found for any figurine at any site." ("Vassey's Paradise", P. T. Reilly, *The Masterkey* October-December 1966 Southwest Museum, Los Angeles pp. 126, 136)

3. *New Evidence Shows Prohibited Harmful Effect on Park and Monument Below the Dam.*

The Examiner concluded that the project would not encroach or have adverse effect on "recreational values of Grand Canyon National Park" (Ex. at 11) although he was generous in assigning such effects to the alternate Kanab Diversion (Ex. at 32-34). Yet, he also directed Applicant to consult with the Park Service "in studying the *possible effect on the Grand Canyon National Park*" and Monument of the project and to modify operations or provide a reregulating dam if this were necessary. (Ex. at 46.)

Four years have elapsed and new evidence is available regarding below-dam effects; it would appear that now is the time—before issuance of the license—to determine and weigh the effects on the park and the river therein. The need for the reregulating dam should be determined on re-opening. Since the purpose of the dam would be to reduce fifteen-foot surges of water through the Park and Monument caused by the project, there is no reason why effects on the Park should not be determined and the need and cost of the dam assessed. Further, if such dam is needed, it should be determined how successful such dam would be and what *its* effect would be on the scenic and recreational values of the canyon below the proposed project.

Evidence brought forth in the Congressional Hearings shows that operation of a hydro plant at the proposed site must be on a peaking power basis, necessitating tremendous surges of water through the canyon below that would alternately leave the Colorado River a small trickle and turn it into a raging torrent flooding sand-bars and abutting lands in the Park and Monument. Obviously, boating and camping on the river in the Park and even a foot approach to the river would be dangerous, if not impossible. These points are well described in H. R. Rep. No. 1849 at 143-44. The Club's witnesses are qualified and ready to discuss such effects.

It would seem that under any interpretation of "extraordinary circumstances" and "good cause", the above described effects on this great National Park (even if partially controlled by a reregulating dam) should, upon allegation thereof, justify intervention and reopening.

The National Park Act of 1916 states that—

"[T]he fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (16 U.S.C. § 1; see 16 U.S.C. § 221b)

Section 7 of the Grand Canyon National Park Act states:

"Whenever consistent with the primary purposes of said park, the Secretary of the Interior is authorized to permit the utilization of areas therein which may be necessary for the development and maintenance of a Government reclamation project." (16 U.S.C. § 227)

Section 1 of this Act states—

"There is reserved and withdrawn from settlement, occupancy, or disposal . . . and dedicated and set apart as a public park for the benefit and enjoyment of the people . . . [the Grand Canyon National Park]. (18 U.S.C. § 221.)

Section 7, quoted above, taken in context with section 1 of the Grand Canyon Act and section 1 of the National Parks Act, shows that Congress contemplated no "utilization of areas therein" with the exception of utilization by federal Government projects permitted by the Secretary of the Interior. The specific exception for utilization of areas in the Park by Government projects shows that other projects utilizing Park areas are prohibited. It is important to note that section 7 does not refer only to projects physically within the Park but to "utilization of areas therein which may be necessary for the development and maintenance" of a project.

We take it that flooding of the Park by a reservoir created by a dam built below the Park would clearly fall within the prohibition of the statute unless it were a federal reclamation project consistent with the purposes of the Park and approved by the Secretary of the Interior. We believe that turning the Colorado River on and off within the Park and Monument and the resultant daily flooding and drying up of abutting Park lands and sand bars now used for recreational purposes and effective prohibition of recreational use of the river constitutes a clear example of "utilization of areas" within the Park which is prohibited by law.

"To generate peaking power, the dams must hold back water and then release great volumes of it in a short time. Commissioner Dominy tells us that operation of Marble in full peaking mode would cause a daily rise and fall of 15 feet in river elevation below the dam. Because of the Colorado's very restricted channel through the canyon, the crests will persist almost undiminished for scores of miles downstream through Grand Canyon National Park. Congressman Ed Reinecke questioned Mr. Dominy on this point:

Mr. REINECKE. Now you also indicated that the river would rise and fall some 15 feet in a 24-hour cycle. I am thinking of the safety of these fellows that are sleeping on sandbars about the time that that flood hits. What do you propose to do about this or what is the time period between the minimum and the maximum of this peak discharge of cause of power requirements?

Mr. DOMINY. This of course is something that will have to be worked out in detail and will have to be very carefully handled with the Park Service. Advice and counsel to the users of the river would have to be very explicit as to the changing in level, when it would occur and how to protect themselves against the very thing you point out.

Mr. REINECKE. Having been at the bottom of the canyon I know of places where you can't get more than 2 or 3 feet above the level of the river. This would be a rather embarrassing situation.

Mr. DOMINY. I agree. I am confident that Marble Dam does not offer the full potential for peaking power that it might otherwise offer because we will have to restrict the surges to within limits that can be tolerated consistent with park use immediately below (hearings p. 1388).

"A great deal of the plant and animal habitat in the bottom of the canyon's inner gorge is within a few vertical feet of normal river level. Even if the Bureau sacrifices some of Marble's peak potential in order to reduce the height of daily flood crests, downstream damage is bound to be severe. For not only will the dam discharge water in sudden surges, but it will release clear water from which the sediment has settled out. Clear water has much more capacity to pick up and carry sediment than water that is already heavy laden, and fast-moving clear water is voracious. Daily scouring of the channel below the dams will destroy a great deal of riverside habitat and convey it grain by grain to the head of the nearest reservoir downstream.

"Between Marble Canyon Dam and the head of Bridge Canyon Reservoir, in what the Bureau of Reclamation likes to call a 104-mile undisturbed stretch of river, most of it within Grand Canyon National Park, *the damage will be different in kind but comparable in degree to the damage inflicted by flooding in the reservoir areas.*" (H.R. Rep. No. 1849 at 144)

The Club does not ask the Commission to rely on the Congressional Hearings regarding this combined question of law and fact. The Club believes that an important question exists whether the proposed project must necessarily operate (without and quite possible with a reregulating dam) in a manner which utilizes the Park contrary to the statute. The proceedings should be reopened to consider this question although section 7 appears also to be a basis for jurisdiction of a Federal District Court over this question.

Regarding all these scenic and recreational questions, the Club is prepared to present testimony of several witnesses who are as familiar with the scenic and recreational values at issue as anyone in the United States.

C. Intervention Should Be Granted to Present Updated Evidence Regarding Silting and Water Wastage.

It has already been shown, (*supra* at note 10) that the Bureau of Reclamation estimated in 1963 that the project in question would be silted up within 71 years, absent an additional silt-retention dam not included in the proposed project. If correct, the Bureau's figures bear both on the economics of the proposed project and on the public interest in licensing it, given the effects on the Grand Canyon. A reopened proceeding could readily determine whether the Bureau's or the Applicant's figures are correct.

The Bureau's proposed project, whose reservoir surface was considerably smaller than Applicant's (although the site and height of the dam are the same in both projects), was estimated to evaporate yearly 10,000 acre feet of water. (Congressional Hearings at 1404.) Additionally, loss of water through seepage was substantial. As the minority of the House Committee on Interior and Insular Affairs stated respecting both the Marble and Bridge projects: this water loss would occur "in an area which is already short of water." (H.R. Rep. No. 1849 at 130.) Surely, the Commission should consider the economic and human effects of such a loss, particularly in view of other questionable aspects of the project.

D. Petitioner's Offer of Witnesses

If allowed to intervene, and further, if the requested reopening is granted, the Club would offer a limited number of highly qualified witnesses who have already done a great deal of work and study of the economic feasibility of the instant project. With respect to the data set forth above and also additional supplementary data that is relevant to the question of present economic feasibility, the Club—at this time—is prepared to offer:

1. Dr. Alan P. Carlin (Phd., Massachusetts Institute of Technology), Economist specializing in project analysis in the water, power, and transportation fields. Dr. Carlin is with the RAND Corporation of Santa Monica, California. Dr. Carlin has, with his associate, Dr. William E. Hoehn, spent months in preparing careful economic feasibility studies of the proposed Bureau of Reclamation project at the Marble Gorge site of the instant project. He is well acquainted with and is prepared to offer detailed testimony and exhibits respecting the instant project. His conclusions, as indicated above, are that the proposed project is not economically feasible in view of new cost data regarding the project and in view of alternative sources of power.

2. Dr. William E. Hoehn (Phd., Northwestern University), Economist with the RAND Corporation specializing in nuclear power engineering and project planning. His conclusions, formed in connection with the above studies are the same as Dr. Carlin's.

Drs. Carlin and Hoehn prepared detailed and lengthy statements regarding the Bureau of Reclamation Project at Marble Gorge and presented them in the Congressional Hearings in 1965. (Hearings, *supra* at 1493-1533.) These highly qualified experts convinced nine members of the House Committee signing its minority report, that the Marble Gorge site was not economically justified. The minority referred to these gentlemen respectively as "a specialist in the analysis of water and power projects" and "a specialist in nuclear-power costs." Their study was referred to as "painstaking and detailed" of which the minority stated: "We commend to Members of Congress this important study." (H.R. Rep. 1849 *supra* at 136-37.)

3. Mr. Laurence I. Moss (M.S., Massachusetts Institute of Technology). Mr. Moss is a nuclear engineer and specializes in project analysis. He testified extensively respecting the Bureau of Reclamation's Marble project and its nuclear alternative at the Congressional Hearings. (P. 1540.)

Respecting scenic and recreational issues the Club, at this time, is prepared to offer the following three witnesses who know the issues in question and the values thereof intimately:

1. Mr. David Brower, Executive Director, The Sierra Club.

2. Mr. Martin Litton, Travel Editor, Sunset Magazine. Mr. Litton has for years organized boat trips through the Canyon and knows the area as well as any living person.

3. Mr. Jeffrey Ingram, Southwest Regional Coordinator, The Sierra Club.

VI. *Conclusion Regarding Intervention Under Rule 1.8(d).*—The Club believes that the above showing satisfies the prerequisites of Rule 1.8(d). Substantial questions have been raised respecting economic feasibility of the project, harm to scenic and recreational values and other aspects of the project.

There remains the question whether, in an age of rapid technological progress and well-known cost escalation, the Commission could, consistently with Section 10(a) of the Federal Power Act (16 U.S.C. a. 803.(a)) make the required determinations respecting the project on a record dating back to 1960-61. A record twenty years old would clearly not suffice for issuance of a license in 1967. Yet, as shown, technological and economic change has probably been as significant in the past six years as it has in the twelve years preceding the 1961 hearings. As a matter of law the Commission must update the evidence on which the Examiner relied in his 1962 decision. There would appear to be every reason why the Club should be allowed to participate in the necessary reopening on these important issues.

There is no avoiding the fact that the Club's petition to intervene is not filed within the time called for in the Commission's Federal Register Notice. On the other hand the Commission's Rules do provide for intervention *at this stage* and thus contemplate that in some cases such intervention is justified. The question is whether "extraordinary circumstances" and a showing of "good cause" exist here. (See Rule 1.8(d).)

The Club recognizes it would be unfair to parties to proceedings and would make it difficult for the Commission to operate if late intervention were allowed routinely or even with moderate frequency. From the parties' standpoint, the objection is that late intervention increases expense and causes unwarranted delay. From the Commission's standpoint, there must be some point at which proceedings are closed in the interest of efficiency and economy. Apparently, this point had not been reached when, after the Examiner's decision, the Secretary of the Interior was allowed to intervene and to file his extensive material following oral argument to the Commission.

The other side of the coin and the reason for the Rules' provision for late intervention is that it is obviously not in the public interest, the Commission's interest, or the Applicant's interest to license the building of huge projects of immense cost if late-offered material (especially if not previously available) is important and raises serious, legitimate questions whether the project meets the standards of the Act. If the intervenor makes a showing of data it could present that would cause the case to be decided differently it would seem that intervention is definitely appropriate.

The Club would not be seeking intervention here were it not convinced after careful examination that it possesses new and important data that *require* a conclusion that this project is ill-founded in the economic sense and is totally inconsistent with scenic and recreational values.

In any case involving justification for late intervention, possible harm to other parties must be weighed. Three other parties (see Answers of Jan. 10, 1967) have already urged re-opening. Only Applicant has sought an immediate decision based on the old record. It would not seem, therefore, that anyone other than Applicant would be even arguably affected negatively by the Club's intervention. If reopening is allowed in any event, as the staleness of the record suggests, it is difficult to find even remote injury to Applicant.

It should also be recalled that the Commission's control over licenses is designed at least in part to prevent construction of projects that are economic mistakes. As the Club's data shows, the Club believes that Applicant would be making a serious economic misjudgment, wasting its own and the nation's resources, if it built this project.

Rule 1.8(d) provides for waiver of the requirement that parties serve copies of previously filed exhibits on a late intervenor. The Club readily assents to such condition.

It should also be stressed that the Club's intervention will not require this proceeding to begin anew. The vast bulk of necessary data is in the record. It need only be brought up to date and corrected where it is inaccurate.

The Club is aware of the responsibilities that would fall upon its shoulders if the Commission grants this Petition to Intervene. The Club, in any event, would do its utmost to present the relevant evidence available to it in the most expeditious manner and to confine its questioning of the old data to material and relevant aspects thereof.

WHEREFORE, Petitioner, Sierra Club, respectfully urges: that its Petition to Intervene Pursuant to Rule 1.8(d) be granted and that the Commission permit such intervention to allow the Club: 1) to argue against immediate grant of a license to construct Project No. 2248 pending Congressional resolution of the issue; 2) to petition the Commission for limited reopening of the proceeding; and 3) to participate in such reopened proceeding as the Commission may order.

SIERRA CLUB PETITION TO INTERVENE

EXHIBIT I

Exhibit I is a folio of fifteen 8 x 10 color prints showing various scenes in the Canyon that would be affected by the Project. Captions and explanatory notes accompany these photographs, which describe and comment upon the contents thereof.

One folio is being served on the Commission's Staff and one on the Applicant, in addition to the folio filed with the Commission. The great expense of reproducing these color prints prohibits their service upon all parties. The accompanying captions and explanatory notes are, however, attached, and the Club will make available a folio for inspection upon request.

EXHIBIT 1-A

REDWALL CAVERN, MARBLE GORGE OF THE GRAND CANYON—MILE 33

The proposed Marble Canyon reservoir would place this site under nearly three hundred feet of water—approximately the height of the Statue of Liberty.

EXHIBIT 1-B

MARBLE GORGE OF THE GRAND CANYON—MILE 25

The river, main artery of the Canyon, provides access to a steadily increasing number of visitors to the heart of the Grand Canyon National Park and National Monument, as well as to the parts of the Grand Canyon. River trips vary in duration, the optimum being about three weeks. Shorter or greater duration is perfectly feasible.

EXHIBIT 1-C

MARBLE GORGE OF THE GRAND CANYON—MILE 35

River trips are available to old and young, to the vigorous and to the more lethargic. It is doubtful that there is any wilderness experience that makes less severe demands upon those seeking it than wilderness river travel.

In the past few years the number of people seeing the Grand Canyon in this manner has doubled each year. More than 1,000 traveled through in 1966, including a group of 150 school children. The technique of river travel has steadily improved, and the opportunity to enjoy what many have described as one of the most spectacular trips in the world can be expected to continue to grow. Costs can be expected to drop in future years as they have in the past. One expedition used to run nearly \$1,000 per person. In 1966, costs ran as low as \$200 per person for a 20-day trip, or an average of \$10 per day for all costs, including meals and leadership.

EXHIBIT 1-D

MARBLE GORGE OF THE GRAND CANYON—MILE 24

One of the finest exhibits in the Canyon is the display of river-sculptured boulders where side-canyon flash floods have brought the boulders to the river's edge. Only rarely in the past has the main stream had high enough flows to move the boulders on downstream. Most rapids are the result of the sidestream accumulations. The wearing of river sediment, on through centuries, has revealed boulder structure and form of unrivaled beauty, some of the boulders so revealed coming from rock that is nearly two billion years old.

EXHIBIT 1-E

VASEY'S PARADISE, MARBLE GORGE OF THE GRAND CANYON—MILE 31

Most of the springs which supply clear, fresh water to Canyon travelers emerge from the limestone of the redwall and Muav formations. This one would be far under the waters of Marble Canyon reservoir. It is considered to be the most beautiful to be seen from the river in the entire 280-mile length of the Grand Canyon.

EXHIBIT 1-F

SPRING IN SPOOK CANYON, MARBLE GORGE OF THE GRAND CANYON—MILE 41

This spring would be inundaed by any reregulating reservoir constructed. If built, the reregulating reservoir would inundate approximately twelve more miles of the canyon. If not built, the 104 river miles between Marble Gorge dam and the headwaters of Hualapai dam (if it were built) could not be safely traveled. If Hualapai dam were not built, then approximately the full 200 miles of Colorado River below Marble Canyon dam could not be safely traveled.

EXHIBIT 1-G

REDWALL CAVERN, MARBLE GORGE OF THE GRAND CANYON—MILE 33

One of the most remarkable caves on earth, discovered by John Wesley Powell, and estimated by him to be big enough to hold 50,000 people in its auditorium.

EXHIBIT 1-H

ERODED ROCK, MARBLE GORGE OF THE GRAND CANYON

"Abstract" sculpture, of remarkable variation, abounds along the river and in the lower parts of the side canyons. They are part of the "living textbook" of the Grand Canyon that geologists consider some of the finest revelations of all of the structure of the earth. The many geological epochs that the Colorado River has disclosed in its ten million years' excavation reach down to Vishnu schist, nearly two billion years old; the variation in rock structure gives rise to an extraordinary array of shapes and textures as the river's silt works on them.

EXHIBIT 1-I

LOOKING UPSTREAM AT NANKOWEEP, MILE 52, GRAND CANYON

Although this point is several miles below the proposed Marble Canyon dam, it would be profoundly affected by that dam, as would be the entire stretch of river through Grand Canyon National Park, Grand Canyon National Monument, and the remaining downstream miles not yet afforded special protection. Bureau of Reclamation calculations show that each day's peaking-power releases will cause the river to rise and fall 15 vertical feet immediately below the dam, 13 feet downstream as far as Phantom Ranch, and 10 feet at the head of the proposed Hualapai reservoir.

Vertical rises of this order, when translated to horizontal encroachment as the water rises, would render most of the river's edge unusable for camping and highly dangerous for all purposes. The daily rise of 4 or 5 feet caused by peaking-power generation at Glen Canyon dam already is a problem to the unwary and unskilled. Daily flash floods from the generators would in effect render the Canyon inaccessible, as well as creating an ecological desert between high water and low. Thus, such operation would be in conflict with the requirement that the areas within the National Park Service jurisdiction be preserved unimpaired for enjoyment of present and future generations.

EXHIBIT 1-J

26-MILE RAPID, MARBLE GORGE OF THE GRAND CANYON

Present National Park Service regulations require that only those who have led river trips through the Grand Canyon may now lead them. As soon as these

regulations are liberalized to provide that new leaders may be trained, river travel through the Grand Canyon can be expected to increase substantially. This will provide a recreational resource with no predictable end.

Reservoir recreation, on the other hand, will be adversely affected and finally terminated as sediment encroaches on the impoundment areas and headward aggradation compounds the scenic damage.

EXHIBIT 1-K

MILE 41, MARBLE GORGE OF THE GRAND CANYON

Part of "the most revealing pages of history exposed on the earth," in the words of Joseph Wood Krutch. Daily fluctuation from peaking-power releases would terminate the kind of recreational experience shown here. Mile 41 is below the proposed Marble Gorge dam.

EXHIBIT 1-L

STANTON'S CAVE, MARBLE GORGE OF THE GRAND CANYON, MILE 30.5

Stanton's Cave is one of the three places on earth where split-twig figurines have been found. It is the best site. It would be inundated by the proposed Marble Gorge dam. The figurines have been carbon dated at 4095 ± 100 years. Their meaning and origin is still being speculated upon.

EXHIBIT 1-M

CATTAILS IN RIVER, WHERE CLEAR WATER OF SIDESTREAM MIXES WITH SILT LOAD OF RIVER

EXHIBIT 1-N

TRACKS OF GREAT BLUE HERON, GRAND CANYON

The Great Blue Heron ranges the length of the Grand Canyon. Marble Canyon dam, if built, would inundate 55 miles of habitat and severely alter some 200 wild-river miles in the Grand Canyon below Marble Gorge.

EXHIBIT 1-O

10-MILE ROCK, IN THE MARBLE GORGE OF THE GRAND CANYON

This site is ten miles into one of the most extraordinary experiences available to man—a river trip through the 280 miles of the Grand Canyon, all but the last 40 of those miles being on a living river. This experience would be obliterated for all the time this civilization is likely to last, and for millenia beyond that, if Marble Canyon dam is permitted to be built. This sacrifice is proposed to create hoped-for hydroelectric revenue for between 71 and 104 years, depending on whose silting estimates are accepted.

VERIFICATION

DISTRICT OF COLUMBIA ss:

R. FREDERIC FISHER, being first duly sworn, deposes and says:

That he is the attorney for the Sierra Club; that he has read the foregoing Petition to Intervene and knows the contents thereof, and that the same are true to the best of his knowledge and belief.

R. FREDERIC FISHER.

Dated January 30, 1967.

Subscribed and sworn to before me this 30th day of January, 1967.

ZOLANDA D. MCINALLY,

Notary Public in and for the District of Columbia.

My Commission Expires Jan. 31, 1968.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon all parties of record in this proceeding, by mailing a copy thereof properly addressed to:

<i>Parties</i>	<i>Attorneys Served</i>
Federal Power Commission----	Joseph B. Hobbs, Esquire, Commission Staff Counsel, 441 G Street, N.W., Washington, D.C. 20426.
Arizona Power Authority-----	Mr. E. G. Nielson, Administrator, P.O. Box 6492, Phoenix, Arizona 85005. W. T. Wiley, Assistant Attorney General, State of Arizona, 1810 West Adams Street, Phoenix, Arizona 85007.
Coachelle Valley County Water District.	Earl Redwine, Esquire, 207 Lewis Building, Main Street at 10th, Riverside, California.
Hualapai Tribe of the Hualapai Reservation.	Royal D. Marks, Esquire, Title & Trust Building, Phoenix, Arizona. Arthur Lazarus, Jr., Esquire, 1700 K Street, N.W. Washington, D.C. 20036.
Imperial Irrigation District El Centro, California.	Horton, Knox and Carter, Law Building, 895 Broadway, El Centro, California.
The Metropolitan Water District of Southern California.	Charles Cooper, Jr., Esquire, 306 West Third Street, Los Angeles, California.
Navajo Indian Tribe-----	Norman M. Littell, Esquire, 1826 Jefferson Place., N.W., Washington, D.C. 20036.
Colorado River Commission of Nevada.	A. J. Shaver, Secretary, State Building, 215 East Bonanza Road, Las Vegas, Nevada.
Palo Verde Irrigation District Blythe, California.	Francis E. Jenney, Esquire, 458 South Spring Street, Los Angeles, California.
Upper Colorado River Commission.	Hon. Calvin Rampton, Governor, State of Utah and Vice Chairman, Upper Colorado River Commission, State Capitol Building, Salt Lake City, Utah. Ival V. Goslin, Engineer-Secretary, Paul L. Billhymer, Esquire, 355 South Fourth East Street, Salt Lake City, Utah.
Colorado River Board of California.	Dallas E. Cole, Chief Engineer, 909 South Broadway, Los Angeles, California. Northcutt Ely, Esquire, Ely & Duncan, 1200 Tower Building, Washington, D.C. 20005.
Department of Water and Power of The City of Los Angeles.	Gilmore Tillman, Esquire, Chief Assistant City Attorney for Water and Power, P.O. Box 3669, Terminal Annex, Los Angeles, California. General Manager & Chief Engineer, P.O. Box 3669, Terminal Annex, Los Angeles, California.
Southern California Edison Company.	John R. Bury, Esquire, P.O. Box 351, Los Angeles, California.
National Parks Association----	Anthony Wayne Smith, Esquire, Executive Secretary & General Counsel, 1300 New Hampshire Avenue, N.W., Washington, D.C. 20036. Smith W. Brookhart, Esquire, Brookhart, Becker & Dorsey, 1700 K Street, N.W., Washington, D.C. 20036.
Department of the Interior----	Hon. Stewart L. Udall, Secretary of the Interior, Washington, D.C. 20240. Frank J. Barry, Esquire, Solicitor, Washington, D.C. 20240.
Colorado Open Space Coordinating Council.	Roger P. Hansen, Executive Director, 2422 South Downing Street, Denver, Colorado 80210.

R. FREDERIC FISHER.

JANUARY 30, 1967.

THE GRAND CANYON CONTROVERSY—1967: FURTHER ECONOMIC COMPARISONS OF NUCLEAR ALTERNATIVES

Alan P. Carlin and William E. Hoehn,² the Rand Corporation, Santa Monica, California

Since our 1966 papers¹ questioning the economic feasibility of the proposed Grand Canyon dams, the costs of the alternative nuclear power sources we used have been revised and the relative importance of the two dams in the over-all Colorado River Basin Project has been reversed. The purpose of this paper is to present new calculations incorporating revised cost estimates of the nuclear powerplant alternatives and reflecting the increased importance of one of the proposed dams, the Hualapai (formerly Bridge Canyon) Project. The new calculations also introduce several refinements on our earlier methods.

Late in 1966 the General Electric Company substantially revised its 1965 price list for nuclear generating plants, on which our 1966 calculations of alternative nuclear costs were largely based. The effect was to increase the list prices for the installation of nuclear boilers, to eliminate the turn-key prices for the complete installation of nuclear plants, and to reduce most fuel costs. In light of these changes and the upward trend in contract prices for nuclear plants during the last year, we have decided to base our new calculations on deliberately conservative (that is, overstated) assumptions as to nuclear costs. These (and other assumptions) have been made with a view to avoiding all controversy as to whether they might possibly understate nuclear costs.

In the spring of 1966 we foresaw little real possibility that Congress would give serious consideration to the (then) Bridge Canyon Project in light of the unfavorable decision on it by the Bureau of the Budget, and accordingly directed most of our attention to the other project, Marble Canyon. Subsequent events indicate that the present position is now just the reverse. For this reason we have undertaken much more detailed calculations on Bridge than those presented last year.³

We have also adopted a somewhat different approach to developing a lowest cost alternative to Hualapai. In the 1966 analysis we considered a lower cost alternative consisting of a 762 mw base loaded nuclear plant and a 588 mw pumped storage plant. Because of our decision to include energy value adjustments in our calculations (to be discussed shortly), nuclear plants alone become an even lower cost alternative. Use of an entirely nuclear alternative has the added advantage that it removes the possible uncertainty from the relationship between pumped storage costs and the geography and other peculiarities of particular sites. Unfortunately, it is not possible to evaluate this relationship without detailed engineering studies. Nuclear costs, on the other hand, are comparatively invariant with the particular site chosen, given reasonable care in avoiding geologically suspect areas and areas with extremely high land values.

The major innovation in our computational methods is the introduction of an energy value adjustment. In order to insure comparability with the dams in our 1966 papers we unfairly penalized our nuclear alternatives by assuming that they generated power only during the same hours as the dams, despite the fact that they would have the lowest operating costs of any non-hydro installations on the power systems concerned. This resulted in the *economically* unlikely assumption that the nuclear alternatives would stand idle⁴ during off-peak hours

¹ Any views expressed in this paper are those of the authors. They should not be interpreted as reflecting the views of The RAND Corporation or the official opinion or policy of any of its governmental or private research sponsors. Papers are reproduced by The RAND Corporation as a courtesy to members of its staff.

² Alan P. Carlin and William E. Hoehn, "Is the Marble Canyon Project Economically Justified?" The RAND Corporation, P-3302, February 1966, reprinted in Alan P. Carlin, "Economic Feasibility of the Proposed Marble and Bridge Canyon Projects," in U.S. Congress, House, Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project*, Hearings before Subcommittee, Part II, 89th Congress, 2nd Session, May 13, 1966, pp. 1497-1512 (hereafter referred to as Hearings); Alan P. Carlin and William E. Hoehn, "Mr. Udall's Analysis: An Unrepentant Rejoinder," *ibid.*, pp. 1521-1535. The principal issues of economic interest arising out of the controversy over our 1966 papers are summarized in Alan Carlin, "The Grand Canyon Controversy: Some Lessons for Federal Cost-Benefit Practices," The RAND Corporation, P-3505, February 1967. A popularized summary of P-3505 is available as "The Grand Canyon Controversy or How Reclamation Justifies the Unjustifiable," The RAND Corporation, P-3541, February 1967.

³ See Alan P. Carlin, "Economic Feasibility . . ." *op. cit.*, Hearings, pp. 1511-1512.

⁴ Except for the overly-generous 10 percent fuel consumption we assumed merely to keep the plants up to operating temperatures for quick start-up.

while conventional plants generated power at much higher incremental costs. The real life situation, of course, would be just the reverse. The nuclear plants would be base loaded and a corresponding amount of thermal capacity would be relegated to peaking service. The Federal Power Commission's Technical Memorandum No. 1 recommends that under these circumstances the alternative be credited with the resulting savings when it is compared with a hydroelectric project.⁵ Or more accurately, it recommends that the alternative be credited with one-half the savings on the argument that the cost of energy from other conventional plants will fall over the life of the hydroelectric project. It seems unlikely, however, that the *operating costs* of nuclear and conventional thermal plants will narrow very rapidly or that the inventory of conventional plants yet to be relegated to peaking service will vanish for many years to come either. Nevertheless, in the interests of conservatism, we have adopted the procedures of the FPC Memorandum.

The second major innovation is that we have calculated the benefit-cost ratio not only at the Bureau's preferred interest rate of 3½ percent, but also at 5 percent. Although even this does not adequately reflect the economic risks involved in Bureau of Reclamation hydroelectric projects, it does suggest the effect that higher, more realistic interest rates have on the benefit-cost ratios for the two dams.

It is important to point out that the use of either 3½ or 5 percent does not imply anything about the type of financing that is assumed to be used in building either the dams or the alternatives. In an economic analysis of the benefits and costs of a project to the nation, the choice of interest rate should be based on the pure rate of interest for long-term investments plus an allowance for the economic risks of the project. This applies *regardless* of the type of financing that would actually be used if the project were built.

NEW CALCULATIONS

Table 1 shows average annual costs for nuclear alternatives to Hualapai and Marble Canyon dams under three sets of assumptions. The Hualapai alternative is assumed to be located on the ocean near Los Angeles and the Marble alternative on Lake Havasu near Parker Dam. The Marble alternative is assumed to supply 225 mw of power to the nearby Central Arizona Project pumps and to transmit the remainder to the Phoenix area over a 345 kv line (which is included in the costs).

Since our 1966 papers did not include an all-nuclear alternative to Hualapai, column (1) shows the costs of such an alternative using the assumptions as to its operating hours and interest rate used in our Marble alternative last year.⁶ Column (2) reflects the use of the energy value adjustment at the same 3½ percent interest rate, while column (3) is costed at 5 percent. Only the energy value adjustment cases are shown for the Marble alternative, once again at 3½ (column 4) and 5 percent (column 5).

Table 2 develops up-to-date capital costs for the two projects using Bureau of Reclamation indexes of project costs in 18 Western states and Alaska. The cost of an afterbay structure has also been added to the Marble costs (line 5).

The alternative costs developed in Table 1 and the project capital costs developed in Table 2 are then used to derive new benefit-cost ratios in Table 3. It is found that the Hualapai Project has a benefit-cost ratio of 0.78 to one without the energy value adjustment and 0.61 to one with it, while Marble has a ratio of 0.77 to one with the adjustment. At 5 percent interest the ratios are only 0.52 to one for Hualapai and 0.61 to one for Marble, thus suggesting that the ratios are quite sensitive to changes in the interest rate assumed.

But even the ratios at 3½ percent interest imply that the Projects are not economically justified in terms of their costs and benefits to the nation. Furthermore, the ratios are so far below one-to-one that it appears most unlikely that the results would be reversed by still more detailed calculations. In fact, it can be shown that *even* if the Bureau's alleged \$6 per kilowatt were used for the

⁵ Federal Power Commission, Bureau of Power, *Instructions for Estimating Electric Power Costs and Values*, Technical Memorandum No. 1, Revised March 1960, pp. 9-11.

⁶ Except that only 5 percent of the full fuel cost is allowed for spinning reserve during off-peak hours, based on an analysis of decay-heat curves. The operating hours have, of course, been adjusted to fit the proposed Hualapai output.

transmission costs of the alternatives, the benefit-cost ratios would still be less than one-to-one at 3½ percent interest.⁷

In these calculations we have endeavored to quantify all reasonable but previously unquantified assumptions that have occurred to us⁸ which if left unquantified tended to bias the conclusions against the dams. We have, however, left unquantified a number of other items which if quantified would be unfavorable to the dams. The effect of these remaining unquantified assumptions, the most important of which we shall enumerate in the next section, is obviously to further weaken the economic case for the dams. In order to show that our benefit-cost ratios are underestimates, it would first be necessary to show that whatever upward revisions may be desired in our alternative costs are greater than the net effect of the remaining unquantified assumptions favorable to the dams.

ASSUMPTIONS FAVORABLE TO THE DAMS

1. Use of Overstated Nuclear Costs

Nuclear costs in our previous papers were estimated from the 1965 edition of the General Electric Company pricing handbook.⁹ It is evident from contract awards during that time period that this represented a conservative basis, as discounting of actual bids from the price list was widespread. Since that time, however, General Electric has discontinued turn-key contracting, resulting in the elimination of complete plant price lists, and has twice revised upwards its price list for nuclear steam supply systems (and widened the scope of supply). At the same time, nuclear fuel scope of supply has been broadened with more comprehensive warranty provisions added, and costs have been adjusted. The net effect has been to lower nuclear fuel costs for first and second cores and to raise slightly third core costs. Since no comprehensive cost studies similar to the TVA and Oyster Creek analyses have been published recently, the appropriate capital cost levels in relation to the latest General Electric nuclear steam supply price list is not clear.

In March 1966 Philip Sporn, Chairman of the System Development Committee of the American Electric Power Company, presented an analysis of nuclear power costs to the Joint Committee on Atomic Energy based on recalculations of his 1964 analysis of the nuclear Oyster Creek and conventional Cardinal plants.¹⁰ In that paper, he indicated that his original calculation of \$139 per kw for post-Oyster Creek class reactors was a "handbook-type" price, that would have to be reduced to correspond to a negotiated price. As a discounting factor he used the percentage discount from the handbook price that Dresden II enjoyed. This results in an adjusted 605 mw(e) plant cost of \$128 per kw, a figure including switchyard costs. Our assumed plant costs for a 600 mw(e) net plant are \$150 per kw and \$155 per kw at 3½ percent and 5 percent respectively, excluding switchyard costs but including an additional \$2.50 per kw for field fabrication costs. Correcting for these differences, our plant costs represent a roughly 20 percent increase over the costs developed by Mr. Sporn, which is more than sufficient to cover increases in nuclear costs since that time.

For the twin unit plant of 1350 mw(e) net total capacity, the basic cost assumed for the first unit is \$149 per kw and \$154 per kw at 3½ percent and 5 percent respectively, including switchyard; a discount of \$10 per kw has been allowed for the second unit, based on low incremental land and site costs and on reported cost discounts for a second unit at a site.¹¹ If the intent of this paper were to evaluate current nuclear power economics for private utilities, we would be prepared to endorse figures at least \$10 per kw lower than those used for the specific comparisons herein.

⁷ As explained in P-3505, *op. cit.*, pp. 12-17, the Bureau of Reclamation makes the highly questionable assertion that transmission costs of \$6 per kw-yr should be charged against the alternatives (at least in the case of Marble and possible Hualapai as well). This would add \$8.10 million (1350 mw at \$6,000 per mw) to Hualapai benefits, or \$26.5 million in all, and \$2.9 million (600 mw at \$6,000 per mw minus about \$0.7 million already included under line 6 of Table 1) to Marble benefits, or \$13.1 million in all.

⁸ And Representatives Morris Udall and Craig Hosmer, the Bureau of Reclamation, and other dam proponents.

⁹ *Atomic Power Equipment Handbook*.

¹⁰ Philip Sporn, "Nuclear Power Economics: An Appraisal of the Current Technical-economic Position of Nuclear and Conventional Generation" (March 17, 1966), in U.S. Congress, Joint Committee on Atomic Energy, *AEO Authorizing Legislation, Fiscal Year 1967*, Hearings, Part 1, 89th Congress, 2nd Session, 1966, Appendix 14, pp. 561-571.

¹¹ See, for example, *Nucleonics Week*, October 18, 1966, p. 4.

2. Exclusion of Other Hualapai Expenditures

In addition to the expenditures for the benefit of the Hualapai Indians included in line 5 of Table 2, H.R. 4671 (the Colorado River Basin Project considered by the 89th Congress), as revised, provided that the Government would "make available to the Hualapai Tribe up to twenty-five thousand kilowatts and up to one hundred million kilowatt-hours annually of power from the Hualapai unit at the lowest rate established by the Secretary [of the Interior] for the sale of firm power from said unit for the use of preferential customers."¹² We are unable to evaluate what the financial costs to the government of this provision would be. We note, however, that Representative Reinecke has stated that the Hualapai Tribe would receive \$60.8 million in non-cash benefits¹³ under H.R. 4671. If \$12.3 million of this represents the Peach Springs-Diamond Point road, this would appear to leave \$48.5 million as the cost of the power benefits. Although this may be distributed over a number of years, it does not appear to be included in the project costs shown in the project report.

3. Use of Bureau Cost Indexes

After reviewing a variety of construction price indexes we find that the Bureau of Reclamation's index used in Table 2 is one of the lowest composite indexes available. Most others, such as the *Engineering News-Record* construction price index, are much higher. The ENR index, for example, is over 20 percent higher than in October 1961, versus about 10 percent for the Bureau index.

4. Exclusion of Value of Water in Bank Storage

No charge is made in Table 3 for the value of water that would be held in bank "storage" around the proposed Marble Canyon Reservoir. Unless the Reservoir can be filled during years when this water would otherwise run waste into the Gulf of California, an annual charge should be made for this water, which is unlikely to be recovered (as the Reservoir will eventually be filled with silt rather than emptied). This annual charge might be about \$0.6 million.¹⁴

5. Exclusion of Effects on Aesthetic and Other Park Values

No value has been attributed to what many conservationists believe will be the impairment of the natural scenic beauty of what is commonly acknowledged to be an unusually scenic canyon and of other park values in Grand Canyon National Park and Monument that will result from the construction of either dam. Although it is difficult to attach an exact momentary value to this cost, it is not negligible, judging by the public response to the appeal of the conservationists to defeat the dams and the many man-hours that have been voluntarily poured into this effort. If no afterbay structure were included in the Marble costs shown in Table 2, this effect would be substantially greater.

6. Exclusion of Possible Effect of Marble on Boating Expeditions

Table 2 assumes that the Marble Canyon Project includes an afterbay structure that would be capable of reducing the peak flows in the River resulting from the operation of the Project as a peaking plant from 30,800 cubic feet per second to 20,500 cubic feet per second. Even with the structure, there is some dispute whether boating expeditions down the River would still be possible through Grand Canyon National Park. At the very least, the length of such trips would be greatly reduced. If they were no longer possible, the cost in terms of producers' and consumers' surplus foregone might be about \$0.2 million per year.¹⁵

7. Use of Stream Flows Assumed in Project Reports

We have assumed the same stream flows used in the 1964 Bureau project reports. More recent studies have suggested that stream flow past the dam sites

¹² U.S. Congress, House, *Colorado River Basin Project*, Report No. 1849, 89th Congress, 2nd Session, August 11, 1966, p. 5.

¹³ *Ibid.*, p. 127.

¹⁴ Stewart Udall has stated that bank "storage" at Marble "could amount to between 300,000 and 400,000 acre-feet" (Hearings, p. 1403). At \$54 per acre-foot (see note to Table 1, line 7), 350,000 acre-feet would be \$0.59 million per year at 3½ percent interest.

¹⁵ According to the Sierra Club, National Park Service statistics show that 547 persons made the Canyon boat trip in 1965 and 1,067 in 1966 (see "Supplement to Petition of the Sierra Club for Leave to Intervene Pursuant to Rule 1.8 (d) before the Federal Power Commission in the Matter of Arizona Power Authority, Project No. 2248," January 30, 1967, p. 45). A conservative assumption would be that if Marble is not built, an average of at least 1,000 per year will make the trip over the next 100 years. If the average price paid is taken as \$300 and the producers' and consumers' surplus as \$175 per person, the net cost would be \$0.175 million per year.

may be somewhat lower. The effect of such a reduction would be to further lower the benefit-cost ratios for the dams.¹⁶

8. Use of Heavily Subsidized Interest Rates

As the use of a 5 percent interest rate in Table 3 demonstrates, the use of higher, more realistic interest rates has a strong effect in lowering the benefit-cost ratios of the Projects. Use of even higher rates, which would be even more suitable from the standpoint of economy theory,¹⁷ would only be further lower the ratios since the Projects are more capital intensive.

TABLE 1.—Average annual costs of alternative nuclear powerplants

(In millions of dollars)

Alternative to.....	Hualapai (Bridge Canyon)			Marble Canyon	
	3½ No	3½ Yes	5 Yes	3½ Yes	5 Yes
Interest rate (percent).....	(1)	(2)	(3)	(4)	(5)
Energy value adjustment.....					
1. Capital.....	10.57	10.57	13.59	4.89	6.28
2. Fuel.....	7.33	2.22	2.61	1.43	1.59
3. Operating and maintenance:					
(a) Fixed.....	1.26	1.26	1.26	.84	.84
(b) Variable.....	.49	.49	.49	.23	.23
4. Special nuclear insurance.....	.52	.52	.52	.31	.31
5. Hydro adjustment.....	.59	.59	.74	.29	.36
6. Transmission and substations.....				.86	1.08
7. Makeup water for cooling towers.....				.41	.41
8. Reserves.....	1.35	1.35	1.35	.60	.60
Total.....	22.11	17.00	20.56	9.86	11.70

NOTES ON LINES

1. Columns (1) and (2): Capital costs of two 675 mw(e) net nuclear plants at 5.435 percent. The 5.435 percent is the sum of 3.125 percent interest, 0.25 percent for interim replacement, and 2.06 percent for depreciation (30-year sinking fund basis). The capital costs are computed on the basis of \$145 per kw plus \$4 per kw (for a switchyard) for the first 675 mw(e) unit and \$135 per kw plus \$4 per kw for the second (or an over-all average of \$144 per kw). The total cost of \$194.40 million includes \$5.4 million for a switchyard and \$4.9 million for marine lines. Column (3): Capital costs of \$201.15 million (based on an over-all average of \$149 per kw to account for the increased cost of interest during construction) at 6.755 percent. The 6.755 percent is the sum of 5.0 percent interest, 0.25 percent for interim replacement, and 1.505 percent for depreciation (30-year sinking fund basis). Column (4): Capital cost of one 600 mw(e) net nuclear plant at 5.435 percent. The capital costs are computed on the basis of \$150 per kw (excluding a switchyard). The total cost of \$90.0 million includes \$4.8 million for cooling towers and a \$1.5 million differential for field rather than shop fabrication of the pressure vessel. Column (5): Capital cost of \$93.0 million (\$155 per kw, representing higher interest during construction) at 6.755 percent.

2. Column (1): Annual generation of 4.933 billion kwh per year (Hualapai production minus transmission losses) at 1.40 mills per kwh plus 5 percent of full load fuel requirements during off-peak hours when the reactor is not shutdown. The 5 percent is an upper estimate of the additional fuel that would be required to keep the system at operating temperature during off-peak hours. Because a nuclear reactor continues after shutdown to produce large amounts of heat from fission product decay, no load fuel requirements to keep the system at hot operating temperature are minimal. Fuel consumption would probably be required only over the week-end period, as decay heat should be sufficient for daily carry-over; the 5 percent used here allows an additional margin above that requirement, however. Column (2): Annual generation of 4.933 billion kwh per year at

¹⁶ See Alan P. Carlin. "Economic Feasibility . . ." *op. cit.*, Hearings, pp. 1510-1511.

¹⁷ The interest rate question is discussed in P-3505, *op. cit.*, pp. 18-19.

0.45 mill per kwh. The 0.45 mill is the difference between the average fuel cost at 80 percent load factor (1.34 mills per kwh) and X, the energy value adjustment according to the following formula given in Federal Power Commission, Bureau of Power, *Instructions for Estimating Electric Power Costs and Values*, Technical Memorandum No. 1, March 1960, p. 11:

$$X = \frac{F_p - F_a}{F_p} \cdot \frac{I_a - I_s}{2}, \text{ where}$$

X=adjustment in mills per kwh

F_a=average annual plant factor of alternative

F_p=average annual plant factor of hydro project

I_a=incremental cost in mills per kwh of alternative plants

I_s=incremental cost in mills per kwh of existing steam electric plants.

In this case, F_a=80 percent, F_p=41.7 percent, I_a=1.44 (equal to 1.34 mills per kwh for fuel plus 0.10 mill per kwh for variable operating and maintenance), and I_s=3.37 (the energy cost supplied by the FPC and used by the Bureau of the Reclamation for their thermal alternatives to the Grand Canyon dams, as given in a Memorandum dated May 11, 1966 to the Commission from F. Stewart Brown, Chief, Bureau of Power, on the subject of "Marble Canyon Project, Arizona," p. 2). Column (3): Annual generation at 0.53 mills per kwh. In this case I_a=1.49 (corresponding to a fuel cost of 1.39 mills per kwh at a 5 percent interest rate). Column (4): Annual generation of 2.308 billion kwh (Marble production at site) at 0.62 mill per kwh. In this case F_p=43.9 percent and I_a=1.62 (equal to 1.34 mills per kwh for fuel plus 0.10 mill per kwh for variable operating and maintenance plus 0.18 mill per kwh for cooling water). Column (5): Annual generation at 0.69 mill per kwh. In this case F_p=43.9 percent and I_a=1.67 (corresponding to a fuel cost of 1.39 mills per kwh).

3a. Assumes average fixed operating and maintenance costs (in addition to the interim replacement included in line 1) of \$1.40 per kw-year. This figure is taken from Atomic Energy Commission, Division of Reactor Development and Technology, Office of Civilian Power, "A Specific comparison of Nuclear Electric Power and Hydro Electric Power—Bridge and Marble Canyon Projects" (February 1965), printed in U.S. Congress, House, Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project. Hearing before Subcommittee, Part II, 89th Congress, 2nd Session, May 12, 1966, p. 1373*. For the two units in Los Angeles, a reduction of 33 percent has been taken to reflect savings resulting from a twin-unit plant.

3b. Assumes average variable operating costs of 0.1 mill per kwh, *ibid.*

4. Estimates for the Marble alternative are based on the premium paid by Commonwealth Edison Company for their Dresden Plant, as shown in U.S. Congress, Joint Committee on Atomic Energy, Subcommittee on Legislation, *Selected Materials on Atomic Energy Indemnity Legislation*, 89th Congress, 1st Session, June 1964, pp. 17 and 68. Private nuclear liability insurance rates for Dresden are used for the first \$60 million of coverage. The remaining \$14 million of private insurance is taken at the rate of 2.5 percent of the base rate per \$1 million coverage. Price-Anderson Act insurance (to \$486 million) is computed at the rate of \$30/mw(t). These estimates are very conservative in that up to 75 percent of the private premiums is maintained in a special fund which is earmarked for refund on the basis of the first ten years of experience. The Bridge estimate for the private insurer portion of coverage on the two units is taken to be one and a half times the estimated amount for a single unit, reflecting an economy of multiple unit siting.

5. Five percent of annual fixed (capacity) costs (line 1 plus line 3a), as suggested by FPC Technical Memorandum No. 1, *op. cit.*, pp. 7-9.

6. Cost of a sending switchyard at the plant, a receiving substation in Phoenix, and 130 miles of double circuit 345 kv line. Transmission line capital costs are taken as \$85,000 per mile (based on \$5,000/mile for right of way and clearing and \$80,000/mile for structures as given in FPC, *National Power Survey, Part II—Advisory Reports*, October 1964, p. 87). Capital costs of switchyard, substation, and associated transmission facilities are taken as \$5.0 million. Operating, maintenance, and interim replacement are based on FPC, Technical Memorandum No. 1, *op. cit.*, pp. 45, 96, and 97. Also following the FPC, transmission lines are assumed to have a service life of 50 years and substations 35 years.

7. Value of 7,600 acre-feet per year required to make-up evaporation losses from cooling towers at \$54 per acre-foot. This is based upon expected water costs of \$65 per acre-foot from the Metropolitan Water District's proposed water desalinization plant near Los Angeles (see *Nucleonics Week*, September 16, 1966, pp. 1-2), minus marginal pumping costs for the Colorado River Aqueduct of about \$11 per acre-foot. The \$54 per acre-foot is thus the net cost to the Metropolitan Water District of replacing water no longer available from the Colorado River. Use of this figure assumes that any additional evaporation from the reservoirs will reduce the water available to the MWD by an equal amount. Although there may be some years of surplus flow on the River, these are expected to be few once the Central Arizona Project is built and even fewer once the Upper Basin states use their entire allotments. Although the desalinized water would be of somewhat better quality than the Colorado River water it would replace, the \$65 per acre-foot cost does not include the substantial subsidies that would be provided to the plant by the Federal Government under present plans.

TABLE 2.—*Capital costs of Hualapai and Marble Canyon projects*

[In millions of dollars]

	Hualapai (Bridge Canyon)		Marble Canyon	
	3½	5	3½	5
	(1)	(2)	(3)	(4)
Interest rate.....				
1. Construction costs shown in project reports.....	\$511.3		\$238.7	
2. Prices as of.....	(1)		(1)	
3. Construction costs in October 1966 prices.....	560.5		259.3	
4. Less investigation costs.....	-1.7		-1.1	
5. Other construction costs not shown in project reports.....	18.5		34.0	
6. Construction costs.....	577.3		292.2	
7. Interest during construction.....	40.5	62.1	25.8	39.7
8. Total capital costs.....	617.8	639.4	318.0	331.9
9. Annual capital costs.....	20.23	32.21	10.42	16.72

¹ October 1961.² October 1963.

NOTES ON LINES

1 and 2. Columns (1) and (2): As given in U.S. Department of the Interior, Bureau of Reclamation, *Pacific Southwest Water Plan, Supplementary Information Report on Bridge Canyon Project, Arizona*, January 1964, p. 18. Columns (3) and (4): *Ibid.*, *Supplementary Information Report on Marble Canyon Project, Arizona*, January 1964, p. 19.

3. Derived by applying Bureau of Reclamation cost indexes to each sub-item shown in the "Basic Estimate DC-1 Summary" for each project. The indexes used are those for October 1966 as given in *Engineering News Record*, December 15, 1966, p. 101.

4. As shown in Bridge Canyon Project report, *op. cit.*, p. 23, and Marble report, p. 25.

5. Columns (1) and (2): Section 303 of H.R. 4671, 89th Congress, as revised, provided for the payment of \$16,398,000 as "compensation" to the Hualapai Indians for the taking of "easements, rights-of-way, and other interests in land within the Hualapai Indian Reservation . . . for the construction, operation and maintenance of the Hualapai unit" (see U.S. Congress, House, *Colorado River Basin Project*, Report No. 1849, 89th Congress, 2nd Session, August 11, 1966, p. 5). This exceeds by \$6,283,000 the cost of "lands and rights" shown for Bridge Canyon Dam and Reservoir (see project report, *op. cit.*, p. 18). Assuming (charitably) that no payments would be made for other lands or rights for the Project, it is evident that the project report underestimated this item by at least this amount. The same Section of H.R. 4671 also provided for Federal construction of a paved road from Peach Springs to Diamond Point (on the proposed reservoir). This road, which the Department of the Interior has estimated would cost \$12,260,000 (see U.S. Congress, House, Committee on In-

terior and Insular Affairs, *Lower Colorado River Basin Project*, Hearings before Subcommittee, Part II, 89th Congress, 2nd Session, May 12, 1966, p. 1411), does not appear to be included in the project report. Together, these items benefitting the Hualapai Indians add at least \$18.5 million to the cost of the Bridge Canyon Project. Columns (3) and (4): Cost of an afterbay structure below Marble that would be capable of reducing the peak flows in the River from 30,800 cubic feet per second to 20,530 feet per second in order to preserve park values within Grand Canyon National Park and Monument and to improve the possibilities for boating expeditions down the Colorado through the Park if Marble should be built. The cost figure is based on a preliminary estimate supplied by Floyd E. Dominy, Commissioner, Bureau of Reclamation, to Representative Ed Reinecke in a letter dated September 6, 1966.

6. Line 3 minus line 4 plus line 5.

7. Derived by using the same percentage shown in the project reports for interest during construction as a percentage of construction costs, corrected for the differences in interest rates. The percentages for Hualapai are 7.01 at 3½ percent and 10.77 at 5 percent. The corresponding Marble figures are 8.85 and 13.59 percent.

8. Columns (1) and (3): Line 7 at 3.28 percent (including depreciation of 0.15 percent on a 100 year sinking fund basis). Columns (2) and (4): Line 7 at 5.04 percent.

TABLE 3.—*Benefits and costs of Grand Canyon Dams*

[Dollar amounts in millions]

	Hualapai (Bridge Canyon)			Marble Canyon	
	3½ No	3½ Yes	5 Yes	3½ Yes	5 Yes
Interest rate (percent).....	(1)	(2)	(3)	(4)	(5)
Energy value adjustment.....					
1. Benefits:					
a. Power.....	\$22.11	\$17.00	\$20.56	\$9.67	\$11.51
b. Fish and wildlife.....	.66	.66	.66	.18	.18
c. Recreation.....	.33	.33	.33	.16	.16
d. Area redevelopment.....	.36	.36	.36	.15	.15
e. Total.....	23.46	18.35	21.91	10.16	12.00
2. Costs:					
a. Capital charges.....	20.23	20.23	32.21	10.42	16.72
b. Operating costs.....	4.49	4.49	4.49	1.94	1.94
c. Power purchases.....	.91	.91	.91	.39	.39
d. Additional water evaporation.....	4.59	4.59	4.59	.54	.54
e. Total.....	30.22	30.22	42.20	13.29	19.59
3. Benefit-cost ratio (ratio to 1).....	0.78	0.61	0.52	0.76	0.61

IMPORTANT NOTE

Line 3 overstates the benefit-cost ratios in that they make the following assumptions favorable to the projects: (1) Use of overstated nuclear costs, (2) exclusion of other Hualapai benefits, (3) use of Bureau cost indexes, (4) exclusion of value of water in bank storage at Marble, (5) exclusion of effects on aesthetic and other park values, (6) exclusion of possible effect of Marble on boating expeditions, (7) use of stream flows assumed in project reports, and (8) use of heavily subsidized interest rates.

NOTES ON LINES

1a. Columns (1) to (3): From Line 9, Table 1, Columns (4) and (5); Line 9, Table 1 minus \$0.19 million representing the annual loss of revenue resulting from the reduction in energy generation from the Glen Canyon Power Plant if the Marble Gorge Project is built.

1b and c. One-half of the benefits shown by the Bureau of Reclamation in *Pacific Southwest Water Plan, Supplemental Information Report on Bridge Canyon Project, Arizona*, January 1964, p. 22 and the *Supplemental Information Report on Marble Canyon Project, Arizona*, January 1964, p. 24. The proposed

reservoirs would be about equally far from major population centers as existing reservoirs, particularly Lake Powell and Lake Mead, which are by no means overcrowded. To the extent that recreational and fishing use of the proposed reservoirs would be likely to draw visitors away from the existing reservoirs, there would be no net increase in benefits to the nation. Since there is no evidence that the Bureau has taken this into account in its estimates, it seems safe to assume that at least one-half of the use assumed by the Bureau would not contribute any net benefits.

1d. From the Bridge and Marble Canyon Project reports, *ibid.*

2a. From Table 2.

2b and c. From project reports, *op. cit.*

2d. Additional evaporation resulting from construction of each reservoir as given by the Department of the Interior (see U.S. Congress, House, Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project*, Hearings before Subcommittee, Part II, 89th Congress, 2nd Session, May 12, 1966, p. 1403) valued at \$54 per acre-foot (see note to line 7, Table 1).

WHAT THE PARSONS STUDY REALLY SAYS ABOUT NUCLEAR POWER ECONOMICS: THE GRAND CANYON CONTROVERSY, ROUND ?

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The Ralph M. Parsons Co. was retained by the Arizona Interstate Stream Commission to "show the effect of substituting nuclear-fueled power generation facilities for proposed hydroelectric power generating plants at Hualapai Dam and Marble Canyon Dam on the Basin Account Consolidated Payout Schedule."²

The principal conclusion of the Parsons study are:

(1) Comparing nuclear alternatives with the hydroelectric plants on a peaking basis shows that the nuclear plants themselves will never pay out since the annual interest payments are greater than the net revenues as demonstrated in the Consolidated Payout Schedules herein.³

(2) This study also compares the funds accumulation from a base-loaded nuclear plant with those accumulated from the hydroelectric plants. While this comparison accrues the most funds from the various nuclear alternatives considered in this study, the funds accumulated are substantially less than those accumulated from the hydroelectric plants.⁴

(3) Even at the federal financing interest rate of 3.222%, the baseloaded nuclear power plants could not repay their costs if it were not for the outside contributions to the combined fund of revenues from Hoover, Parker, and Davis Dams in later years of the analysis.

(4) Evaluating only the economics of nuclear energy production at the plants—by neglecting *all* transmission costs—the four nuclear plants, base-loaded, could not repay their costs if the aggregate fixed charge rate (including depreciation) were in excess of 6.1% per annum.

These latter implications are astoundingly contrary to the overwhelming preponderance of evidence from the real world that the credibility of the related Parsons Study conclusions quoted in (1) and (2) above seems doubtful. With regard to conclusion (3), the Bureau of Reclamation (an outspoken proponent of the dams) has admitted:

"There is little doubt, from a theoretical point of view, that a nuclear plant could be selected of a certain size and operational pattern to contribute as much or more to the Development Fund as would the Marble Canyon hydroplant."⁵

¹ Any views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of The RAND Corporation or the official opinion or policy of any of its governmental or private research sponsors. Papers are reproduced by The RAND Corporation as a courtesy to members of its staff.

² "Economics Analysis, Nuclear Versus Hydroelectric Power Generation, Colorado River Basin Project, Interstate Stream Commission, State of Arizona." The Ralph M. Parsons Co., Number 3874-1, July 20, 1966, p. 11; hereafter cited and referred to as the "Parsons Study."

³ *Ibid.*, p. 12.

⁴ *Ibid.*, p. 12.

⁵ U.S. Congress, House Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project*, Hearings before Subcommittee, Part II, 89th Congress, 2nd Session, May 13, 1966, p. 1520.

In the recent announcement that the Administration no longer favors construction of either of the dams as a feature of the Central Arizona Project, but favors the purchase of energy from thermal plants to be built by WEST Associates, Secretary of the Interior Stuart L. Udall described the new plan as "a victory for common sense."⁴

With respect to conclusion (4), in the last two years investor-owned (private) utilities, with overall fixed charge rates ranging from 10%–14% per annum, or roughly double the break-down figure of the Parsons Study, have placed orders for more than 20,000,000 kilowatts of new nuclear generating capacity. In fact, in 1966 more nuclear capacity than fossil-fueled capacity was ordered. If the implicit conclusion (4) of the Parsons Study were true, this would mean that these utilities through their independent evaluations of nuclear power economics, have committed themselves to an aggregate investment of well over two billion dollars that cannot be repaid even through baseload operations. If this were indeed the case, this even would represent a miscalculation unparalleled in the history of private sector investment decisions, and one that would rank with only the most remarkable of past federal reclamation project miscalculations.

To verify that conclusion (3) is implicit in the Parsons Study, one need only refer to either Table S or Table W of the Parsons Study. Column 5 of those tables shows the unpaid balance of the (interest-bearing) investment in the plants by years. In each of the first 18 years, the unpaid balance increases demonstrating that annual revenues are less than annual costs (including, of course, interest on invested capital).⁵ Only with Year 19 and following years, when revenues from Hoover, Parker, and Davis are incorporated into Column 1 of those tables (Net Operating Revenue), does the investment begin to decline.⁶

Somewhat more effort is required to verify conclusion (4). The Parsons Study evaluates no less than eight alternative cases—three plants in Los Angeles and one in Arizona versus four plants in Los Angeles, both baseloaded and peak-loaded, and all at both 3.222% interest and 4.5% interest—and the mass of data and proliferation of tables is more than sufficient to stun the casual reader. Accordingly, conclusion (4) will be verified herein only for the case of three plants at Los Angeles and one in Arizona, which most nearly corresponds to the proposed distribution of energy. Tables 1 and 2 reproduce, respectively, relevant portions of the Parsons Study capital cost and annual cost tables for this alternative location.⁷

The exclusion of transmission costs assumed in conclusion (4) permits us to discard Item 9 of Table 1, reducing investment in plant and equipment to the \$397 million of Line 8, and to discard Line 7 of Table 2, reducing annual costs before replacement and interest on investment from \$30.877 million to \$28.904 million. At the assumed overall fixed charge rate of 6.10%, the annual replacement (a form of depreciation accounting) and interest charges on the \$397 million investment would be \$24.217 million. Then total annual costs are \$53.121 million.⁸ Annual revenues in the Parsons Study fluctuate slightly from year to year; however, the sum of the Gross Nuclear Revenues over the 75-year period of analysis is \$3,983,239,000,⁹ so that the average annual revenue may be taken to be \$53.110 million. Thus, at a 6.1% fixed charge rate with no allowance for transmission costs, taxes or other private-utility costs, the four baseloaded

⁴ Quoted in the *Los Angeles Times* (Preview Edition), Thursday, February 2, 1967, p. 2.

⁵ In the Parsons Study, annual costs *except for interest charges* are developed for all alternatives. These interest-less "costs" are then deducted from gross nuclear revenues on one set of charts (Tables H—O of the Parsons Study) in which revenues from Hoover, Parker, and Davis Dams are commingled with nuclear gross revenues. The resulting series for each alternative (which bear the label "Consolidated Net Annual Revenues") are then carried over to another set of eight charts (Tables P—X of the Parsons Study) of "Consolidated Payout Schedules," where, under the Power section in the "Interest Bearing Investment" column, interest payments are finally applied. That is, under the Parsons Study procedures, revenues are first used to defray annual operating and maintenance costs; remaining revenues are used to defray the depreciation account (the Replacement Fund); any remaining revenues are then applied first to payment of annual interest charges and then to reducing the unpaid balance of the investment account. Thus an *increasing* unpaid investment account indicates that revenues are insufficient to meet even the total annual interest charges.

⁶ Tables J and N, in which Net Operating Revenues for Tables S and W, respectively, are derived, show in Column 9 (Hoover, Parker, Davis Net Revenues) that Year 19 is indeed the first year in which outside revenue is added.

⁷ Parsons Study, *op. cit.*, Tables C and G.

⁸ The sum of \$28.904 million operating and \$24.217 million capital costs.

⁹ Parsons Study, *op. cit.*, Table N., Column 8, p. 89.

nuclear plants incur losses of \$11,000 per year.¹³ Moreover, at at typical private-utility fixed charge rate of 12% per annum, the deficit for the four units would be in excess of \$23.4 million per year under the Parsons Study cost and revenue assumptions, or an annual loss of \$5.95 million per nuclear plant. Thus, if the Parsons Study analysis is to be accepted, it follows that those private utilities that have ordered nuclear plants have not just made a minor error, but have indeed made a colossal miscalculation.

TABLE 1.—*Parsons Study capital cost assumptions—3 units in Los Angeles and 1 in Arizona*

<i>Line and item</i>	<i>Cost in millions</i>
1. Equipment and facilities.....	\$270. 90
2. Land and land rights.....	7. 60
3. Site development.....	16. 70
4. Indirect capital.....	14. 60
5. Subtotal, lines 1-4.....	309. 80
6. Interest during construction.....	9. 90
7. Working capital.....	77. 30
8. Subtotal.....	397. 00
9. Transmission facilities.....	141. 00
10. Total.....	538. 00

Source : Parsons Study, op. cit., table C. p. 52.

TABLE 2.—*Parsons Study annual costs for baseloaded plants—3 units in Los Angeles and 1 unit in Arizona*

<i>Line and item</i>	<i>Cost in millions</i>
1. Operating and maintenance labor.....	\$1. 665
2. General and administration expenses.....	0. 371
3. Maintenance materials and supplies.....	0. 270
4. Nuclear insurance.....	2. 261
5. Nuclear fuel.....	23. 687
6. Cooling water.....	0. 650
7. Transmission maintenance.....	1. 973
8. Total annual cost before replacement.....	30. 877
9. Replacement fund (at 3.222%).....	8. 620
10. Total annual cost before interest on investment.....	39. 497

Source : Parsons Study, op. cit., table G, p. 61.

Now that it has been shown that the Parsons Study analysis implies certain unacceptable conclusions, it may be of interest to identify some of the more important points at which various estimates and assumptions have contributed to the unfortunate disparity between the Parsons Study and real-world nuclear power economics. We consider first those aspects dealing with nuclear power costs and revenues in the general case, and then some aspects of the particular comparison of nuclear and hydropower for the Development Fund.

NUCLEAR POWER COST ESTIMATION

Under this heading we will briefly consider the following items—powerplant selection and costs, land costs, and interest during construction.

Powerplant Selection and Costs.—The nuclear powerplant design assumed in the Parsons Study is the dual-cycle reactor of the Dresden I type. Unfortunately, the dual-cycle reactor type assumed in the study is no longer offered by any of the major U.S. reactor vendors, and was last offered as an alternative to the

¹³ This is, admittedly, a simplified analysis. The Parsons Study uses a combination interest charge and sinking fund rate, with a 100-year period on the items in Lines 1, 4, 6, and 7 of Table 1, 50-year on transmission (Line 9) and 100-year on land and site development (Lines 2 and 3); under this procedure, the break-even interest rate is 4.58%, with fixed charge rates (including sinking fund) of 6.197 for 30-year items and 4.633 on land. This, of course, closely approximates the overall 6.1% fixed charge rate used above.

Oyster Creek and Nine Mile Point plants in 1963. In both cases, the utilities selected the single-cycle version because it entails lower initial investment and greater efficiency, and because developments such as variable flow recirculating pumps proved to be a more flexible method of handling load changes. In the Oyster Creek analysis,¹³ the contract price of the single-cycle reactor was \$1.5 million less than the dual-cycle. Since the Oyster Creek reactor is roughly the size of each of the four reactors assumed in the Parsons Study, capital costs for plant and equipment would appear to be overstated by some \$6 million plus overheads, which represents an annual cost reduction of some \$330,000 at the 3.222% interest rate.

The Parsons Study also assumes a net capacity of 2450 electric megawatts (MWe) from the 2600 MWe gross capacity of the four units. For single-cycle plants of 650 MWe gross using ocean water cooling, auxiliary power requirements should not exceed 20 MWe, and for inland plants, because of cooling tower fan power requirements, auxiliary power should be about 30 MWe, so that the net rating of the three plants in Los Angeles and one in Arizona should be about 2510 MWe. This is somewhat academic, as the Parsons Study inadvertently used the gross power rating rather than net power in computing the annual nuclear generation of 18.22 billion kilowatt-hours (kwh) per year at baseload (80% load factor), which is the figure used throughout. This would result in adjusted annual energy production of 17.59 billion kwh.

In the absence of more detailed cost estimates it is not possible to comment on the accuracy or acceptability of the various estimates; the overall level of nuclear capital costs appears reasonably representative of costs as of the publication date of the study.

Land Costs.—The Parsons Study based its estimate of land costs on a Bechtel study of alternative sites for the proposed power and desalting plants. Land costs are assumed to be \$25,000 per acre for "ocean frontage" and \$10,000 per acre for "land to the rear of the ocean frontage."¹⁴ Total land costs for the case of all four plants in Los Angeles is given at \$8.25 million for 400 acres.¹⁵ The only purchase consistent with these figures is 283½ acres of ocean frontage and 116¾ acres of land to the rear.

Since plants would be placed along the shoreline with the exclusion area to either side and inland, these oceanfront acres appear to be acquired as long thin strips.¹⁶

Quite as remarkable is the assumption that land costs fall from \$8.25 million to \$7.6 million for the case of three plants in Los Angeles and one in Arizona. Since the Los Angeles plants would be located immediately adjacent to each other, land savings for the deletion of a fourth unit at an oceanfront site would be negligible, while costs for acreage in Arizona would be added.

The proposed site is surely among the most expensive that could have been selected; alternatives not discussed in the Parsons Study would include avoiding the purchase of oceanfront land by locating slightly inland from the beach (as at Malibu), locating on government land (as at San Onofre), or even, considering the cost, of building on a man-made island as is planned for the power-desalting complex for Los Angeles.¹⁷

Interest During Construction.—The amount of interest during construction appears to have been improperly estimated. The Parsons Study states:

"On the basis of using federal financing and assuming that capital costs are expended at a uniform rate during construction, a factor of 3.2 per cent is applied against the sum of equipment and facilities, land and land rights, site costs, and indirect capital."¹⁸

This would, of course, be the appropriate figure for straightline construction of the construction period were somewhat less than two years. The traditional procedure for estimating interest during construction assumes a sigmoid curve

¹³ Report on Economic Analysis for Oyster Creek Nuclear Generating Station; Jersey Central Power and Light Co., February 17, 1964; also reprinted in AEC Authorizing Legislation—1965, Part 2, Appendix 4.

¹⁴ Parsons Study, *op. cit.*, p. 53.

¹⁵ *Ibid.*, p. 53 and Table B.

¹⁶ For a 6000-foot ocean frontage, each "ocean frontage" acre has the unusual dimensions of 21 feet in width by somewhat over 2050 feet in depth.

¹⁷ Most of the acreage required there is for the desalting plant flash evaporator trains, so that the size might be substantially reduced.

¹⁸ Parsons Study, *op. cit.*, p. 54.

for construction expenditures; then interest during construction can be estimated from the relation ship

$$IDC = \frac{iT}{100} (L + 0.45C),$$

in which i is the interest rate in per cent, T is the duration of construction in years, L is land cost and C is construction cost; the factor 0.45 is a weighting factor indicating that construction expenditure is greater towards the end of the period than earlier.¹⁹

For the first four items of Table 1, adjusted as discussed above, interest during construction would amount to \$18.14 million rather than \$9.9 million.

FUEL CYCLE COSTS

Under this heading, we consider investment in fuel working capital, working capital charge rates, and nuclear fuel costs.

Investment in Fuel Working Capital.—Item 7 of Table 1 lists investment in working capital as \$77.3 million. The Parsons Study describes this as follows:

"A total of \$9,820 per megawatt thermal of reactor rating was utilized for fuel inventory. A percentage factor of 0.25 per cent of the sum of equipment and facilities plus depreciable site costs was used to estimate the cost of maintenance materials."²⁰

The 2600 MWe of reactor rating at an efficiency of 33.3% would correspond to a thermal rating of 7800 megawatts resulting in an average investment of \$76.6 million of the \$77.3 million in fuel working capital. The \$9800, per thermal megawatt corresponds then to an investment of \$29.40/kw of electric capacity. For comparison, the Oyster Creek study lists average annual investment in fuel of \$22 in Years 6-10, \$26 in Years 11-20, and \$24 in Years 21-30,²¹ all of which are substantially below the value assumed in the Parsons Study. Improvements in core performance, reductions in fabrication cost, and a slight decrease in enrichment since the Oyster Creek Analysis suggest that current values are substantially lower. As an instance, PG&E's Diablo Canyon 1060 MWe pressurized-water reactor has an investment of about \$20/kw, or \$6380 per thermal megawatt.²² Assuming working capital at \$6500 per thermal megawatt, or \$19,500 per electric megawatt, the fuel working capital investment is reduced to \$50.7 million.

The preceding applies only to a consideration of baseloaded plants. For peaking plants, the average investment in fuel working capital is somewhat lower as fabrication and reprocessing occur less often, so that these costs are spread over a longer interval.²³ Thus, for peaking plants, the appropriate figure might be more on the order of \$17,000 per electric megawatt. Of course, the annual interest on this amount is distributed over fewer kilowatt-hours per year, so that the fuel cost for the peaking plant lies above that for a baseloaded plant, as will be discussed subsequently. Inasmuch as the baseloaded plants produce about double the kilowatt-hours per year of the peaking plant, fuel cost differentials due to varying load factor should be considered. These considerations are nowhere discussed in the Parsons Study.²⁴

Working Capital Charge Rates.—In addition to estimating a somewhat inflated value for fuel working capital investment, the Parsons Study further proceeds to levy a sinking fund charge (in addition to normal interest) against this amount. Working capital, of course, represents only a form of payment for expenses incurred in advance of revenues, and therefore the interest that could have been earned by alternative investment of these funds is added as an expense. The principal amount of the working capital investment is recovered in due course, and there is nothing whatever depreciable about this account. Therefore, the applica-

¹⁹ See, e.g., Geller, Hogerton, and Stoller, "Analyzing Power Costs for Nuclear Plants," *Nucleonics*, Vol. 22, No. 7 (July 1964), pp. 64-72. The value of T should be 4 years, not 2.

²⁰ Parsons Study, *op. cit.*, p. 54.

²¹ Oyster Creek Analysis, *op. cit.*, Table 1.

²² Pacific Gas and Electric Application No. 49501 Before the Public Utilities Commission, State of California, filed December 23, 1966, Exhibit J.

²³ For a more detailed treatment of this, see the now-classic article by John M. Vallance, "Fuel Cycle Economics of Uranium Fueled Thermal Reactors," P/247, Geneva Conference on Peaceful Uses of Atomic Energy.

²⁴ Additionally, it should be noted that the replacement figures of Tables E and G are different although both tables pertain to the same plant; it has not been possible to reproduce either set of figures from the data and directions in the Parsons Study. The true figures do appear to lie within the ranges of those figures, however.

tion of sinking fund charges against this account as is done in the Parsons Study is an unacceptable economic practice. Only the 3.222% interest rate should be applied to the average annual total.²⁶ Since the 30-year sinking fund charge rate (corresponding to 3.222% interest) is 2.027%, this represents an overcharge on the \$77.3 million assumed by the Parsons Study of \$1,567 million per annum.

Nuclear Fuel Costs.—In addition to inflating the value of fuel working capital investment and improperly charging depreciation against this account, the Parsons Study appears to add working capital costs in a second time under the nuclear fuel account. The Parsons Study on the subject of nuclear fuel costs states:

"The third core for a 650 megawatt electrical reactor is quoted in a manufacturer's handbook at 1.38 mills per kilowatt hour . . . The factors which enter into the 1.25 mills quoted for the Tennessee Valley Authority nuclear power plant are not fully known and although we can expect some reduction in cost if the plant were on a bid basis, the most reasonable value to assume for fuel cost appears to be about 1.3 mills per kilowatt-hour which is 0.05 mills higher than the Tennessee Valley Authority cost and 0.08 mills lower than the handbook values."²⁷

We note first that 1.3 m/kwh times the 18.22 billion kwh per year generation assumed in the Parsons Study yields the fuel cost of \$23,687 million of Table 2. Therefore, the Parsons Study has used a fuel cost of 1.3 m/kwh *plus* working capital charges which, under the Parsons Study methods of calculation, amount to an additional 0.22 m/kwh.

The reference to "a manufacturer's handbook" is evidently a reference to the 1965 General Electric Company pricing handbook, wherein the third core fuel cost for a 650 MWe *single-cycle* non-reheat nuclear powerplant is estimated to be as shown in Table 3.

TABLE 3.—650 MWe 3d-core fuel cost¹—Single-cycle, non-reheat

Component	Cost, M/kwh
Uranium Depletion-----	0.58
Pu Credit—credit-----	(0.21)
Recovery-----	0.21
Fabrication-----	0.48
Fuel Cycle Financing Cost-----	0.32
Total-----	1.38

¹ General Electric Co. Atomic Power Equipment Handbook, sec. 8805, Nuclear Fuel, May 24, 1965.

Note that the fifth item in this handbook listing is the working capital charge, so that the manufacturer's handbook price of 1.38 m/kwh *includes* working capital costs.

The TVA report states:

"The suppliers have warranted the cost (including the interest cost on the fuel inventory) of the heat produced, and therefore the evaluations include the interest cost on the fuel inventory as part of the cost of the fuel.

"Fuel costs for the BWR units range from 1.57 mills per kwh in 1970 to 1.09 mills per kwh by the end of the warranty period."²⁸

Thus, both the G.E. and the TVA figures cited by the Parsons Study *included* working capital costs, whereas the Parsons Study assumed a fuel cost midway between those two figures, and then added in separately working capital costs resulting in a gross overestimate of fuel costs.

It should be noted that the G.E. figures on Table 3 assume working capital charge rates of 5% before irradiation and 9% during and after irradiation, whereas the TVA figures include working capital at only the 4.5% cost of money. Since the G.E. figures of Table 3 give an estimate of 1.06 m/kwh for fuel cost less working capital charges, and since the TVA charge rate is about half that assumed in the G.E. figures, adding half of the G.E. financing cost yields 1.22 m/kwh as an estimate of equivalent TVA third core costs (including financing charges on working capital) for a 650 MWe unit. In reality, the 1965 G.E. handbook fuel prices are based on less optimal design than is available to TVA or

²⁶ See, e.g., Geller, Hogerton, and Stoller, *op. cit.*

²⁷ Parsons Study, *op. cit.*, p. 54.

²⁸ "Comparison of Coal-Fired and Nuclear Power Plants for the TVA System," Office of Power, Tennessee Valley Authority, Chattanooga, Tennessee, June 1966, p. 5. The end of the warranty period is 1982, so that the 1.09 m/kwh is roughly representative of TVA third core costs.

to new plants. The 1965 handbook was based on burnup of 20,000 megawatt days per short ton (MWD/T) of uranium, whereas present design burnup is 27,500 MWD/T.

Power density has also been increased by some 40%, coupled with a slight decrease in enrichment. All these factors suggest that even the assumption of 1.3 m/kwh for these plants based on the reports cited in the Parsons Study would have been somewhat on the high side even before working capital costs were added.

Since the Parsons Study was completed, G.E. has published a new fuel cost handbook, which revises upward several of the economic assumptions on which third core costs were based. For 600 MWe plants, third core costs are warranted at 13.87 cents per million BTU's and for 700 MWe plants, 13.83 cents per million BTU's.²⁸

Then, by interpolation, third core warranted costs for a 650 MWe plant would be 13.85 cents per million BTU's, or at a net heat rate of 10,400 BTU/kwh, 1.44 m/kwh including financing charges at 5% and 9% as discussed previously. If financing costs represent the same fraction of costs as in the 1965 listing, this 1.44 m/kwh consists of direct costs of 1.10 m/kwh direct costs and 0.34 m/kwh financing charges. At 3.222% interest rather than the 5% and 9% rates used in the G.E. figures, financing charges might amount to 0.15 m/kwh, for a total fuel cost, *including* working capital charges, of about 1.25 m/kwh. Since the effect of the various Parsons Study procedures is to use a rate of 1.52 m/kwh, this reduction of 0.27 m/kwh on the 18.22 billion kwh per year means total annual fuel cost reductions of \$4.92 million per annum, or about \$369,000,000 over the 75 year period of analysis of the Parsons Study.

For peaking plants, fuel costs are probably about 1.35 m/kwh when the higher working capital costs for this mode of operation are added.

NUCLEAR PLANT REVENUES

The effect of the above charges (excluding possible reductions in land costs) is to reduce baseload nuclear generating costs (excluding transmission) by somewhat less than \$5,000,000 per year; this would be sufficient to permit these plants to pay out without the use of revenues from Hoover, Parker and Davis at an interest rate of 3.222% (but the payout period would be protracted) but not at an interest rate of 4.5%. Since the annual generating cost figures with this \$5,000,000 reduction are somewhat under 2.7 m/kwh neglecting transmission costs, this strongly suggests that the difficulties encountered by the Parsons Study's nuclear plants lie on the revenue side. As we have derived above, the average annual revenues to the baseloaded plants (18.22 billion kwh per year) are \$53.11 million under the Parsons Study revenue assumptions. This is equivalent to a minuscule 2.91 mills per kwh sales price. Now the Bureau of Reclamation proposes to market power from the dams (if built) at \$10 per kilowatt of capacity per year demand charge plus 3 mills per kwh for each kwh of energy generated.²⁹ From Table N of the Parsons Study, the hydro plants generate an average of 7.619 billion kwh per year and receive an average gross revenue of \$37,622 million per year, for an average sales price of 4.94 m/kwh. Under the Parsons Study methodology the nuclear plants are credited with the same revenue for the first 7.619 billion kwh per year, but all kwh from that point to the 18.22 billion kwh assumed baseload generation is assumed to receive only 1.5 m/kwh! Since, as we have noted above, the implicit baseload fuel cost including working capital is 1.52 m/kwh, it should not be surprising to find that these baseloaded nuclear plants are not much different than the peaking plants.

In justification of this extraordinarily low revenue assumption, the Parsons Study states:

"In the future, the proportion of peak electrical energy supplied by thermal power plants will increase because sites for additional hydroelectric power plants

²⁸ General Electric Company, *Atomic Power Equipment Handbook*, Section 8803, Nuclear Fuel, Fuel Cycle Service, October 24, 1966, p. 11. Figures are for single-cycle non-reheat plants for 1972 initial operation at an 80% load factor.

²⁹ Utility rates are often expressed as a continued demand (\$1/kw-yr) and energy (m/kwh) charge. The capacity charge is, in effect, a fee paid to reserve a part of capacity output, and the energy of charge is an incremental charge. When a load factor is given, the demand charge can be allocated over the annual generation in kwh and added to the energy charge to derive an equivalent energy rate. Thus for a 40% factor for the dams, the \$10 per kilowatt-year capacity charge is equivalent to 2.85 m/kwh so that the equivalent sales price from the dams is 5.85 m/kwh.

will not be available. Consequently, as long as power systems demand large amounts of peaking energy, the thermal plants, normally baseloaded, which will supply this peaking energy will have large amounts of 'dump' energy available at incremental costs. Incremental fuel cost estimates range from 1.25 to 1.30 mills per kilowatt-hours for nuclear power plants and from 1.6 mills to 3.0 mills per kilowatt-hours for fossil-fueled power plants. Over the period of time covered by this study, because of the competitive nature of the resources industries, these incremental costs will tend to converge. If the cost gap does not close, the 'defender' alternative of power generation, fossil fuel will become obsolete and not be selected for a fuel when contrasted to the 'challenger' nuclear fuel. Consequently, 1.5 mills per kilowatt-hour have been used over the life of the payout period as the value to attach to excess power from the nuclear alternative. Perhaps early years will yield slightly higher revenues for off-peak energy, but later years will result in much lower revenues. Investigation of economy-interchange agreements and elements of costs for thermal equipment rendered idle by the nuclear plant resulted in the conclusion that higher revenues for off-peak energy are not justified."³⁰

A line by line rebuttal to this might proceed along the following lines.

"In the future, the proportion of peak electrical energy supplied by thermal power plants will increase because sites for additional hydroelectric power plants will not be available."

Quite true. The best hydro sites have already been developed, and additional sites tend to be less favorable from an economic standpoint.

"Consequently, as long as power systems demand large amounts of peaking energy, the thermal plants, normally baseloaded, which will supply this peaking energy, will have large amounts of 'dump' energy available at incremental costs."

Not necessarily true. There are several forms of thermal plants which do not have "dump" energy available. Foremost of these are gas turbine peaking units, which have quite low capital costs and high fuel costs and are adapted to meet peak loads and occasional emergency power. Percentage increases in orders for this form of capacity have been greater in the last year than even that of nuclear plants. Another form is the pumped storage project, in which off-peak "dump" energy is used to refill the upper reservoir in preparation for the following day's peak load. Furthermore, there is no assurance that the divergent trend between peak and baseload will continue. Such developments as the electric automobile could in a relatively short period supply such a demand for "dump energy" for overnight recharging as to reduce the differences between peak and off-peak loads. This would, in turn, reduce the spread between peak and off-peak rates.

"Incremental fuel cost estimates range from 1.25 to 1.30 mills per kilowatt-hour for nuclear power plants and from 1.6 to 3.0 mills per kilowatt-hour for fossil-fueled power plants."

Hardly the case. In testimony regarding the offer of the California Power Pool to supply energy to the California Water Project Pumps, the range of incremental fuel costs for the PG&E, Southern California Edison Company, and San Diego Gas and Electric Company, ranged from a low of 3.1 m/kwh to a high of 5.01 m/kwh.³¹

Also, the two most efficient steam plants in the central Arizona region had average incremental costs of 3.5 m/kwh.³² Quite apart from this point, the installation of new capacity is ordinarily undertaken to meet growth in both base and peak load, and unless the peak load increases more rapidly than the baseload increases, new capacity has no dump energy available. Dump energy is largely available only from less efficient and more expensive plants that will be relegated to peak load service. Their cost of producing "dump" energy is not competitive. The present situation with dump energy widely available in the Northwest is essentially a short-term phenomenon.

"Over the period of time covered by this study, because of the competitive nature of the resources industries, these incremental costs will tend to converge.

³⁰ Parsons Study, *op. cit.*, pp. 77-78.

³¹ AEC *Authorizing Legislation, Fiscal Year 1966*, Part 3, Hearings Before the Joint Committee on Atomic Energy, Mar. 11, 18, 19, 24 and April 13, 1965, p. 1571; data are from 1964 FPC report FPC S-166, *Steam-Electric Plant Construction Cost and Annual Production Expenses—1964*.

³² F.P.C. Report S-171, *Steam-Electric Plant Construction Cost and Annual Production Expenses—1965*, March 1966.

If the cost gap does not close, the "defender" alternative of power generation, fossil fuel, will become obsolete and not be selected for a fuel when contrasted to the "challenger" nuclear fuel."

This is sheer nonsense. The selection of fossil or nuclear capacity is based on overall production costs, *not* incremental costs. There is no reason either to expect the incremental cost gap to narrow or to expect one or the other form of capacity to vanish. So long as fossil fuel capital costs remain sufficiently far below nuclear capital costs, the resulting cushion will allow the use of a higher cost (fossil) fuel and fossil and nuclear plants can coexist. Incremental costs are used *only* in deciding the sequence in which a set of existing units should be brought on line, and not in deciding what kind of plant to build.

"Consequently, 1.5 mills per kilowatt-hour have been used over the life of the payout period as the value to attach to excess power from the nuclear alternative. Perhaps early years will yield slightly higher revenues for off-peak energy, but later years will result in much lower revenues. Investigation of economy-interchange agreements and elements of costs for thermal equipment rendered idle by the nuclear plant resulted in the conclusion that higher revenues for off-peak energy are not justified."

To deal with the last point first, any capacity that is "rendered idle" by the nuclear plants will remain idle only until the load grows to accommodate the nuclear plants. Since the growth of peak load on the PG&E system alone is forecast to be in excess of 650 MWe per year,³³ the idling would extend *at most* only four years. Crucial to the argument, of course, is the need to integrate the plants into the various utility networks. In this respect, the California Power Pool proposal is instructive; the proposal letter states:

"However, should the State decide to install initially its own atomic generating facilities, the suppliers are willing, as we have indicated in previous meetings, to cooperate in contracting for the integration of such facilities into our interconnected systems and for the operation of the plant by one or more of the suppliers."³⁴

The Power Pool contract, incidentally, established 3 mills/kwh as the rate to the California project, and this is the lowest rate available to any of the Pool's customers, based on the large block required. By contrast the Metropolitan Water District, another large user, paid 5¼ mills/kwh for off-peak energy.³⁵ Thus we might infer that in the "early years" revenues will be substantially above 1.5 mills (not "slightly"); also since the floor is somewhere around 1.3 to 1.4 m/kwh representative of private utility incremental costs, "later years" can hardly result in "much lower" revenues than the 1.5 m/kwh assumed. On balance, 1.5 m/kwh appears to be an extremely unlikely assumption as to off-peak revenues over the next 75 years. Even on an economy-interchange basis, revenues should easily be in the 2.25-2.5 m/kwh, and that is probably a minimum estimate. Needless to say, at higher revenues, the nuclear plants turn out to be quite effective contributors to a Development Fund.

NUCLEAR VERSUS HYDRO FOR THE COLORADO BASIN

The preceding discussion has for the most part focused on the economics of nuclear power in the abstract; the Parsons Study, however, is intended as a specific comparison of nuclear plants versus hydro plants as contributors to the Basun Development Funds. In evaluating this specific comparison, the Parsons Study has applied what, for want of a better term, might be described as "Robinson Crusoe Economics." The meaning of this will become plain when we consider how a "comparable" nuclear alternative was selected.

Hydro

The two dams have an aggregate rating at site of 2100 MWe, and the largest generating unit is 250 MWe, so the rating with one unit down is 1850 MWe at-site. Hualapai at 1500 MW would primarily supply energy to Southern California, and Marble at 600 MW would primarily supply Arizona and the Central Arizona Project pumps at Lake Havasu.

³³ PG&E Application 49501, *op. cit.*, Exhibit G. Area load growth is in excess of 3000 MWe per year.

³⁴ AEC Authorizing Legislation—1966, *op. cit.*, p. 1568. The suppliers are Southern California Edison, San Diego Gas and Electric, Los Angeles Department of Water and Power, and Pacific Gas and Electric.

³⁵ *Ibid.*, p. 1573.

The Parsons Study Nuclear Alternative

The Parsons Study selected a total of four 650 MWe nuclear plants, so that with one unit out of service, the aggregate rating would be 1950 MWe, or 100 MWe *more* than the dams.³⁶ They state that the fourth unit is intended primarily as backup. Also, transmission lines (at initial cost of \$141 million) are provided between Los Angeles and Phoenix; when all four plants are located at Los Angeles, this provides for the Arizona load; when 3 are in Los Angeles and one in Arizona, the lines "would still be required in order to provide the necessary reserve backup for the one unit in Phoenix."³⁷

On the revenue side, however, hydro revenues are computed on the basis of full rated capacity (not one unit out capacity), while the nuclear plants are credited *only* with the same generating hours and revenues as the dam with the additional capacity during peaking hours and the added availability at other hours given no credit. In the baseload case, all kilowatt-hours produced by the nuclear plants in excess of those generated annually by the dams are evaluated as off-peak despite the fact that 50% of the hours in a week by utility definition are on-peak hours, although the dams operate only 41% of the time. In addition, the deliverable capacity of Hualapai is only 1350 MWe and that of Marble is only 552 MWe due to losses in transmission from the remote dam sites to load centers. Since the nuclear alternatives are located at load, losses are negligible. These effects have not been evaluated in the Parsons Study. Thus for the nuclear alternative, peaking revenues are substantially understated.

The Parsons Study thus envisions a comparable alternative to the dams as a completely self-contained power generation system with its own full reserves, and with full backup interconnection among units. It is as though in the service area there were no other generating capacity, transmission lines, reserves, emergency, interchanges, and the like—hence the term "Robinson Crusoe Economics."

However, the Parsons Study assumptions are not even least-cost "Robinson Crusoe Economics", as the following example shows: For three plants in Los Angeles and one in Arizona, the \$141 million transmission line at 3.222% and 50 year depreciation has an annual cost of \$5.713 million plus annual operating and maintenance costs of \$1.973 million for a total annual cost of \$7.686 million. Four 140 MWe gas turbine peaking units could provide 560 MWe capacity (slightly more than the deliverable capacity of 552 MWe of Marble) for a total investment cost of \$44 million.³⁸ Since they would be used only for standby we might assume a 50 year service lifetime for these units, in which case the annual investment cost is only \$1.783 million, even assuming no credit for standby emergency service. Thus even in the Crusoe world of the Parsons Study the cost of the nuclear alternative has been overestimated by almost \$6 million per year. Much the same argument could be directed to the fourth nuclear plant. Since under the Parsons Study assumption, it never receives any peaking power revenue, but instead receives only 1.5 m/kwh, its replacement by five 140 MWe gas turbine peaking units would cost about \$55,000,000, or about \$2.229 million per year, which is less than the annual investment and operating cost minus the assumed baseload revenue of the fourth plant. Of course, for *realistic* revenue projections, the fourth nuclear unit would be preferred.

USE OF BUREAU OF RECLAMATION CALCULATIONS

A final point pertains to the estimates by the Bureau of Reclamation of annual costs and contributions to the Basin fund. The Parsons Study has used without modification the figures developed over the course of the past few years, which have been shown to be of limited accuracy. In particular, since costs for the dams were estimated some years ago, general price escalation during the intervening period has raised the cost of the dams by some ten to fifteen percent. Also, the calculations by the Bureau neglected certain other expenses, such as \$34 million

³⁶ Or 1880 MW net with two at Los Angeles and one in Arizona on-line.

³⁷ Parsons Study, *op. cit.*, p. 41.

³⁸ Prepared Testimony of Alexander Lurkis, Alexander Lurkis Associates, Consulting Engineers, before the Federal Power Commission, Project No. 2338, (Cornwall Project), 1966.

for an after-bay on the river below Marble Canyon Dam to re-regulate the flow of the Colorado through the Grand Canyon, an undetermined amount as compensation to the Hualapai Indian tribe for encroachment on reservation lands,³⁹ and a charge against power revenues for the amount of water evaporated by the dams.

Hydro "Fuel"

With regard to this latter point, the Parsons Study has (rightfully) charged the Arizona power plant with the cost of cooling water. The baseload plant is assumed to use 13,000 acre feet per year, and the peaking plant, 5,700 acre feet, charged at \$50 per acre foot. Parsons also makes much of the phrase "The nuclear plant requires fuel; the hydroelectric plant requires none." In the ordinary sense of the word, perhaps not; but hydroelectric power *does* require impounded water, which is subject to evaporation and other losses. Evaporation is particularly critical in this instance since, as has been pointed out, the waters of the Colorado River are *already* over-allocated; thus every extra acre-foot evaporated behind a dam is an acre-foot lost to some beneficial consumptive user further downstream.⁴⁰

When the purpose of a dam is flood-control or storage and diversion, the annual evaporation can with some justification be imputed to these items, but (since Lake Powell lies immediately above Marble Reservoir and Lake Mead immediately below Hualapai) neither flood-control nor storage and diversion can be claimed in this instance. Therefore, the annual reservoir evaporation in excess of that which would occur in the absence of the dams is in a very real sense a cost of the power produced. Although there is some uncertainty as to the actual extent of evaporation from the proposed reservoirs, the Bureau has admitted that at least 85,000 acre-feet per year from Hualapai and 10,000 acre-feet from Marble would be lost (over and above what is presently lost from the stretches of the river to be inundated).⁴¹

In summation, then, the Parsons Study contributes little to our understanding of either present nuclear power economics or the substitutability of nuclear power for dams in the Lower Colorado Basin.

THE GRAND CANYON CONTROVERSY: LESSONS FOR FEDERAL COST-BENEFIT PRACTICES

(By Alan Carlin,¹ the RAND Corporation, Santa Monica, California)

Over the last decade the economics profession has devoted considerable energy to suggesting practical procedures for improving the evaluation of water resource projects.² It would be difficult, however, to find any area of public policy in which the profession's recommendations have been so nearly unanimous or met so little acceptance in practice. Few cases provide a better illustration of how little change has occurred than the bitter controversy that raged during the 89th Congress over the construction of two dams in the Grand Canyon. This probably represents the first time that a Federal water resource agency has had to make a serious public defense of its economic justification for a major project prior to its authorization as the result of an attack based on the improved procedures recommended by the profession.

³⁹ The Navajos apparently would not object to some compensation also.

⁴⁰ In this instance, to Southern California, since it currently withdraws from the Colorado more water than that to which it is entitled under the Supreme Court decision.

⁴¹ At an imputed cost of \$50 per acre-foot—typical of municipal and industrial rates obtainable for water—the annual cost of the hydro "fuel" would be \$4.75 million.

¹ Any views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of The RAND Corporation or the official opinion or policy of any of its governmental or private research sponsors. Papers are reproduced by The RAND Corporation as a courtesy to members of its staff.

I am indebted to Jack Hirschleifer, William E. Hoehn, and William A. Johnson of The RAND Corporation for their comments.

² For a fairly complete bibliography of this work, see A. R. Prest and R. Turvey, "Cost-Benefit Analysis: A Survey," *The Economic Journal*, No. 300, December 1965, pp. 731-735.

The latest round³ of the Grand Canyon controversy provides ample material concerning the deficiencies of the economic criteria currently used by Federal water resource agencies. It is the purpose of this article to review this material. Although the controversy over the dams has led to a reversal of the Administration's stand on them and some expressions by the leadership of the Interior Department of a desire to examine alternatives to these particular dams⁴ and in the future to all projects before they are submitted to Congress,⁵ there is little indication that the Administration plans the major overhaul of the economic criteria and project review procedures that would be required to insure that the future development of water resources would be more in accord with economic principles.

BACKGROUND

The Grand Canyon controversy arose because of the proposal to build two dams in the Canyon as part of the proposed Colorado River Basin Project, one in Marble Gorge and the other in Bridge Canyon. Bridge Canyon Dam (now to be called Hualapai Dam as part of an agreement made with the Indian tribe of the same name) would be located 53 miles downstream from Grand Canyon National Monument while Marble Canyon Dam would be 12.5 miles above the boundary of Grand Canyon National Park. Backed by seven Southwestern states, the Project was opposed primarily by conservationists (particularly the Sierra Club) and the Pacific Northwest.⁶

The publicly stated purpose of the dams is to provide revenue to subsidize the Central Arizona Project (CAP) to bring Colorado River water to the Phoenix-Tucson area from the existing Lake Havasu impounded by Parker Dam. It has been shown, however (and admitted with certain reservations by the Bureau of Reclamation⁷), that the dams are not needed to finance the CAP at all,⁸ and that their real but little publicized purpose is to build a fund for the possible future importation of water into the Colorado River⁹ (presumably from the Columbia River) if and when this should prove to be politically and economically feasible.

Briefly stated, the economic controversy over the Projects arose largely as a result of a study¹⁰ by Dr. William B. Hoehn and the author that concluded that the benefit-cost ratios for both projects are less than one-to-one when compared with nuclear alternatives. The differences between the various estimates are shown in Table 1.

³ The battles over the proposed Grand Canyon dams during the 89th Congress constitute something of a separate chapter in the long history of disputes over the Colorado River and the Central Arizona Project. For once, the proponents presented a united front, but faced the much more militant opposition of conservation groups and the Pacific Northwest. Although approved by the House Interior Committee, the Colorado River Basin Project died in the House Rules Committee, apparently because of fears as to what might happen to it if it reached the floor. On February 1, 1967, Secretary of the Interior Stewart Udall announced a revised Administration plan for the development of the Lower Colorado that excluded both of the Grand Canyon dams.

⁴ In September 1966, Secretary Udall proposed that nuclear power plants be substituted for the Grand Canyon dams in the Colorado River Basin Project.

⁵ Luther J. Carter reports in "Grand Canyon Dams: Interior To Ask, 'Are They Necessary?'" *Science*, Vol. 154, October 7, 1966, p. 134, that a speech in July 1966 by John A. Carver, then Under Secretary of the Interior, but reflecting Secretary Udall's views, amounted to a frank admission that the traditional approach [to water resource development planning] was faulty.

Carver said that Congress and the public should be informed of the alternatives to hydropower as a means of financing water projects. "Present procedures," he said, "do not provide an adequate comparison of such alternatives. . . . Classically, legislation, whether it be for a project or a government policy, has been presented by the executive branch to the legislative branch as an act of advocacy, the best possible case for a particular course of action or a single project. The process of identifying alternatives—indeed of discovering whether any exist—is left to the arena of countervailing powers in the political process."

⁶ See U.S. Congress, House, Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project*. Hearings before Subcommittee, 89th Congress, August 23 to September 1, 1965 and May 9 to 18, 1966, Serial No. 89-17 (hereafter referred to as Hearings).

⁷ Hearings, pp. 1378 and 1397.

⁸ Jeffrey Ingram, "Study of the Effect of Accelerating the Pay-Out of the Municipal and Industrial Costs: Lower Colorado River Basin Project," Hearings, pp. 1472-1476.

⁹ Representative Craig Hosmer, "The Battle of Grand Canyon," *Per Se*, Vol. 1, No. 4, Winter 1966, p. 23.

¹⁰ Alan P. Carlin, "Economic Feasibility of the Proposed Marble and Bridge Canyon Projects," Hearings, pp. 1497-1512. This includes Alan P. Carlin and William B. Hoehn, "Is the Marble Canyon Project Economically Justified?" originally printed as P-3302 by The RAND Corporation, February 1966.

TABLE 1.—Benefit-cost ratios estimated for Grand Canyon dams (Carlin-Hoehn)

[Ratio to 1]

Dam	Original	With added quantification	Bureau of Reclamation
	(1)	(2)	(3)
1. Marble Canyon.....	0.95	0.79	1.7
2. Bridge Canyon (Hualapai).....	.86	2.0

NOTES ON LINES

1. Col. (1): Based on use of General Electric Co. nuclear plant and fuel costs, 10.55 million acre-feet streamflow, 600 mw nuclear alternative, and 3½ percent interest. Use of lower plant and fuel costs and streamflow, and higher interest rates, all of which are probably more realistic, would lower the benefit-cost ratio below this base case. The figure given is from Alan P. Carlin and William E. Hoehn, "Is the Marble Canyon Project Economically Justified?" reprinted in U.S. Congress, House Committee on Interior and Insular Affairs, *Lower Colorado River Basin Project*, hearings before subcommittee, 89th Cong., 2d sess., serial No. 89-17, pt. II, May 9 to 18, 1966, p. 1510. This figure also overstates the benefit-cost ratio because it does not include various less easily quantified factors discussed in the paper that on balance are judged to favor the project. Col. (2): Includes additional minor unquantified costs of the alternative insisted upon by Representative Morris Udall, as well as partial additional quantification of project costs, as derived in Alan P. Carlin and William E. Hoehn, "Mr. Udall's 'Analysis': An Unrepentant Rejoinder," hearings, p. 1534. This figure still overstates the benefit-cost ratio because of the presence of still other unquantified project costs and continued use of the generous assumptions listed under col. (1). Col. (3): U.S. Department of the Interior, Bureau of Reclamation, *Pacific Southwest Water Plan, Supplemental Information Report on Marble Canyon Project, Arizona*, January 1964, p. 24.

2. Col. (1): Based on use of General Electric plant and fuel costs, project report streamflow, 3½ percent interest, and a combined 762 mw nuclear plant and 588 mw pumped storage plant, as derived in hearings, pp. 1511-1512. Col. (3): U.S. Department of the Interior, Bureau of Reclamation, *Pacific Southwest Water Plan, Supplemental Information Report on Bridge Canyon Project, Arizona*, January 1964, p. 22.

BUREAU'S QUESTIONABLE BENEFIT-COST PRACTICES

In the course of the controversy,¹¹ as the Bureau of Reclamation sought to defend its analysis, it developed that the differences resulted from a number of economically questionable procedures the Bureau had used in computing its benefit-cost ratios. Of these, the most important from the point of view of economic theory are as follows:¹²

(1) Choice of what was claimed to be the "most likely" alternative rather than the least cost alternative

(2) Use of higher interest rates and taxes in evaluating the alternative than the project

(3) Insistence that any alternative must distribute energy to exactly the same customers as would allegedly be served by the Project, without regard to the objective of minimizing the cost of meeting demand in a regional power system.

In addition, although the Carlin-Hoehn study did not make a major issue out of it, we nevertheless objected to:

(4) The use of a rate of interest below even current costs of borrowing by the Federal Government and with no allowance for the economic risks of the projects.

¹¹ The major published statements by each side besides "Economic Feasibility . . ." are Morris K. Udall, "Analysis of Alan P. Carlin's Testimony," "Economic Feasibility of the Proposed Marble and Bridge Canyon Projects, May 1966," Hearings, pp. 1516-1519; Bureau of Reclamation, "Analysis of Alan P. Carlin's Testimony—Economic Feasibility of the Proposed Marble and Bridge Canyon Projects, May 1966," Hearings, pp. 1519-1521; Alan P. Carlin and William E. Hoehn, "Mr. Udall's 'Analysis': An Unrepentant Rejoinder," Hearings, pp. 1521-1535; Laurence I. Moss, "Considerations in the Use of Nuclear Power as Compared with Power from the Grand Canyon Dams," Hearings, pp. 1558-1563; Morris K. Udall, "Analysis of Laurence I. Moss's Testimony, 'Considerations in the Use of Nuclear Power as Compared with Power from the Grand Canyon Dams,' May 1966," Hearings, pp. 1548-1549; and L. I. Moss, "Comments on Morris K. Udall's Analysis of the Testimony of L. I. Moss," Hearings, pp. 1550-1551.

¹² This by no means exhausts the list of differences; most of the others are items of less theoretical interest, such as the Bureau's omission of the value of water evaporated from the reservoirs and price increases since the Bureau made its estimates.

(1) and (2) Most Likely Alternative and Higher Interest Rates

The Bureau defended¹³ its use of what it claimed to be the "most likely" alternative on the basis of a Senate Document.¹⁴ This Document states that "The usual practice is to measure [electric power benefits] . . . in terms of achieving the same result by the most likely alternative means that would exist in the absence of the project."¹⁵ Further, the Document says that—

When costs of alternatives are used as a measure of benefits, the costs should include the interest, taxes, insurance, and other cost elements that would actually be incurred by such alternatives rather than including only costs on a comparable basis to project costs as is required when applying the project formulation criteria under paragraph V-C-2(d).¹⁶

In the case of the Grand Canyon dams, the Bureau obtained the costs of the "most likely" alternative from the Federal Power Commission, which interpreted the concept as follows:

"The alternative to a hydroelectric project should be the lowest cost alternative that normally would be selected for the most economic growth of the regional power supply in the absence of the project. The alternative power costs should be based on the types of financing, public or private, that would be expected to apply to the alternative plant. In the case of the Marble Canyon project, we believe that the alternative cost should be based upon a weighing of the cost of power from private and non-Federal public sources in the area in proportion to the amount of power expected to be provided by these sources. With the exception of the TVA area, it has been the policy of Congress not to authorize the construction of Federal thermal-electric plants. A federally financed nuclear plant is not, therefore, a reasonable alternative to hydroelectric power development outside the TVA area."¹⁷

This directly conflicts, it should be pointed out, with stated Commission policy with respect to projects that come before it for licensing under the Federal Power Act. In *Idaho Power Company*¹⁸ the Commission said that:

"When the comparative economics of two mutually exclusive plans are to be delivered, it is essential that all plans be compared on as similar a basis as is possible from the record, and this would include the use of the same assumed basis of financing, whether that be private financing or Federal financing."

Specifically, in computing the cost of the alternatives to the Grand Canyon dams, the FPC used the cost of power from five existing steam-electric plants "based on a combination of both private and non-Federal public financing in proportion to the electric power requirements of these groups in the market area."¹⁹ The Commission does not state exactly what average rate it effectively used for capital charges, but it was probably between 10 and 15 per cent.²⁰ Ignoring differences in depreciation charges, this can be compared with the 3.17 per cent used by the Bureau.²¹

Whatever its legal standing may be, the trouble with the "most likely" alternative principle is that there is no economic justification for its use and no objective standards for its application. The "most likely" alternative is inherently a matter of judgment. Its faithful application would involve attempting to foresee whether a privately or publicly owned utility would build the marginal addition to a regional grid at some time in the future (due to the longer construction period generally required for a hydroelectric project) and to infer

¹³ Analysis . . . "Hearings, *op. cit.*, p. 1520.

¹⁴ U.S. Congress, Senate, *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources*, Document No. 97, 87th Congress, 2nd Session, 1962.

¹⁵ *Ibid.*, p. 10.

¹⁶ *Ibid.*, p. 8.

¹⁷ Memorandum of May 11, 1966, to the Commission from F. Stewart Brown, Chief, Bureau of Power, on the subject of "Marble Canyon Project, Arizona" (unpublished), p. 1.

¹⁸ 14 F.P.C. 55, 63, as quoted in Federal Power Commission, "Decision, Arizona Power Authority, Project No. 2248, upon Application for License under Section 4(e) of the Federal Power Act (issued September 10, 1962)," p. 31.

¹⁹ Memorandum of May 11, 1966, *op. cit.*, p. 2.

²⁰ The FPC states (*ibid.*, p. 2) that the five plants had capital costs of \$102 to \$120 per kw and that the computed cost of power was \$19.05 per kw-yr plus 3.37 mills per kw-h. The fixed charge of \$19.05 is 17.3 per cent of \$110, but this no doubt includes other fixed costs besides capital charges on the generating plants.

²¹ U.S. Department of the Interior, Bureau of Reclamation, *Pacific Southwest Water Plan, Supplemental Information Report on Marble Canyon Project, Arizona*, January 1964, p. 25. This figure includes depreciation of 0.17 per cent. The assumed life of the Commission's steam plants was presumably less than the dams, so that depreciation would be higher and the two rates of interest not strictly comparable.

the type of plant, location, and cost of such a plant. The approximations inevitably involved in applying such a criterion have already been suggested by the FPC Memorandum. In this particular case, the rapid introduction of nuclear power for new projects in the last few years suggests that the application of the "principle" may have engendered particularly inaccurate forecasts of alternative costs.

But even assuming that the Bureau or FPC can divine what is the "most likely" alternative, the principle runs into theoretical problems because the hypothetical utility is very likely to face quite different factor costs (particularly for capital) and taxes in selecting the type of plant to be built as its marginal project, and in costing the marginal plant. The result is that the power benefits of the hydroelectric project are valued at the cost to the hypothetical alternative supplier rather than the cost to the nation, the relevant consideration in cost-benefit analysis. This means that benefits are inflated by the amount of federal, state, and local taxes and added capital costs the alternative supplier must pay. Taxes generally do not represent a real resource cost to the nation—just a political acceptable way of raising revenue. Although the implicit interest rate used to derive the cost of the "most likely" alternative is probably close to that which pure economic theory would require the Project to use, the appropriate interest rate is subject to some dissent. Not subject to dissent, in the author's opinion, is that *the same interest rate must be applied to the evaluation of both the project and the alternative.*²⁵ To do otherwise is to value the resources used at different prices and hence to compare final cost estimates that are not comparable.

Senate Document 97 seeks to justify the use of the "most likely" alternative on the basis that this "standard affords a measure of the minimum value of such benefits or services to the users."²⁶ This, however, ignores the fact that in power development the choice is almost always between competing alternative sources rather than between power and no power in an area. The economic analysis should therefore also be directed at the same question. To attempt to enter the murky world of "value to the users" in order to decide which alternative is more economical is not only empirically difficult, but also irrelevant to the economics of power development.

(3) Transmission Costs

The Bureau insists that transmission costs of \$6 per kw-yr be included in the cost of any alternative to Marble.²⁷ This compares with \$6.68 per kw-yr used in their Marble calculations.²⁸ Representative Morris Udall, the leading Congressional advocate of the Colorado River Basin Project, explains²⁹ that "It is our contention, no matter where in the five states (California, Nevada, Arizona, New Mexico, and Utah) that a nuclear alternative or alternatives would be located, or even if you put one in Arizona and one in California, that substantially the same expenditure would be necessary to transmit the peaking power from the nuclear alternative to the same load centers as peaking power from the hydroplants will be delivered."

He then "demonstrates" the need for transmission facilities by showing the amounts of peaking power which, he claims (without supporting references), "will be required to be delivered to each load center." This includes about seven per cent for Utah and Northern New Mexico, despite the Federal Power Commission's statement that in its computations of the cost of the "most likely" alternative it assumed that "Arizona, Southern California, and Southern Nevada would be the [only] area in which power from the two hydroelectric projects would be marketed."³⁰ But even assuming that Mr. Udall was factually correct as to the

²⁵ Perhaps the best reference is Otto Eckstein, *Water-Resource Development*, Cambridge, Harvard University Press, 1958, p. 242.

²⁶ *Op. cit.*, p. 8.

²⁷ "Analysis . . ." Hearings, p. 1521.

²⁸ Based on U.S. Department of the Interior, *op. cit.*, pp. 18, 20, and 25. Interest and amortization charges of \$4.65 per kw-yr are computed on the basis of a 3.17 per cent return (3 per cent interest plus depreciation as used by the Bureau, p. 25), and 8.5 per cent allowance for interest during construction (as in Bureau calculations, p. 25). At 3½ per cent interest, the equivalent cost is \$6.83 per kw-yr.

²⁹ "Analysis of Laurence I. Moss's Testimony . . ." Hearings, p. 1548.

³⁰ Memorandum of May 11, 1966, *op. cit.*, p. 2. It is interesting to note that no part of Utah is even shown in the "Power Market Areas" for either the Marble or Bridge Canyon Projects by the Bureau of Reclamation (see U.S. Department of the Interior, Bureau of Reclamation, *Pacific Southwest Water Plan, Supplemental Information Report on Bridge Canyon Project, Arizona*, January 1964, Drawing 65-314-28 an Marble Canyon Project Report, *op. cit.*, Drawing 65-314-25).

proposed distribution of Marble and Bridge power, his claim that substantially the same distribution costs would be required can only be said to be highly dubious.

Even if one accepts Mr. Udall's assertion that the alternatives must serve exactly the same load centers as he alleges would be served by the dams, it does not follow that substantially the same costs would be involved. Nuclear alternatives can be placed much closer to load centers than the singularly remote Grand Canyon, and there is a marked difference between the costs of transmitting power east and west across Arizona and Southern California. By placing the alternative to Hualapai Dam near Los Angeles and the Marble alternative at Lake Havasu, most of Mr. Udall's alleged power distribution could be served with little additional transmission expenditures beyond a transmission line from Lake Havasu to Phoenix.²⁸

The marked difference between the cost of transmitting power east and west across Arizona and Southern California reduces, if not eliminates, the cost of serving the remaining bits and pieces of load that Mr. Udall claims outside the major metropolitan centers near Phoenix and Tucson and along the Southern California Coast. Because present and planned generating capacity in Northern Arizona and nearby areas of adjoining States greatly exceeds present and projected peakload demands in the same area, there are now and are expected to be in the foreseeable future substantial exports of power to Southern California. Consequently, the cost of transmitting power eastward along present (and eventually planned) west-bound transmission routes from a Los Angeles-based alternative can be said to be *negative*. These savings are equal to the incremental costs of transmitting an equal amount of power in quantity and timing westward.²⁹ These savings should be enough to pay for a substantial part and perhaps all of the transmission facilities that may be included in the Bureau's estimates from existing and planned west-bound facilities to load centers allegedly to be served by the dams in Eastern California, Northern Arizona, Southern Nevada, and Southern Utah.

But in any case, there is no particular reason to believe Mr. Udall's statement as to the proposed distribution of Grand Canyon power is correct. Mr. Udall has not furnished any sources for his distribution, nor has the Bureau ever furnished a detailed analysis as to the length, voltage, or routes of proposed Bureau-financed transmission facilities. Since no contracts have been signed with potential users, this is hardly surprising. But even more important, it is really unimportant what the distribution would be since Mr. Udall is by no means correct in claiming that the alternatives to the dams must serve exactly the same customers. Perhaps the best theoretical formulation available is that recently suggested by A. R. Prest and R. Turvey:³⁰

"The (electric) supply system constitutes a unity which is operated so as to minimize the operating costs of meeting consumption. . . .

"If we now try to apply in the principle of measuring benefits by the cost savings of not building an alternative station it follows from the system independence just described that the only meaningful way of measuring this cost is to ascertain the difference in the present value of total operating costs in the two cases and deduct the capital cost of the alternatives. . . . In general. . . a very complicated exercise involving the simulation of the operation of the whole system is required."

It has not been possible for the author to carry out such a simulation, which would, in any case, be quite difficult given the lack of information on Bureau marketing plans. Nor has the Bureau made such a study available. However, because of the market-oriented nature of nuclear power plants, it is apparent that such a study would show that the transmission costs of the system with the nuclear alternatives would be substantially less than that of the system with re-

²⁸ This was included in the costs of the Carlin-Hoehn Lake Havasu alternative (see "An Unrepentant Rejoinder," *op. cit.*, Hearings, pp. 1532-1534). The costs of the alternative included generating off-peak power for the Central Arizona Project pumps, but could be adjusted for purely peaking operation.

²⁹ Where the westbound lines would otherwise all be used during both off- and on-peak hours, the savings would only amount to the transmission losses for an equivalent quantity of power during on-peak hours. But where particular westbound lines would otherwise have to be built and one or more lines are used only for transmitting peaking power, the savings would amount to the full annual cost of building and maintaining lines to carry an equivalent quantity of power, as well as the transmission losses. These larger savings would seem to apply at least as far east as Hoover Dam and the Colorado River.

³⁰ *Op. cit.*, p. 710.

source-oriented dams that would be located far from any load center. In fact, given that the Bureau apparently plans to tie in its transmission system with that of WEST Associates, and to serve many of the same customers as WEST, and that the WEST System will exist of without the dams, it would appear to be a safe assumption that a systems analysis would show that the transmission costs of the alternatives could be approximated by the cost of transmitting power to the nearest load center capable of absorbing the power. Where the alternative was assumed to be located in or very near a major load center, such as Los Angeles, the transmission costs were therefore assumed to be negligible in the Carlin-Hoehn study.

Such a systems analysis would result in much more than lower transmission costs for the system with the nuclear alternatives, however. It would also show very substantial savings in generation costs for the system including the nuclear alternatives compared to those implied by the Carlin-Hoehn study. These savings would result from the substitution of the lower cost nuclear plants for higher cost thermal generation during off-peak hours. In order to insure comparability with the dams, the Carlin-Hoehn study imposed the artificial handicap of using the alternative nuclear plants only for on-peak generation. Since they would have the lowest operating costs on the system, they would actually be used to displace conventional plants with higher operating costs, which would then be relegated to peaking service. A rough computation suggests that a systems analysis might show a reduction in the system's cost of the nuclear alternative to Marble by as much as 25 per cent of annual Marble costs.²¹

(4) *Abnormally Low Interest Rates*

The Bureau of Reclamation insisted that the correct interest rate to use in the computations was $3\frac{1}{4}$ per cent. This claim once again rested on Senate Document 97, which prescribes that the interest rate to be used in cost-benefit studies is the average rate for outstanding U.S. Government securities of at least 15 years maturity at issue.²²

There are several problems with this criterion for the selection of an interest rate. First of all, present interest rates would seem to offer a better guide to rates at the time of construction of a project now being considered than an average of past rates, particularly when the average may reflect a large representation from the 1930s when abnormally low rates prevailed. Secondly, the selection of rates from U.S. Government securities of at least 15 years maturity at issue is a biased sample of even past long-term interest rates because of the $4\frac{1}{4}$ per cent ceiling imposed by Congress on interest payable on Treasury bond issues maturing in more than five years. Whenever interest rates exceed this level, as in 1966, the Treasury is forced into short-term borrowing, which is not reflected in the averages computed according to the formula. Finally, even if the formula accurately represented the present cost of long-term Government borrowing, it does not include any allowance for the economic risks of the projects considered. Government bond rates are probably an accurate reflection of the cost of risk-free capital, but Federal water projects have proved to be far from economically risk-free.²³ One careful study recommended a rate of at least 10 per cent at a

²¹ By making a few reasonable assumptions, it is possible to make a rough order-of-magnitude estimate of the savings included. If it is assumed that a base loaded nuclear or thermal plant operates 85 per cent of the time and a peaking plant 40 per cent, the off-peak generation involved is 45 per cent. If the operating costs of the nuclear plant are 1.5 mills per kwh (as in the GE fuel costs shown in the Carlin-Hoehn nuclear alternatives to Marble) and 3 mills for thermal (certainly a lower bound for the least efficient base loaded plant in the Pacific Southwest—see, for example, U.S. Congress, Joint Committee on Atomic Energy, *AEC Authorizing Legislation, Fiscal Year 1966*, Part 3, Hearings, 89th Congress, 1st Session, March 11 to April 13, 1965, pp. 1570-1572), then the 550 mw nuclear alternative to Marble should be credited with savings of (550,000 kw) (8,760 hrs/yr) (45 per cent) (\$0.0015/kwh) = \$3.25 million. This is 24 per cent of quantified Marble costs of \$13.22 million (see Hearings, p. 1534).

²² *Op. cit.*, p. 12. The complete statement reads as follows:

"The interest rate to be used in plan formulation and evaluation for discounting future benefits and computing costs, or otherwise converting benefits and costs to a common time basis shall be based upon the average rate of interest payable by the Treasury on interest-bearing marketable securities of the United States outstanding at the end of the fiscal year preceding such computation which, upon original issue, had terms to maturity of 15 years or more. Where the average rate so calculated is not a multiple of one-eighth of 1 per cent, the rate of interest shall be the multiple of one-eighth of 1 per cent next lower than such average rate."

²³ A thorough theoretical discussion of the whole interest rate question can be found in Jack Hirschleifer, James C. DeHaven, and Jerome W. Milliman, *Water Supply: Economics, Technology, and Policy*, University of Chicago Press, 1960, pp. 114-151.

time when long-term Treasury bond rates were about 4 per cent.³⁴ No doubt the authors would recommend somewhat more now.

The Carlin-Hoehn study made a major concession to dam proponents by using the Bureau's 3½ per cent interest rate, although it noted that the use of higher, more suitable interest rates would further weaken the economic case for the dams.

Other faulty evaluation procedures

Although the transmission dispute revolves around some of the more technical issues of benefit-cost analysis, it is already evident that most of the problems stem directly from the basic cost-benefit procedures currently used in the evaluation of water resource projects by the Bureau of Reclamation and other Federal agencies. Some of the faulty economics found in the present procedures have already been outlined. Others, such as the overly-generous treatment of secondary benefits, are not hard to find. It would not be difficult, in fact, to attack the cost-benefit ratio itself as a suitable criterion.³⁵

Perhaps the most serious of the faults with the present procedures that have not as yet been discussed is the permissive definition of secondary benefits as "the increase in the value of goods and services which indirectly result from the project as compared to those without the project. Such increase shall be net of any economic nonproject costs that need be incurred to realize these secondary benefits."³⁶ The abuses that such definitions can lead to have been repeatedly documented and analyzed.³⁷ Very generally speaking, such benefits should only be assumed when it can be shown that the factors involved in the production of these goods and services would otherwise be unemployed during the construction of the proposed project.

Another incorrect procedure prescribed in Senate Document 97 is that "prices used for project evaluation should reflect the exchange values expected to prevail at the time costs are incurred and benefits accrued,"³⁸ even though it has been repeatedly pointed out that both costs and benefits should be evaluated in the same prices.³⁹

After all that has been written about the evaluation of water projects, it would be naive to assume that the thinking represented by Senate Document 97 and its application to the Grand Canyon controversy results entirely from ignorance of economic principles; much more can be explained by the political realities of the situation. The most important of these realities is the mutuality of interest between members of Congress anxious to obtain projects beneficial to their constituents and Federal water agencies looking for more business. Loose evaluation criteria serve the ends of both,⁴⁰ as does the practice of having the agencies themselves apply these criteria to individual projects.

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CAN WE END THE GRAND CANYON CONTROVERSY HAPPILY?

(By Jeffrey Ingram, Southwest Representative)

The Grand Canyon controversy is at a crucial point. It can be ended now; and what is decided this month will determine whether the conflict will be amicably resolved or whether a bitter struggle will be renewed. The responsibility is shared by all of us on every side of this complex subject. Wishing to go on to other, more constructive work, we offer this memorandum, which we believe provides a basis for negotiation on, and solution of, the problem.

In brief, the repayment analysis of the Lower Colorado River Basin Project, which appears on the next page, shows that more water could flow to Phoenix and Tucson sooner, with less cost to the water user, the power user, and the general taxpayer, than any other plan advanced.

³⁴ *Ibid.*, p. 146.

³⁵ See, for example, Roland N. McKean, *Efficiency in Government through Systems Analysis*, New York, John Wiley, 1958, and Hirshleifer, *op. cit.*, pp. 137-138.

³⁶ Senate Document No. 97, *op. cit.*, p. 9.

³⁷ See McKean, *op. cit.*, pp. 154-163, and Hirshleifer, *op. cit.*, pp. 126-131.

³⁸ *Op. cit.*, p. 12.

³⁹ Hirshleifer, *op. cit.*, p. 142 and McKean, *op. cit.*, pp. 180-182 and 222.

⁴⁰ Interestingly enough, what was to become Senate Document 97 was originally signed by the Secretaries of the Army, Interior, Agriculture, and Health, Education, and Welfare, although no doubt prepared by their staffs (including the Bureau of Reclamation and the Corps of Engineers).

Lower Colorado River Basin project repayment analysis without construction of Grand Canyon dams—2,500 c.f.s. aqueduct

	Hoover Dam fund		Municipal and industrial			Irrigation	
	Aid to Lower Colorado River Basin project	Lower Colorado River Basin project	Net operating revenue	Interest on unpaid balance, at 3.225 percent	Unpaid balance	Net operating revenue	Unpaid balance
1973.			-\$32	\$1,176	\$36,477		\$23,151
1974.			3,433	4,718	146,306	-\$1,560	271,448
1975.			3,541	4,969	154,063	-593	302,635
1976.			3,723	5,863	212,820	2,363	322,091
1977.			5,645	6,965	215,960	2,380	319,711
1978.			6,001	7,007	217,280	2,089	317,622
1979.			6,342	7,040	218,286	2,052	315,570
1980.			6,675	7,062	218,984	2,051	313,519
1981.			7,031	7,075	219,371	2,018	311,501
1982.			7,362	7,076	219,415	1,991	309,510
1983.			7,694	7,067	219,129	1,920	307,540
1984.			8,025	7,047	218,502	1,967	305,573
1985.			8,356	7,015	217,524	1,949	303,624
1986.			8,688	6,972	216,183	1,936	301,688
1987.			9,029	6,917	214,467	1,921	299,767
1988.			9,359	6,848	212,355	1,912	297,855
1989.			9,692	6,768	209,844	1,891	295,964
1990.			10,022	6,673	206,920	1,888	294,076
1991.	\$6,368	\$6,368	10,359	6,565	203,571	1,867	292,219
1992.	6,347	12,715	10,694	6,457	198,409	1,840	290,379
1993.	6,326	19,041	11,019	6,297	182,605	1,821	288,558
1994.	6,305	25,346	11,354	6,089	171,149	1,805	286,753
1995.	6,284	31,639	11,691	5,830	159,010	1,727	285,026
1996.	6,263	37,893	12,002	5,128	146,163	1,677	283,349
1997.	6,242	44,135	12,337	4,714	132,612	1,599	281,750
1998.	6,221	50,356	12,661	4,277	118,310	1,485	280,265
1999.	6,200	56,556	12,972	3,816	103,274	1,379	278,886
2000.	6,179	62,735	13,308	3,330	87,402	1,285	277,601
2001.	6,158	68,983	13,308	2,819	70,734	1,172	276,429
2002.	6,137	75,030	13,308	2,281	53,549	1,128	275,301
2003.	6,116	81,146	13,281	1,727	36,858	1,112	274,189
2004.	4,951	86,097	13,271	1,156	17,627	1,063	273,126
2005.		86,097	13,245	569	0	1,033	272,093
2006.		86,097	13,245	0	0	990	257,858
2007.		86,097	13,243	0	0	940	243,675
2008.		86,097	13,207	0	0	293	229,545
2009.		86,097	13,207	0	0	870	215,468
2010.		86,097	13,181	0	0	845	201,442
2011.		86,097	13,181	0	0	805	187,456
2012.		86,097	13,171	0	0	752	173,533
2013.		86,097	13,143	0	0	735	159,655
2014.		86,097	13,143	0	0	692	145,820
2015.		86,097	13,118	0	0	664	132,038
2016.		86,097	13,106	0	0	617	118,315
2017.		86,097	13,080	0	0	600	104,635
2018.		86,097	13,080	0	0	547	91,008
2019.		86,097	13,055	0	0	519	77,434
2020.		86,097	13,053	0	0	485	63,896
2021.		86,097	13,017	0	0	458	50,424
2022.		86,097	13,017	0	0	405	36,999
2023.		86,097	12,991	0	0	393	23,615
2024.		86,097	12,965	0	0	367	10,283
2025.		83,101	12,955	0	0	324	0
2026.		69,866	12,930	0	0	305	
2027.		56,684	12,902	0	0	280	
2028.		43,554	12,902	0	0	228	
2029.		30,488	12,867	0	0	199	
2030.		17,464	12,839	0	0	185	
2031.		4,484	12,839	0	0	141	
2031.		0	12,839	0	0	141	

I. The bulk of this memorandum describes a repayment analysis for the Lower Colorado River Basin Project. The analysis demonstrates that the costs of the Project can be paid back:

- (1) without construction of any dams in the Grand Canyon, which extends from Lee's Ferry to the Grand Wash Cliffs;
- (2) without using revenues from Parker or Davis dams;

- (3) without federal construction of or investment in any type of power generating facilities;
- (4) without raising the rates for Hoover Dam power beyond their present level.

Further, any Hoover revenues used in repayment of the Project will be repaid by the beneficiaries of the Project.

Legislatively, repayment by this method could be accomplished by Section 403, H.R. 4671, 89th Congress, plus an amendment to the Boulder Canyon Project Adjustment Act which would provide that:

- (1) revenues from Hoover dam shall be used to aid in repayment of the Lower Colorado River Basin Project;
- (2) any revenue so used shall be repaid by the Lower Colorado River Basin Project as soon as that Project is paid for.

II. A key to this analysis is the recently-signed contract between the California Department of Water Resources and four California power suppliers. Under the contract, the utilities would supply off-peak power to pump water in the California Water Project at the rate of three mills/kwh. (See enclosed clipping.) This repayment analysis is based on the assumption that a similar contract can be negotiated for the Lower Colorado River Basin Project. Since not all pumping power can be supplied during off-peak hours, the analysis uses a 65% load factor as the switch-over point from off-peak to peak rates. The peak rate used here was six mills/kwh. (The switch-over point could have been as low as 40% without changing the analysis and its conclusions.)

The peak power requirements for pumping has been allocated to irrigation, since municipal and industrial water, being of necessity a firm supply, has first claim. It should be noted that the conclusions would not be changed under any other assumption about allocation of peak-rate pumping power.

If the two Grand Canyon dams are not built, then some 100,000 acre-feet of water per year, which would have been evaporated off the reservoirs, becomes available for diversion. This is a firm supply of water. The most advantageous use of this water is for municipal and industrial needs and, if this extra water had been used in the analysis, there would have been additional net operating revenue of some \$3.25 million available after the year 2010. Before that year, some lower figure would be appropriate, depending on how much was allocated to irrigation. However, in order to keep the present analysis as simple as possible, this extra water was not included in the calculations.

III. The repayment analysis presented stops with the repayment of the Hoover dam revenues, and there is thus no build-up of any Development Fund. It has often been pointed out that the main purpose for the Grand Canyon dams, raising the rates for Hoover dam power, building a federally financed thermal power plant, etc., is to build up a large Development Fund for augmenting the Colorado River's water supply. Since all of these revenue-production methods are controversial, and since the possible means of augmentation are both speculative and controversial, we thought it best to leave the building-up of a development fund to another time. The point of this memorandum is that the Grand Canyon dams—one, two, or more, high, low, or middle-sized—are unnecessary; the Lower Colorado River Basin Project can proceed and succeed without them.

IV. Details of Method: The figures for capital costs, water supply, power needs, interest rate, etc., are those supplied to me by the Bureau of Reclamation for the 2500 c.f.s. Central Arizona aqueduct, and used by the Bureau in its own analyses. The Hoover Dam aid is extrapolated from the Bureau figures. The methods used in this analysis are those of the Bureau, as provided for in present practices and H.R. 4671.

The net operating revenue for municipal and industrial water, as provided by the Bureau, was adjusted to take account of the fact that the Bureau's cost for pumping such water is $4\frac{1}{4}$ mills/kwh, while this analysis uses the three-mill figure. Likewise, the net operating revenue figure for irrigation water was adjusted to account for the difference between $2\frac{1}{2}$ mills/kwh, the Bureau's figure, and the three-mill and six-mill figures used here.

Using these adjusted revenue figures, the municipal and industrial costs were repaid, with Hoover Dam aid used as it became available in 1991. Municipal and industrial costs were paid off in 2004. No more aid from Hoover was used, and all water revenues were used to pay off irrigation costs by the year 2024. The Hoover dam aid was then repaid, using all water revenues, by the year 2031.

[San Francisco Chronicle, 11-19-60]

UTILITIES, STATE SIGN WATER-PUMPING AGREEMENT

The State Department of Water Resources and the director of California's four largest utilities signed a contract yesterday pledging enough electricity to pump Northern California water to the Southland.

Roughly, enough power to serve a city of two million will be provided to 42 separate pumping units along the 444-mile pipeline to Los Angeles. The cooperation of the utility companies eliminates the need for the State to duplicate costly, utility-owned facilities along the route.

Under the terms of the agreement, Pacific Gas and Electric Company will supply 43 per cent of the power, Southern California Edison Company, 36 per cent, the Los Angeles Department of Water and Power, 15 per cent and the San Diego Gas and Electric Company, 6 per cent.

The agreement calls for the utilities to supply off-peak, steam-generated power through their interconnected systems at a rate of three mills per kilowatt-hour. Ultimately, sales under the contract are expected to reach \$30 million annually paid by the southern water users.

Most of the power will be used to boost the water nearly 3000 feet over the Tehachapi mountains. The task requires pumps with a combined capacity of 1.7 million horsepower.

Department of Water Resources director, William E. Warne, said the project is expected to save water users \$20 million annually. The contract, he added, makes the State the utilities' biggest customer.

"The contract we are signing today required two full years of exceedingly complex negotiations," Warne said at the signing. "After general agreement was reached on the principles and the rates involved, there still remained many details to scrutinize."

"The new director of the Department (of Water Resources) now can move with full confidence into the construction of the remaining facilities needed to put the project into operation."

Warne's administration will end with Governor Edmund G. Brown's.

SIERRA CLUB,

Washington, D.C., January 30, 1967.

Re Lower Colorado Basin Project: Hualapai Dam or a National Water Commission?

The PRESIDENT,
The White House,
Washington, D.C.

DEAR MR. PRESIDENT: The purpose of this letter is to transmit a documented demonstration that the authorization of the proposed Hualapia Dam in the Grand Canyon is antithetical to the purpose of the National Water Commission that your administration has so wisely proposed. We urge for that reason that your support for the Lower Basin Project be contingent upon establishing a National Water Commission as previously recommended by you and the omission of both proposed Grand Canyon dams—Hualapai and Marble Canyon.

The enclosed statement is by Jeffrey Ingram, whose testimony before the 89th Congress showed that revenue from the Grand Canyon dams is not necessary for Southwest water development, including the Central Arizona Project. His contention was conceded to be right by the Bureau of Reclamation. His present statement has been reviewed by Laurance I. Moss, nuclear engineer with Atomics International, who has extended the reasoning of Dr. Alan Carlin and Dr. William Hoehn of the RAND Corporation, also presented to the 89th Congress, to show that the benefit-cost ratio of the proposed Hualapai Dam is less than unity. Our petition of today before the Federal Power Commission for leave to intervene explains in detail our separate concern about the proposed Marble Canyon Dam.

The Sierra Club, in supporting the National Water Commission, understandably does not commit itself to supporting all the conclusions the commission may reach. We have our own commitment to try to protect the superb living things and places that humanity and other forms of life may enjoy but cannot replace.

We know that either of the proposed Grand Canyon dams would irreversibly change the Grand Canyon. The change would be so much to the lasting detriment of the Grand Canyon that an extraordinarily greater cost would be justified for an alternate solution to Southwest water development. Actually the alternatives are likely to cost substantially less in dollars, and infinitely less in the cost to mankind were there any further impairment of the Grand Canyon.

We urge you to join Theodore Roosevelt in the admonition, "Leave it as it is," and to continue to support your earlier proposal to establish a National Water Commission and thus bring fresh thinking to the solving of water problems.

Sincerely,

DAVID BROWER, *Executive Director.*

THE NATIONAL WATER COMMISSION v. HUALAPAI DAM

(By Jeffrey Ingram, Southwest Representative, Sierra Club)

Either the creation of the National Water Commission, or the authorization of Hualapai Dam may be justifiably sought; not both. For they represent contradictory ways of solving the water problems of the future.

The National Water Commission is to take a broad fresh look at the nation's water resources and come up with recommendations which are not biased by prior commitment or predetermined plan (1). Hualapai Dam would be built to provide a development fund for future water projects. This memorandum argues that the existence of such a dam-based development fund is itself a "prior commitment and predetermined plan," and would make unbiased conclusions by the National Water Commission impossible or irrelevant.

Authorization of Hualapai Dam would be a commitment to one particular method of solving the future water problems of the West. This statement might need to be qualified if Hualapai Dam were an integral part of the operation and financing of the Central Arizona Project in the sense that the CAP could not succeed without that dam. The project can succeed, however, without the dam; no proponent of the Colorado River legislation now seriously contends that the Hualapai Dam is necessary in this sense (2). The dam would provide a convenient way to finance water development because it is the traditional way; but there are other ways (3). Moreover, it is the very fact that it is the traditional way that makes authorization of Hualapai Dam so dangerous.

What the proponents of Hualapai Dam lay their stress on is the need to accumulate funds to help solve the long-range water problems of the Southwest. They would extend the traditional method of funding reclamation projects far into the future to pay for supplying water for various uses and from various sources. Of the various sources being considered for augmented water supply in the Southwest only large interbasin transfers, to move water from one basin to another for agricultural purposes, need the money from Hualapai Dam (4).

Paradoxically, the dam's contribution will be nowhere near large enough to cover the costs of such interbasin transfers (5) and other subsidies will be needed. In spite of the inadequacy of the Hualapai Dam's revenues, in the final analysis they serve only one purpose: supplying imported water for irrigation.

A further point, subtle but important, is that the authorization of Hualapai Dam would be a victory for those who believe with Commissioner Dominy that "The high Hualapai Dam project is much more economically feasible and fits into the operating procedure and revenue requirements much better than any thermo-generation proposal" (6). Without arguing the merits of the statement, we can conclude that what Mr. Dominy is voicing is a self-fulfilling prophecy; i.e., the dam, if built, will be better because the alternative was never tried, except on paper, and concrete is better than paper, and old thinking better than new.

The President and the Senate last year approved a National Water Commission to "study alternative solutions to water problems without prior commitment to any interest group, region, or agency of government" (1), Rep 1212, 1966, a committee free to survey the field, to search out the best way to supply water needs. But last year, and now this year, the Bureau of Reclamation urges that a dam be authorized that will give what Senator Anderson has called the "ditch and dam method" of water supply a lead over any other method. If the Bureau

now succeeds, then by the early 1970's, when the recommendations of the National Water Commission are being considered, the Bureau can say: "See the dam work. It is the best way."

If accepted as the best way, the ditch and dam method will dominate all others. Commissioner Dominy goes a step further when he says: "Weather modification in the high reaches of the Rockies gives extraordinary promise of additional precipitation which will even further justify the proposed hydropower development on the Colorado" (8). Thus, one of the alternatives a National Water Commission might consider is already being used to "justify" the traditional dam and ditch method.

Authorization of the CAP could appropriately close out a period, the Reclamation-for-Agriculture period, the ditch-and-dam period.

Authorization of Hualapai Dam, however, will project that period too far into the future, a future in which the water needs are most likely to be the needs of cities and industries. Authorization of Hualapai will make it exceedingly difficult to consider city-oriented solutions to water problems. Some dams and ditches may still be needed, but for a city they will probably be a small part of an over-all water-supply complex. We cannot predict this, nor can the Bureau of Reclamation. The National Water Commission should be able to make the best predictions. Unbiased analysis of what this water-supply complex should consist of will be precluded in the face of the actual presence of a Hualapai Dam.

The National Water Commission is aimed at the future: it is the President's response, with which we concur, to the need of being responsible to the future. We can do that only with a clean slate. If Hualapai Dam is written in large letters at the top, then the type of solution it represents will most likely fill the rest of the slate in the decades ahead.

In short, the Hualapai Dam, with a purpose of trying to make money the old way to pay for future water projects, and the National Water Commission, with the purpose of searching out the best new way to solve future water problems without commitment to present methods, are contradictory.

If Hualapai Dam is authorized, the Commission's recommendations will either be determined for it or ineffectual against the argument, "We have a dam; it works; our old method works; it is the best way; try no other."

Consequently, if the Hualapai Dam is authorized, the National Water Commission will be a waste of time.

On the other hand, if Hualapai Dam is not authorized, then the National Water Commission can consider all methods, without prejudice, without being faced by a fait accompli. The Commission will be able to weigh all data, to choose freely between alternate methods, and to fit those methods into rational plans which, by brining out the best in present thinking, can most effectively provide for the future's needs.

NOTES

(The references are abbreviated; correspondence referred to, or appropriate excerpts from documents cited, are available on request to the Sierra Club, Mills Tower, San Francisco, attention: David Brower, Executive Director.)

(1) Letter, Senator Henry M. Jackson to Jeffrey Ingram, Nov. 9, 1966.

(2) Commissioner Floyd Dominy in House hearings, August 1966. Director Felix L. Sparks, Colorado Water Conservation Board Meeting, December 14, 1966.

(3) Alan Carlin and William Hoehn, RAND Paper presented in House hearings, 89th Congress.

William E. Martin and Leonard G. Bower, "Patterns of Water Use in the Arizona Economy," *Arizona Review*, Univ. Arizona, Dec. 1966.

Jeffrey Ingram, testimony in House hearings, 89th Congress.

(4) Letter, Jeffrey Ingram to Felix L. Sparks, January 17, 1967.

Letter, David Brower to Felix L. Sparks, January 16, 1967.

(5) Morris K. Udall cited in House hearings, 89th Congress, a capital investment rule-of-thumb of \$1 billion/1 million acre-feet of import capacity. Bureau of Reclamation testimony, *loc. cit.*, shows only \$2 billion earned by both Grand Canyon dams by 2047.

(6) Grand Junction (Colorado) *Daily Sentinel*, January 22, 1967.

(7) Senate Report 1212 on National Water Commission, p. 2, 1966.

(8) Grand Junction (Colorado) *Daily Sentinel*, January 22, 1967.

SIERRA CLUB.

Albuquerque, N. Mex., January 17, 1967.

Mr. FELIX SPARKS,
 Director, Colorado Water Conservation Board,
 Denver, Colo.

DEAR MR. SPARKS: Your letter of the 3rd raises serious questions about the future of the bills introduced into the 90th Congress by various Colorado Basin Representatives, including Mr. Aspinall.

Your essential point is that the dams are needed to help pay for augmenting the Colorado Basin water supply. You talk of "tremendous costs", and the Bureau of Reclamation claims that, with both dams, a development fund will total one billion dollars in 2025, two billion in 2047.

What methods of augmentation are foreseeable that would require such sums of money?

1) *Reallocation of water* from low value, extensive irrigation uses would end the water crisis in large measure, as studies at the University of Arizona show. Such reallocation will not require large sums of money, only the courage to overcome the oft-repeated myth of water shortage.

2) *Weather modifications* may increase water yield in certain sections of the West, but again there is no indication this will require large sums of money.

3) *Large dual-purpose nuclear plants* may help localities. Large capital expenditures will be required, but the fact that such plants will themselves generate large amounts of power for commercial sale indicates that the revenue produced by the Grand Canyon dams may not be required. Moreover, the combination of off-peak power for pumping with on-peak power for commercial sale from these dual-purpose plants will compete with the dams, and, according to the work of Carlin, Hoehn, Moss, & the Parsons Company, actually undersell the dam's power. More study of this crucial matter is needed, but the dams seem neither economic nor necessary given this third possible method of augmenting the water supply.

4) *Importation of water* from another river basin is most frequently mentioned, in part, of course, because it is the most traditional method. There are three uses for such imported water, and each has a different financial structure.

a) *Importation to relieve the Mexican treaty burden* will not require a development fund, since the legislation proposed would charge this job to the taxpayer in New York, Massachusetts, Florida, Oregon, etc.

b) *Importation for municipal & industrial needs*, over & above what will be satisfied by taking over water supplies used by agriculture, will not need the dam's revenues because municipal & industrial users are charged enough to pay for their share of the capital costs.

c) *Importation to irrigate crops* is traditionally subsidized, and in this brief summary, appears to be the only purpose which needs a development fund which might require the Grand Canyon dams. The question that faces you, then, is what is the future of any Colorado Basin bill which includes authorization of dams, whose only purpose can be to finance bringing irrigation water from the Columbia River, or some other convenient basin?

I find it hard to avoid certain conclusions, and would like your comment:

1) The Grand Canyon dams will be a divisive element among water-users in any attempt at the West-wide water planning that Mr. Aspinall spoke of at the N.R.A. convention in Albuquerque.

2) The conservation organizations will be further stimulated to oppose dams in the Grand Canyon, since they seem unnecessary even in remote prospect.

3) Augmentation can succeed in various ways, if many alternatives are studied imaginatively & pursued diligently. Such study & pursuit will most likely occur if the moratorium on Grand Canyon dams is extended by Congress, thus avoiding temptation to take the old dam-&-ditch way, and if an independent National Water Commission is created, thus allowing conclusions which will be in the national interest, rather than a sectional interest.

And of course, by 1972, everybody might see the value of a Grand Canyon, "left as it is".

Regards,

JEFFREY INGRAM.

SEDIMENTAL JOURNEY: GRIM PROSPECT FOR THE COLORADO

(By David Brower, executive director, Sierra Club)

INTRODUCTION

Somewhere, on the Colorado before it pauses momentarily in the reservoir backed up by Glen Canyon Dam, scoop up a cupful of river, let it settle, and consider the sediment in the bottom of the cup. It has more story to tell than tea leaves ever would. Contemplate what the sand there does if it is free—such creations as the Grand Canyon, for example, And what it will do if man tries to entrap it. Be frightened a little.

Part A

When the Bureau of Reclamation boasts of turning into sparkling blue lakes and crystal clear streams good for fishing something that had previously been too thick to drink and too thin to plow, there is a tendency to share the Bureau's delight. But there is a good question to ask before we get too ecstatic: What happened to all the sediment and debris, all the silt and sand that gave the Colorado its color?

In the first place, for a whole series of reasons, many of them consisting of abusive treatment of the land, the Colorado tributaries are still stripping just as much off the land as ever and starting it all down to the Gulf of California. Sooner or later, it will arrive there. In geological time, all the reservoirs man builds on the river will become filled with sediment, filled to the brim and more. The river will cascade over the dams, finally erode them, and in the end transport the sediment to the sea, cleaning out its channel, revealing once again what was buried there, and resuming the work rivers must always carry on—the constant attempt to level the land.

Long before this, man may have disappeared from the earth. A more discernible perspective is needed. What will be the immediate effect on this civilization, on the generations of people those of us now alive will know and must feel some responsibility for, of the sedimentation of the Colorado River reservoirs now existing?

Of immediate importance, how about sediment and the proposed Grand Canyon dams? For the foreseeable future, what kind of storage loss and water loss can be expected? What validity is there to projections of long-range revenues, for example, if there are poor forecasts of sedimentation rates and if it is assumed certain reservoirs will be storing water, conserving water, and producing hydroelectric power for longer periods than they actually will?

There is a lot of Mark Twain's philosophy in what follows. By a simple extrapolation of one known statistic, he showed how the Mississippi must at one time have extended more than a thousand miles into the Gulf, as narrow as a fishing rod. And he commented on "something exciting about science." "One gets such wholesale returns of conjecture out of a trifling investment of fact," he said.

If you will, with pencil and scratch pad handy, let's invest the trifling facts at hand, multiply and divide a little, and conjecture a lot. Try to take all the figures in stride, reading them as if they were poor prose. There will be no final examination—except by posterity if we fail. The figures won't be too dull, silty though they are, and may even stir someone in government into producing better figures in time to save us. Meanwhile, here are some data to work with, and lots of luck! Or you may skip the next several paragraphs, miss some of the fun, and resume reading at Part B, below.

For sedimentation rates on the Colorado, House Document 364 (1954) showed that 100,000 acre-feet of sediment passed the Glen Canyon damsite each year. This, then, is the amount that is now beginning to finish off Lake Powell, with its water capacity of 27,000,000 acre-feet.

Walter Huber, the late former president of the American Society of Civil Engineers, and an expert on dam construction and operation who was well aware of Colorado River hydrological statistics, told me that one-third of the silt that went into Lake Mead came from the Little Colorado River. If you assume, then, that 180,000 acre-feet went into Mead (before Glen Canyon dam), then 60,000 would come from the Little Colorado, 100,000 from the Main Stem above Glen, and 20,000 from all others. One of the siltiest others is the Paria, which flows 22,600 acre-feet per year. Other tributaries would be the Virgin and the host of water tributaries within Grand Canyon's limits—Kanab, Havasu, Tapeats, Spencer, Quartermaster, Separation, and so on.

In the early predictions for Bridge Canyon dam, with no upstream sediment control, a 37-year silt life was predicted. The capacity of Bridge at elevation 1866 is 3.7 million acre-feet (maf henceforth), its surface area 16,700 acres. The capacity of sediment would be perhaps 25 percent greater than the capacity in water, assuming headward aggradation (the upstream grade a river builds back from the reservoir that stops it) from the dam itself that could produce a grade of 1.5 feet to the mile. This figure must be predictable and the calculation should be checked. If it is correct, 125,000 acre-feet of sediment passes Bridge Canyon site, or enough to render the upper 40 miles of the reservoir recreationally unusable in $3\frac{1}{2}$ years—assuming no upstream control. (There is now major upstream control, remember, in Glen Canyon, but there is a lot that Glen doesn't control.)

As a cross-check, the Southwest Water Plan, 1963 edition, shows 2.1 maf capacity for the Coconino silt-retention reservoir, and the Pacific Southwest Water Plan Supplement on Bridge says this will last 100 years. Add 25 per cent for aggradation, or .5 maf, divide by 100 years and you get 26,000 acre-feet/year Little Colorado sediment. This is less than half what our previous estimate shows. This may be explained if it is really a gross underestimate of the Coconino sediment capacity. Considering the shape of the Coconino impoundment area, the gross underestimate is possible. The area is 76,000 acres when full of water. Bridge Canyon reservoir, for comparison, is 16,700 acres for 3.7 maf capacity, versus Coconino's 76,000 for 2.1 maf capacity and compared with Glen's 176,000 acres for 27 maf capacity. Thus, in acres per maf capacity: Bridge, 4,500; Glen, 6,500; Coconino's 38,000. So gently sloped a basin might aggrade unconscionably. If aggradation doubled Coconino's capacity for sediment, as compared with its water capacity, we'd get our 60,000 acre-feet per year of sediment—and an incredibly big silt trap, of perhaps a 150,000-acre surface.

A 1949 publication of the Bureau of Reclamation (N.H. Daines, Study of Suspended Sediment in the Colorado River) may be too old to be of much help. It shows an average of 175,000,000 tons per water year of sediment discharge at Grand Canyon station (probably near Kanab Creek), 1926–1948. At an assumed density of 1.1, this is some 150,000 acre-feet of sediment at almost the Bridge site (albeit, some 120 miles above it, but with little silt entering between). The bedload was not measured, but that could hardly explain the difference.

So we probably shouldn't place much store in the Daines opus. An interesting figure may be worth remembering: 90 per cent of the water and 60 per cent of the sediment of the Colorado comes from above Glen. Reading this backwards, 40 per cent of the sediment comes from below Glen, and it would be easy to estimate that one-third of the sediment in Mead would come from the Little Colorado. Just what Walter Huber said.

In the Pacific Southwest Water Plan Appendix, the Geological Survey lists all kinds of plans for studies, but none for studies of sedimentation. In pursuing sedimentation data at the USGS last August, we were told that the USGS was "*not permitted to make sedimentation projections.*"

Now for a couple of flow figures. What's the Little Colorado got? Using the 90–10 ratio above, and taking some flow figures accompanying a letter, August 3, 1966, from the Bureau of Reclamation to Walter Edwards, we find the virgin flow at Lee Ferry, 59-year average, is 15,025,000 af; 90 per cent of that leaves 1,503,000 for the Little Colorado and associated streams below Lee Ferry. The Paria average, 1914–65, was 22,000 acre feet, so we can say the Little Colorado does about 1.6 maf per year. (Note: it's really nearer 300,000; but don't worry because errors of this magnitude are trivial in the league we're playing in.)

One further detail about the Paria and we can close up the data gathering and try predicting.

The Paria silt-detention reservoir holds 98,000 acre-feet of water. It is 13 miles long and has an 8,000-acre surface according to the BuRec map (2,500 on the area-capacity curve in the same supplement!). Note: Although the Southwest Water Plan says 98,000 acre-feet capacity, the Marble Supplement says 235,000 in text, 200,000 being all that shows on the area-capacity curve accompanying the text. The text says there is 5,100 acre-feet of sediment per year between Glen and Marble, with the Paria contributing about 4,475 annually (a nice precise figure, that one). The dam is 18 miles up the Paria, with some 250 square miles of Paria watershed below the dam, so perhaps 4,000 acre-feet per year will end up in Paria until it is full, in its century; the rest ends up in Marble, which has only a 363,000 acre-feet capacity.

Part B

The preceding paragraphs prove that the figures hardly ever check out. If my arithmetic is bad, I've been working too long with Bureau of Reclamation figures. Remember that, depending upon which page you read of their figures that are in the evidence before Congress, the Paria silt trap has an area of either 2,500 or 8,000 acres and a capacity of 98,000 or 200,000 or 235,000 acres-feet. Vote for one—and then move on to something stranger still. The Federal Power Commission has been told that the Marble Canyon reservoir would hold 480,000 acre feet of water and that without the Paria silt trap, Marble would be silted up in 104 years. The Bureau of Reclamation, with the same dam, would have a reservoir with one-fourth less capacity—so it would silt up in 71 years (assuming Glen Canyon dam still works; otherwise four years' silt would finish Marble). So Marble would be gone in plus or minus 7 decades (i.e., before it is as old as the Sierra Club) unless Paria were built to extend Marble's life 25 or 60 or 70 years, depending upon how you voted on the Bureau's credibility gap.

Or Marble could go sooner. The Sheep Creek test barrier that the Bureau and Corps of Engineers constructed jointly on the Paria was supposed, I am told by an expert sedimentologist, to last from 10–20 years. It was filled by one "event." The Bureau assumed 4475 af of silt per year in the Paria, so this one event would extrapolate to 45,000–90,000 af for the whole Paria-Marble basin below Glen Canyon dam—and half a dozen such events would wipe out Marble and Paria silt-detention capacity and be at work at Hualapai's, aided by other helpful events in the Lower Basin.

If there seem to be too many figures, don't let it bother you. They don't bother the Bureau too much, so why should you worry? Reclamation Commissioner Floyd Dominy told me and a New Mexico radio audience last November that Glen Canyon would never silt up; apparently he doesn't take his own Bureau's figures seriously, even though he does want you and me and 200,000,000 Americans to put up the money for the dams his figures advocate. So in its first century, to go into more figures, Marble would be $\frac{2}{3}$ (or $1\frac{1}{4}$) full of sediment and be having troubles in power generation and with clogging up Glen Canyon's tail-water. Marble would be quickly finished off thereafter if the Paria detention dam were built—and done in by silt. The closer Marble gets to its death, the more the reservoir must fluctuate daily to put its peaking-power water through the turbines. The initial ten-foot fluctuations would get grimmer and grimmer, and would probably exceed 100 feet daily in the vestigial puddle at the lower end of the Marble Canyon sediment flats.

Note in passing that with the Paria averaging 22,600 acre-feet per year flow and 4,475 acre-feet per year of it sediment, a cupful of Paria will not stir easily—it is flowing 20 per cent nonwater.

Before we leave the Little Colorado, with the sun setting fierily in the West, we should look at the Southwest Water Plan supplement map of the Little Colorado's Coconino silt-retention reservoir basin. As scaled on the Bureau's map, it has about one-eighth the area of Bridge Canyon reservoir. Yet we know from the text that Coconino's area is 4.5 times that of Bridge. Error factor: 3600 per cent! That's what I meant about figures that don't quite check out.

Now let's start a preliminary summing up and assessing of error of a dimension that should produce shock.

1. Nowhere do we have a reliable estimate, or more than detached pieces of estimate so far removed as not to fit together, of what the all-important sedimentation rates really are.

2. The U.S. Geological Survey, one of the few remaining objective agencies that John Wesley Powell hoped to have so many of, is not permitted to make sedimentation predictions. If it is permitted, really, and someone merely misspoke, where are their predictions? If they exist, please send a set to Mr. Dominy.

3. The Bureau admits 20 per cent sedimentation in the Paria, 0.6 per cent in the Colorado above Glen, and an approximate 1.4 per cent in the Little Colorado. The wide range is cause for suspicion.

About that headward aggradation of 1.5 feet: The mechanics of this aggradation will always puzzle me, but if carrying capacity really and truly does vary as the sixth power of velocity, then when a river slows to half its speed, it must dump 98 per cent of its load. The slowing happens gradually, not all at once; but in any event the river has to figure out what to do with all the water and silt it has when it must dump the silt but still get the water on toward the sea.

In some situations it will cross itself up, dumping the load so fast it has to ride on ridges instead of in gulches. Slow China's Yellow River with dikes and it will ride higher than the land the dikes seek to protect. On a steep alluvial fan, with a flash flood and boulders rolling at an alarming clip, a stream can apparently lose its mind. In a restricted canyon like the Colorado's, where the river builds bar and the side streams tear them apart and build dams, and the river tears those apart when it is up to strength, the things a Colorado River will do when a 736-foot concrete clot is poured into it are not yet really quite known. Happily, no one has yet tried to dam the Grand Canyon and the Colorado River that runs through it was able, because of the sediment, to carve the canyon. All we can do, until too late, is to postulate.

A point in passing: If the 1.5 feet/mile is too much aggradation, then there will be less immediate damage to Grand Canyon National Park and Monument, et al., but there will be much more immediate damage to the economics of the Lower Colorado Basin Plan because the reservoirs won't last long enough to pretend to pay for it, and pretend they must.

In the worst case, for the economics, we have $6\frac{1}{4}$ maf capacity in the (Grand Canyon; i.e., Marble, Paria, Bridge, Cononio) 4-dam complex, a river than has about 100,000 acre-feet per year to fill it, and a 4-dam silt life of 62.5 years. Looking backward, this takes us just about exactly to the year Theodore Roosevelt said of Grand Canyon, "leave it as it is." If they had paid as much attention to him then as the Bureau of Reclamation fails to pay now, all four dams would be through today. And their revenues would have been diminished to one-half when FDR declared a bank holiday and beer came back.

In the best case, we can add some 25 per cent to the silt capacity, since silt slopes better than water does. We can drop the Colorado's silt habit index to half. That would be about 8 maf silt capacity, 50,000 acre-feet per year of silt doing it in, and 160 years to go. Power revenues would be on a half-life basis.

But don't cheer too fast. The Colorado River flow records are brief. We have a nice 59-year average. But those 59 years have not yet included a once-in-a-century flood. The California redwood country had a once-in-a-century and a once-in-a-millennium flood within a single decade. So don't place your bets yet. Remember that constant: the carrying capacity of the Colorado varies as the sixth power of its velocity. If at 6 miles per hour it can carry 150,000 tons of suspended sediment per year, not to mention bed load, then at twelve miles per hour, for the day the extraordinary flash flood excites the river that much, the Colorado can carry in that single day 21 times as much as the 60-year-average-river carried in its average year.

One U.S.G.S. man who is primarily concerned with prediction of sediment yield told me that up in the redwood country, where logging has helped the water flow more freely, a "single event" in 1964 did more to the watershed in 36 hours than had been done by all the rains and snows and runoff for several hundred years—perhaps 800—previously.

Things like this shake your faith in what engineers are thinking of when they say the Paria carries 4475 af of sediment a year and Marble will last 104 years. This is a little hard to grasp. But grasping it helps you understand how that little stream down there a mile below you, which looks as if it had dried up in the bottom of that incredible canyon, could carve the whole works in just a few minutes, if you use eons for years, or in about 10 million years if you insist upon being conventional.

In any event, with nice columns of figures that don't check out as often as we wish they did, the Bureau of Reclamation has postulated a revenue-producing operation of dams in Grand Canyon that in the course of a century will, they pray, pay for the fraction of their projects that the nation as a whole doesn't have to pay for first. The Bureau counts on that century of operation, and puts all the money from the operation in its cash registers and sounds very cheery about it, without having the slightest assurance that the century will ever leave their dams alone and unsilted up.

In the worst case, their revenues start drying up, given a half life, about 60 years before their payout tables face the facts of silt life. In the worst case—if you want to bet on it, remembering the odds that a 6th-power calculation force upon you—they fade 10 years ahead of their schedule. And all the while they assume the public will like the Bureau's hydroelectric peaking kilowatts so much better than anyone else's that they will pay the Bureau, for the very same product (to us, one kilowatt hour looks very much like the next one), about \$2 billion dollars more over the 100-year payout period than they would pay investor-owned, taxpaying utilities. Don't believe it.

But let's sum things up.

Between 60 and 160 years the four Grand Canyon dams (let's group them) will be out of action. Long before that, they will be uneconomic—even by the Bureau of Reclamation's most optimistic dreams about how well power users love the Bureau's high power rates.

But let's all assume a Rip van Winkle capability and wake up 100 years or so from today. The Bay Area Rapid Transit System is almost ready to go and New York's has rusted away. We find we have been forgiven for our faults in handling transportation, but not for letting them dam the Grand Canyon.

The reservoirs are almost gone now; they are loaded with sediment and nearly out of action. There are no equivalent damsites left on the Colorado because we have used the best. There are far more people, needing far more than we do the residue we left them of the earth's treasures after we had first grabs. But they will have to do without anything but the dregs of Colorado damsites.

The best of the scenery is gone, too. It has been replaced, in the Grand Canyon area, by some 200,000 acres of phreatophyte jungle. You don't like asphalt jungles too well; these you will like less, and ask the man who bemoans one. Or even ask the Bureau of Reclamation, an agency that hates phreatophytes so much that it had a major program afoot to eradicate 42,000 acres of the jungle so as to save 100,000 acre-feet of water per year. While tooling up to eradicate the 42,000, the Bureau created another 200,000. And still another 200,000 or so up where Lake Powell was, in another century or two.

Remember those figures. 2 plus 2 equals 400,000 acres of wall-to-wall sediment, topped with that jungle. The evaporation index in this country is about 6-8 feet per year, to which the extra efficiency in evapo-transpiration phreatophytes (saltcedar, or tamarisk, for one, add willows, and other pleasant bits of green you find along desert water courses) are capable of. Round it to 10 feet of evaporation per acre per year to help the arithmetic, and you find that the Bureau of Reclamation has planned a river-development scheme, and now wants to round it out, that will exaporate, beyond anyone's use, 3,000,000 acre-feet of water per year (4,000,000 if you include Lake Mead and more if you include its aggraded expanse and throw in Parker and Davis dams, too) on a river that was going to give them only 7.5 million acre feet in the Lower Basin. That doesn't even leave California half of its 4.4. So Arizona gets left out.

Charge it all to river planning, and especially to the idea that if you are to have any water at all, you must dam it and evaporate it so as to produce hydroelectric power. You must, you see, because here, in the year 1967, with the atom and its energy known for a quarter of a century, we have a Bureau that has let itself be tied to hydropower, and has the political power to go on insisting on being tied.

And all this, to add Ossa on Pellon, stemming from the idea that man can do without unspoiled nature, especially such unspoiled nature as remains in the Grand Canyon. He can do without nature so well that he must continue loading more of his kind on this planet. So many more that within the century even his self-impooverished earth won't sustain him.

P.S. There is one minor item not quite to be ignored: bank "storage." This is a bank that issues many deposit slips, but very few for withdrawals.

As Lake Powell began to fill, the Bureau was chagrined to learn that the prediction of 15 per cent loss to bank storage had risen to 33 per cent, with the reservoir only one-third full (and now dropping). Three years, now, Lake Powell has been trying to get full. The maximum capacity reached was about 9,000,000 acre-feet, one-third of the potential. To get that 9,000,000 with a one-third bank-storage loss, 14,000,000 had to flow in, counting the 1,000,000 lost in the interim to evaporation. That makes 5,000,000 acre-feet beyond recall in three years. Don't let anyone fool you into thinking you can get it back. It's gone, into the wild dark yonder of the desert's understory, which hasn't given forth much water for a long time.

That's just the beginning at Lake Powell. One wild rumor (we hope it's wild, that is) would have 80,000,000 acre-feet of much-needed water disappearing into the great beyond of bank storage when the lake is full. Some will trickle back as the Reclamation Bureau pulls the reservoir back down, 221 feet from time to time. This the Bureau must do, exposing about 100,000 acres or so of badly damaged lake edge, if the Bureau operates Lake Powell as it said it must. When the reservoir is pulled down that 221 feet, some bank storage will flow back into the Colorado Basin. Much of it, oozing out in seeps on desert-hot rock where once-green shade has long since died, will vaporize; but some will get to Los Angeles. Not much to Tucson.

For a while, that is.

But then the lake will fulfill its destiny. The Colorado will fill it full, that is, with sediment. At that point in time, whatever got away into bank storage cannot return when the reservoir gets pulled down because there will be no more pulling down. Quite the opposite. Headward aggradation will build the ramps that can spill still more precious waters into that wild, bank-storage beyond.

So much for Lake Powell, a bad enough beginning. When you take what the aggraded Coconino silt-retention reservoir can do, in addition to impairing, unauthorized, a substantial area on the Navajo Reservation, you will find that it is quite possible that the Bureau's Coconino silt trap will be capable of evaporating all the flow of the Little Colorado. Add the gross losses in bank storage as Cocaina silts up. Do the same for the Paria silt trap, for the Marble Canyon silt trap, for the Bridge Canyon (Hualapai) silt trap, and then remember that Lake Mead's day will come, with Lakes Havasu and Mojave not far behind.

Add up the acres again: Glen, 200,000; Grand Canyon foursome, another 200,000; Mead, duly aggraded, with Havasu and Mojave similarly favored, and the Bureau's few upstream devices, Flaming Gorge, Curecanti, Granby, Juniper, Navajo, and ancillary attraction. Round those all off at a conservative 100,000. Call it all, for easy rounding, 500,000 acres, all of it quite impressive in its phreatophyte expanse, evaporating that average 10 feet per year, and losing in bank storage, and permanently, something like 40 per cent of the total storage capacity.

Multiply this all by the 100 year years of the cost-benefit period the Bureau now likes to use. And see what we have taken away from the generations that will have a harder time making out with the earth than we do—all at a cost to ourselves and them of five to ten billion dollars.

Or perhaps the people would like to give the whole proposition a harder look, insisting that man's inertia be used less and his genius more. Perhaps there's a moral: Grand Canyon is a place to stop, look, and always have a river to listen to—240 miles of river, all of it alive.

STATEMENT BY SENATOR CLIFFORD P. CASE

I introduce for appropriate reference a bill to place all of the Grand Canyon of the Colorado in a national park. Representative John Saylor (R-Pa.) has introduced a similar bill in the House.

Beginning at Lee's Ferry, the Canyon extends 280 miles downstream to the Grand Wash Cliffs. There is no interruption of the Canyon's continuity, not mile of it that can be described without superlatives, no justification for exposing any part of it to commercial exploitation. From end to end, the whole of Grand Canyon is an irreplaceable scenic, scientific and recreational resource.

Most people who think they know Grand Canyon intimately might be surprised to learn that less than one-third of it is included within the existing Grand Canyon National Park—and less than half if it is contained within the park and the adjacent National Monument. Outside the arbitrarily drawn boundaries of the park and monument are more than 50 miles of the Canyon's upper end, in the Marble Gorge area, and nearly 100 miles of Lower Granite Gorge, at the lower end of the Canyon.

Even within the existing park and monument, natural values that they were established to protect would be destroyed by hydroelectric dam and reservoir projects proposed for the Canyon. Until all of Grand Canyon is reliably protected, all of it will remain in jeopardy. The time has come to give the entire Canyon protection within the boundaries of an enlarged Grand Canyon National Park. This is the object of my bill.

Under pending proposals, the Colorado River would be dammed at points north (Marble Gorge) and south (Bridge Canyon) of the Grand Canyon National Park and National Monument. The length of the Colorado's course through the Monument and 13 miles along the national park boundary would be flooded behind the proposed Bridge Canyon or, as it is now called Hualapai dam. The Marble Gorge dam would create a lake 300 feet deep and would inundate 40 miles of the upper Grand Canyon, as well as the undammed remnant of Glen Canyon.

Despite what many believe, the damage caused by the dams would not be localized. The 280-mile-long Canyon is a physical entity, the creation of a free-

flowing river. With the installation of two dams, or even one, this natural process of Canyon-making would be seriously impaired, perhaps even halted. As some conservationists have put it, a living laboratory of stream erosion would be turned into a static museum piece.

Initially, some advocates of the Central Arizona Project, whose purpose is to transport water from the Colorado River to the arid Phoenix-Tucson area, said the Marble Canyon and Bridge Canyon dams were absolutely essential to the CAP. But the proposed dams never had any physical, engineering relationship to this project.

Many people assumed, and many still do, that water would be diverted into the CAP aqueduct from a reservoir behind one of the proposed Grand Canyon dams. Not so; water would not be diverted to Central Arizona from Grand Canyon, but from existing Lake Havasu behind existing Parker Dam, hundreds of miles downstream on the Lower Colorado.

Nor would power generated at the proposed dams be used to pump water into Central Arizona. Too expensive for that, it would be sold commercially as "peaking power" at periods of peak demand; less expensive power would be purchased from other sources to operate CAP's pumps.

Advocates of the dams in Grand Canyon claimed that revenue from the sale of electricity was needed to help pay the costs of CAP. But it was demonstrated conclusively—and finally admitted by the Bureau of Reclamation—that CAP could be built and operated without financial assistance from dams in Grand Canyon.

Ultimately, as other arguments withered under analysis, the real reason for advocating dams in Grand Canyon emerged. It was hoped that dams built with multi-million-dollar federal subsidies would produce revenue for a development fund to be used to pay for transporting water from the Columbia River to the Colorado River Basin. In other words, the dams would be simply a money-raising gimmick.

I make no judgment at this time about a Columbia River water diversion project. Should future study show this to be sound as well as desirable, we should have it. But if and when that time comes, let us pay for it in taxes rather than by selling the Grand Canyon. In no circumstance should we consider selling this birthright of all Americans for a mess of pottage. There is no justification for sacrificing one of nature's noblest works to finance a wholly unrelated project.

Congress has recognized that water supply is a national, not merely a state, problem. As evidence of this, the Senate last year and this year passed a bill creating a National Water Commission to make a long-range study of the nation's water problems. I was glad to both co-sponsor and vote for this measure in 1966 and again this year.

We can meet the problem of water supply without despoiling the Grand Canyon or any of our other natural resources.

The Administration, which never approved authorization of Bridge Canyon dam, has withdrawn its approval of Marble Canyon dam at this time. However, the threat to Grand Canyon remains. Bills now before Congress would authorize one or both dams. Moreover, the Federal Power Commission is considering applications for non-federal dams at both sites. The way to extinguish this threat is to enlarge Grand Canyon National Park, removing from F.P.C. jurisdiction the Colorado's entire course through the masterpiece it created.

The Grand Canyon is a unique treasure belonging to all the people of all the states. It belongs, in a real sense, to all the people of the world. Quite probably the most famous natural creation on our planet, it also is the most revealing geological display on earth. The highest and best use of the Canyon would be to keep it as it is, undammed, undemeanded, and undiminished.

This would, in fact, be keeping faith with President Theodore Roosevelt who, during a visit to the Grand Canyon on May 6, 1903, said:

"Leave it as it is. You cannot improve on it. The ages have been at work on it, and man can only mar it."

Senator HAYDEN. The committee will stand adjourned until 10 o'clock tomorrow morning. We will meet in the committee room of the Committee on Interior and Insular Affairs, room 3110.

(Whereupon, at 4:25 p.m., the subcommittee adjourned until 10 a.m., Friday, May 5, 1967.)

CENTRAL ARIZONA PROJECT

FRIDAY, MAY 5, 1967

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER RESOURCES OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room 3110, New Senate Office Building, Senator Clinton P. Anderson (chairman of the subcommittee) presiding.

Present: Senators Anderson, Jackson, Hansen, Bible, Kuchel, Allott, Jordan of Idaho, Fannin, and Hatfield.

Also present: Peter Dominick, U.S. Senator from the State of Colorado, and Morris K. Udall, U.S. Representative from the Second Congressional District of the State of Arizona.

Staff members present: Jerry T. Verkler, staff director; Stewart French, chief counsel; William Van Ness, special counsel; Roy Whitacre and Mike Griswold, professional staff members; E. Lewis Reid, minority counsel, and Darryl Hart, assistant minority counsel.

Senator ANDERSON. Senator Bible.

Senator BIBLE. Thank you very much, Mr. Chairman.

Mr. Chairman, the Governor of our State, Paul Laxalt, is unable to be here this morning, and he asked me to present to the committee for him and through Mr. Pat Head, the administrator of our Colorado River Commission of Nevada, the official position of the State of Nevada on the various bills pending before the subcommittee, and I ask unanimous consent that his statement be made a part of the record at this point.

Senator ANDERSON. Without objection, that will be done.
(The statement referred to follows:)

STATEMENT OF THE HONORABLE PAUL LAXALT, GOVERNOR OF NEVADA

Mr. Chairman, and members of the committee, it is a pleasure for me to present to your Committee this statement in support of legislation to authorize the future development of the Colorado River Basin.

In many areas of the West, and especially in the Southwest, our economy is being maintained by depletion of underground water resources. In certain of those areas, this resource is dwindling at an alarming rate. The West must unite in a common effort to develop the water resources of the West in a manner to provide the greatest benefit not only to the areas of shortage or the areas of surplus, but the entire West.

Nevada feels that the Central Arizona Project should move forward at an early date to alleviate to the extent possible the depletion of the underground basin in the Salt River Valley. However, studies made by Hydrologists representing the States and the Department of the Interior, indicate that there will not be enough water in the Colorado River to meet the demands of the upper Basin

States, the demands of California and Nevada, the demands of the present Users in Arizona, and also meet the projected demands of the Central Arizona Project within, say, 25 years. It becomes imperative, therefore, that if the Central Arizona Project is to be authorized, and we feel it should, studies must be initiated immediately to find the means to augment the water supply in the Colorado River Basin.

The legislation passed by the Senate, known as S. 20 authored by Chairman Jackson, did provide the organizational structure and the means for a National Water Study. Legislation introduced as S. 1424 goes a step further and authorizes and directs the Secretary of the Interior to study and to report on the water problems of the West including the Colorado River Basin. We do not feel that S. 20 is sufficient in its present form. However, we do feel the passage of S. 1424 along with S. 20, will provide the authorization for the immediate initiation of study to find the means to meet the critical water problems of the Southwest. It would seem appropriate to us, therefore, that legislation to authorize and construct the Central Arizona Project should be in some way cross-referenced to S. 20 and S. 1424 or similar legislation in order to provide the assurances necessary.

We favor the construction of a high Hualapai Dam on the Colorado River. This high dam will provide more than pumping energy for the Central Arizona Project. It will provide revenues to help pay for the construction and operation of the Central Arizona Project, but most important to Nevada and the remainder of the Southwest is that the high Hualapai Dam would provide valuable peaking power to complement the rapidly increasing thermogenerating facilities in the Southwest area. We further favor the authorization of the high Hualapai Dam with a provision authorizing and directing the Secretary of the Interior to conduct studies and negotiations with non-Federal entities to determine the engineering and economic justification for the installation of a combined hydro-pump storage peaking plant.

Some of the legislation under consideration by you in connection with the subject under discussion provides for the establishment of a Lower Colorado River Basin Development Fund. This fund would be created, in part, by a continuation of revenues from Hoover Dam after 1987. Any legislation containing such provision should include language authorizing and directing the Secretary of the Interior to continue the in-lieu of taxes payments to the States of Arizona and Nevada provided for in Section 2(c) of the Boulder Canyon Project Adjustment Act so long as revenues accrue from the operation of the Boulder Canyon Project.

Over the past two or three years much negotiation and discussion has taken place between Arizona and California with respect to a guarantee to California of 4,400,000 acre feet annually from the Colorado River. We consider any legislation dealing with this matter should come about by resolution and agreement between those two States, and those two States only. We want it to be a matter of record, however, that the water users in the State of Nevada shall not be affected in any way by any guarantee agreed to between those two States.

Nevada favors the authorization of programs for water salvage along the mainstream of the Colorado River and for ground water recovery. We also favor the integration of the Dixie and Southern Nevada Water Projects into the Basin Fund if that fund is to be created. Nevada would support the authorization of the Animas-La Plata and Dolores Projects in Colorado.

Mr. Chairman, we in Nevada recognize the seriousness of the water problems of the Colorado River Basin and the Southwest. We stand ready at all times to lend whatever aid we can to find the solution to those problems. The Western States Water Council has made fine progress in bringing about an understanding among the 11 Western States of the problems of the individual States and individual river basins and areas. We are certainly in no position to say today that we should go to the Columbia River for water to augment the Colorado River supply. Neither can we say we should go to northern California for that water. Surely, however, there is enough water in the West to satisfy the needs of the West and we urge that immediate studies be initiated to determine the most feasible plans for the distribution of the waters of the West for the benefit of all of the West.

I thank you for the opportunity to present this statement to you.

Senator ANDERSON. Governor Love, we are very glad to see you.

STATEMENT OF HON. JOHN A. LOVE, GOVERNOR, STATE OF COLORADO, ACCOMPANIED BY RICHARD T. ECKLES, DIVISION OF NATURAL RESOURCES, AND FELIX L. SPARKS, DIRECTOR, COLORADO WATER CONSERVATION BOARD

Governor LOVE. I am delighted to be here and have this opportunity. Thank you very much.

Senator ALLOTT. Mr. Chairman, I am very happy that on this very extensive hearing we are able to have this morning our distinguished Governor from Colorado who is a native of Colorado, and who I think understands the problems that we have been involved in this week as well as anyone.

He testified before the House committee on this matter, and I know that when he concludes his testimony, we will be able to clear up some of the inconsistencies that have appeared in the record to date.

I am glad to see you here, Governor.

Governor LOVE. Thank you very much, Senator.

Senator ANDERSON. We are very glad to have you here.

Governor LOVE. Thank you, Senator.

Senator DOMINICK. Mr. Chairman, on the record I want to say it is a pleasure for me to be able to sit in on this committee hearing. I thoroughly enjoy it. I hope that some day I will get back on this committee.

Senator ANDERSON. So do we.

Senator DOMINICK. It is a pleasure for me to join with my distinguished colleague in welcoming our good Governor to this committee and to listen to his testimony for the hearing record.

Governor LOVE. If I may, Mr. Chairman and distinguished Senators, in August of 1963 there was forwarded to the State of Colorado for its review a report by the Secretary of the Interior entitled "The Pacific Southwest Water Plan." Almost simultaneously, legislation was introduced into the Congress to implement the Secretary's recommendations, the principal feature of which was then and is now the construction of the central Arizona unit. Long before the receipt of the Secretary's plan informed people in the State of Colorado recognized the necessity and desirability of constructing the central Arizona project. However, they also recognized that further drafts on the dwindling water supplies of the Colorado River would create a multitude of problems among present and future water users.

Although Colorado's position has been made clear in my reply to the Secretary's plan of 1963 and by subsequent testimony on pending legislation before the other body of this Congress, we have never previously addressed ourselves to legislation pending before the U.S. Senate on this subject. We in Colorado appreciate the courtesy extended to us at this time by this subcommittee. With your indulgence I would like to as briefly as possible state Colorado's position on the various items of legislation now before the committee.

By terms of the Colorado River compact, the Colorado River system was divided into two basins, the point of division being Lee Ferry on the Colorado River in Arizona. Above that point about 70 percent of the virgin river flow originates from the State of Colorado. Through

coincidence, the Colorado River also produces about 70 percent of all of the surface water available within our boundaries. Our interest in the waters of the Colorado River therefore is not supplanted by that of any other State.

It has been our desire, from the time of the receipt of the Pacific Southwest water plan, to achieve an understanding among the seven States of the Colorado River Basin which would make it possible to enact legislation which would in some measure be of benefit to all of the basin States. It is obviously not possible to divide the Colorado River into more shares than are available. Despite the fact that future river shortages will fall heavily upon the State of Colorado, we have negotiated with the other States for the sole purpose of making it possible to construct the Colorado River Basin project, including the central Arizona unit.

As a result of our negotiations and studies, we have adopted a final position that any legislation to authorize the Pacific Southwest water plan or any of its component parts should incorporate the following four general principles:

1. Recognition and provision that Glen Canyon Reservoir shall be operated to provide the means by which the upper division States can deliver water at Lee Ferry without impairment of their own consumptive uses pursuant to the terms of the Colorado River compact.

2. The return to the credit of the States of the Upper Division those funds which heretofore have or hereafter may be expended from the Upper Colorado River Basin fund to compensate for computer power deficiencies at Hoover Dam.

3. Provision for the continuing water resource development in the Upper Basin States.

4. Provision for an immediate start on a program designed to augment the future water supplies of the Colorado River Basin.

Provisions to accomplish a satisfactory operation at Glen Canyon Reservoir and to reimburse the Upper Basin fund for Hoover power deficiencies are contained in all versions of the proposed legislation now pending before this body. These provisions are of particular interest only to the seven States of the Colorado River Basin. Since these provisions are not now controversial, I shall not dwell upon them. I must observe, however, that they were agreed to only as a result of mutual concessions. As much as we would like to see them incorporated into any legislation, we must in all fairness admit that they constitute no agreement when isolated from other provisions of S. 861, S. 1242, or S. 1409. We appreciate their inclusion in S. 1004 and S. 1013, but to urge their passage in that form would be a breach of faith on our part.

There is no real disagreement among the Colorado River States concerning principles Nos. 3 and 4 which I have previously enumerated. However, since they have caused difficulty elsewhere, I shall dwell upon them in some detail.

Our principle No. 3 states that the pending legislation should provide for the continuing water resource development in the upper basin States. In 1956 the Congress authorized for the benefit of the Upper Basin States one of the most comprehensive reclamation projects ever undertaken in the history of the United States, the Colorado River storage project. This project was authorized to permit the Upper

Basin States to develop their full share of water apportioned by the terms of the Colorado River compact. The main storage units of that project have now been constructed and are in operation. However, the participating units of that project, which will permit us to put water to use in our respective States, are for the most part still unconstructed.

At this point in history, 11 years after the enactment of the Storage Project Act, Colorado has received authorization of projects which will consume only 95,000 acre-feet of water—a sum considerably less than authorized for any other State of the Upper Basin, notwithstanding the fact that Colorado's entitlement of water is greater than all of the other upper basin States combined.

In accordance with the specific terms of the Colorado River Storage Project Act, five projects in Colorado are now ready for authorization—the Animas-La Plata, the Dolores, the Dallas Creek, the West Divide, and the San Miguel. Each of these projects has been demonstrated to be economically feasible and the appropriate reports have been made to the Congress and printed as House documents in the 89th Congress.

Our Colorado projects have not been hastily conceived nor prematurely advanced. The State of Colorado, in past years, has advanced over \$200,000 to Federal agencies to assist in the feasibility planning and has expended an almost equal amount on these projects in its own planning. The commencement of planning on these projects in every case dates back for more than 20 years, and in one case, for over 50 years. Like Arizona, we have waited a long time to construct projects which are essential to our continuing development.

These Colorado projects present no particular controversy, except that the Secretary has recommended that three of them be deferred pending a study by a National Water Commission. We cannot believe that the idea of a National Water Commission was ever conceived to determine the internal allocation of water within any State. If development in Colorado must halt pending a study by the proposed National Water Commission, then we feel that the same limitation should apply throughout the entire United States.

I shall not dwell upon the individual aspects of each of the proposed Colorado projects. Various local subdivisions of our State government, which have been created to act as the sponsoring and contractual agencies for these projects, are represented here today.

They will give you a better insight than I can as to the need for each of the projects which they are sponsoring. Suffice it to say that these projects would contribute greatly to our municipal, industrial, and agricultural water supplies. Two of these projects would enhance the economic opportunities of the Ute Mountain, Ute and Southern Ute Indian Tribes. One of the projects is designed primarily to provide a water supply for our emerging oil shale industry.

By urging the authorization of these Colorado projects, we are not overlooking the rights and interests of other Upper Basin States. None of the other States are now using their full entitlement of Colorado River water. We intend to fully support in the future, as we have in the past, those projects in other States which are necessary to insure them of their full share of water. However, at this time there are no other Upper Basin States which have projects ready for authorization. There are provisions in three of the bills now pending before you which

direct further investigations for the benefit of Utah and Wyoming. We fully support those provisions and particularly those contained in S. 1409 introduced by Senator Moss.

The Animas-La Plata project is actually a joint Colorado-New Mexico undertaking. To insure that New Mexico receives equal treatment with Colorado under that project, a special provision has been included in most of the legislation which would authorize Colorado and New Mexico to execute the Animas-La Plata project compact. Colorado fully supports that authorization.

Our proposal to authorize certain projects within our State under the authority of the Colorado River Storage Project Act is in accordance with long-established State policy and our internal allocation of water. However, there has been considerable misunderstanding within the State of Colorado as to the effect of such projects when viewed in light of certain provisions of Senate Document 80, 75th Congress, first session. This misunderstanding has affected harmonious relationships within the State and needs clarification. As a matter of State policy, our State water board and State legislature have adopted an interpretation of paragraph (i) of the section of Senate Document 80 entitled "Manner of Operation of Project Facilities and Auxiliary Features." The interpretation is that the words "any western slope appropriations" in said paragraph (i) mean and refer to the appropriation heretofore made for storage in Green Mountain Reservoir. We believe that this interpretation defines and observes the purpose of said paragraph (i), and does not, in any way, affect or alter any rights or obligations arising under Senate Document 80 or under the laws of the State of Colorado. Since it was a congressional document which created the problem, we believe that it is appropriate that clarification of the document in accordance with our interpretation be contained in any legislation which would authorize further projects under the authority of the Colorado River Storage Project Act.

Such clarification is contained in some of the legislation now pending and we urge that it be retained.

The major purpose of the pending legislation is to authorize the construction of the central Arizona project for the benefit of the State of Arizona. That State maintains that, under the provisions of the Colorado River compact and by the terms of the recent decision by the U.S. Supreme Court in the case of *Arizona v. California*, it is entitled to use a quantity of water from the main stream of the Colorado River below Lee Ferry. It is the understanding of the State of Colorado that Arizona agrees that any use of water by that State from the Colorado River system is controlled and governed by the Colorado River compact and that the Supreme Court decision only divides among the Lower Division States the water available to those States pursuant to the terms of the compact. It is our further understanding that Arizona recognizes that for some time in the future its central Arizona project would be utilizing waters apportioned to the Upper Division States and that such waters would be subject to retention by the Upper Division States when their needs arise.

It is with this understanding that we endorse the authorization and construction of the central Arizona project. However, we can understand the natural reluctance of any Lower Division State to relinquish

water in the future to the Upper Division. To eliminate future misunderstandings insofar as possible, we are insisting that those five Colorado projects now ready for authorization be authorized simultaneously with the central Arizona project. No other procedure is acceptable to us. On this point there is complete unity within the State of Colorado and among the members of our congressional delegation.

The remaining issue is that principle which would provide an immediate start on a program designed to augment the future water supplies of the Colorado River Basin. The State of Colorado and its citizens since 1922 have become increasingly concerned with their future welfare as it relates to the waters of the Colorado River. Some 15 years ago our State water board intensified its studies as to the future availability of the river waters. For this purpose it employed the nationally recognized engineering firm of Leeds, Hills & Jewett. That firm prepared a report for the State under the title "Report on Depletion of Surface Water Supplies of Colorado West of the Continental Divide." That report was subsequently printed as Senate Document 23, 84th Congress, first session.

In 1965 the State of Colorado, along with other States of the Upper Basin, through the Upper Colorado River Commission, employed the internationally recognized engineering firm of Tipton and Kalmbach to again inventory present and future water resources of the Colorado River system. This report was documented under the title of "Water Supplies of the Colorado River" under date of July 1965. I have copies of that report with me and I ask the committee to accept that report as a part of the record of these hearings.

Senator ANDERSON. Do you want to put it in the hearing we are now conducting? How long is it?

Governor LOVE. It is about 24 pages with a few tables.

Senator ALLOTT. Mr. Chairman, might I remark on this matter? I realize the reluctance of the chairman to unnecessarily build up these records. However, the Tipton report is a very important document. If it simply appears on the files of the committee, it may be relegated to some dust-covered bin, and it can hardly be taken in any portion by itself. It has to be read as a whole.

While it is 24 pages long, it wouldn't be 24 pages in the fine print we get in our hearings. I would suggest and request that it would be advisable to include it as a part of the record if the Chair sees fit.

Senator ANDERSON. Without objection it will be included.

(The report referred to follows:)

**UPPER COLORADO RIVER COMMISSION: WATER SUPPLIES OF THE COLORADO RIVER—
AVAILABLE FOR USE BY THE STATES OF THE UPPER DIVISION AND FOR USE FROM
THE MAIN STEM BY THE STATES OF ARIZONA, CALIFORNIA, AND NEVADA IN THE
LOWER BASIN**

(Prepared by Tipton & Kalmbach, Inc., Denver, Colo., July 1965)

TIPTON & KALMBACH, INC.,
Denver Colo., July 30, 1965.

UPPER COLORADO RIVER COMMISSION,
Salt Lake City, Utah.

GENTLEMEN: During the latter part of May 1965 the firm of Tipton and Kalmbach, Inc., was retained by the Colorado Water Conservation Board to make a study of the water supplies available from the Colorado River for use in the

Lower Colorado River Basin, and to determine whether such supplies would be available at all times to satisfy uses by the states of Arizona, California, and Nevada as defined in the decision of the U.S. Supreme Court in the case of *Arizona vs. California*, et al. 373 U.S. 546. Subsequently, at a meeting with three of the Commissioners and some of their engineering advisors, together with the U.S. representative on the Commission, and the Executive Director of the Commission Board on June 3, 1965, the scope of the studies was discussed and it was concluded that the studies would be sponsored by the Upper Colorado River Commission rather than by the Colorado Water Conservation Board. The studies have been made and a report prepared which embodies the results of the studies.

Drafts of the report were reviewed from time to time by the Commission's Engineering Advisors and by some of the members of the Commission. The suggestions of all of the interested parties have been considered, and those believed to be consistent with the purpose of the report and the thinking of the author have been adopted.

The report consists of two parts: Volume I—Text, and Volume II—Appendices. The text describes the manner in which the studies were made and gives the results of the most pertinent studies and final conclusions based on those results, and the reasons therefor. The Appendices consist of copies of all the detailed river and reservoir operation studies that were considered directly pertinent to the report. The Appendices also contain tables indicating the estimated present depletions on the river by the States of the Upper Division of the Colorado River Basin, and the prognostication by projects of increased depletion in the future, as made by various entities. A master table is included which indicates all known potentials in the Upper Basin and estimates of others which might come into being.

The report is submitted herewith for your consideration.

Sincerely yours,

R. J. TIPTON.

FOREWORD

The reasons for making studies at this time of the available water supplies on the main stem of the Colorado River in the Lower Basin is because of the situation described below.

There are before Congress at the present time a number of bills which would authorize a part of the Southwest Water Plan proposed by the Secretary of Interior. The plan originally contemplated the importation of substantial quantities of surplus water from the streams of the Northwest; this part of the plan has been dropped and is no longer being included in the request for authorization for construction. However, authorization for a study of the contemplated importation is included in the proposed legislation. The principal physical works sought to be authorized are those comprising the Central Arizona Project.

The decision of the United States Supreme Court in the case of *Arizona vs. California et al.*, 373 U.S. 546, considered that the contracts with the Secretary of Interior and the three states of the Lower Basin, Arizona, Nevada and California, and individual entities thereof, constituting an apportionment of 2.8 million acre-feet (maf) of water to Arizona, an apportionment of 0.3 maf to Nevada, and a limitation of 4.4 maf to California effect a valid apportionment of the first 7.5 maf of mainstream water in the Lower Basin. All apportionments by the terms of the contracts are subject to the availability of water. The Master hearing the case recommended that in case of shortage the shortage be divided among the states in proportion to their allocation of water. The Supreme Court in its decree did not follow the recommendation of the Master in respect to the allocation of shortages, but left the matter in the hands of the Secretary of Interior subject to further consideration by the Court or consideration by Congress.

It is understood that the states of Arizona and California have entered into an agreement whereby Arizona will guarantee that her uses will be such as to insure the availability of 4.4 maf of water per year from the main stem to California at all times. The substance of this agreement is spelled out in Bill S 1019 which provides, in essence, a priority to existing consumptive uses by California of Colorado River water on the main stem up to the amount of 4.4 maf annually, and to existing main stem Colorado River consumptive uses and entitlements in Arizona and Nevada by limiting diversions from the main stem for the Central Arizona Project in any year in which the Secretary of Interior determines there

is insufficient main stem Colorado River water available to satisfy the total annual consumptive use of 7.5 maf by the states of Arizona, California and Nevada. This, in itself, would implement one of the suggestions made by the Supreme Court that the matter of allocating shortages among users of the Lower Colorado River Basin be subject to further consideration by Congress. If the Central Arizona Project is authorized and goes into operation, the relevant provisions of Bill S 1019 as now proposed would cause the burden of any shortage in water supplies to be on the Central Arizona Project.

This entire situation poses a problem to the States of the upper division of the Colorado River Basin. Uses in the Upper Basin may not have progressed to the point that all waters apportioned to it by the Colorado River Compact, or to the limit imposed by nature, are being used at the time the Central Arizona Project goes into operation if it is authorized and goes to construction. In other words, there might be some unused water destined for use in the Upper Basin passing Lee Ferry which, if used in the Lower Basin, would pose a problem when those waters subsequently were needed by projects in the Upper Basin. Actually, at the present time some of the uses in the Lower Colorado River Basin on the main stem are being made only because of unused flows in the Upper Basin passing Lee Ferry.

The present studies therefore appeared desirable to enable the Commission to take stock and see what problems might arise because of the situation, and in order that policies and procedures may be developed.

At the meeting of June 3, 1965 of certain members of the Commission and its Engineering Advisors, these studies were authorized and their scope discussed. As the studies progressed, two other meetings were held with the Engineering Advisory Committee to the Commission, at which time the Commissioners from some of the states were also present. Frequent conferences were held with Mr. Ival Goslin, Executive Director of the Commission; some were had with Mr. Felix Sparks, Director of the Colorado Water Conservation Board, and his technical staff. Mr. Cecil Jacobson, Chief Engineer of the Commission, spent some time in the office of Tipton and Kalmbach, Inc., assisting the studies.

The studies were made under the direction of R. J. Tipton. He is solely responsible for the conclusions derived from the studies contained in the report. During the time the studies were being made and drafts of the report were being prepared, the drafts of the report were reviewed by the groups at the meetings mentioned above. Editorial changes suggested by representatives of the Commission for clarification purposes were accepted; other suggestions more substantive in character were not accepted if they were not concurred in by the author of the report.

The author wishes to express his appreciation for the constructive advice afforded by various representatives of the Commission and its Engineering Advisors during the course of the studies and preparation of this report.

SUMMARY

Based upon the recorded historic flow of the Colorado River, it appears that nature has decreed that the river will not supply enough water to support the apportionment made by the Colorado River Compact to the Upper Basin, an amount of 7.5 maf for consumptive use from the main river to the states of Arizona, California and Nevada; and the allocation to Mexico by the Mexican Water Treaty of 1944. The U.S. Supreme Court in *Arizona vs. California, et al.*, 373 U.S. 546, agreed with the Special Master that the Secretary's (of Interior) contracts with Arizona for 2.8 maf and with Nevada for 0.30 maf of water, together with the limitation of California to 4.4 maf effect a valid apportionment of the first 7.5 maf of main stem water in the Lower Basin. All those contracts provide for the stipulated deliveries of water subject to the availability thereof. The Court recognized that shortages might occur. Where the words "apportionment" or "apportion" appear hereinafter relating to the beneficial consumptive-use values of the states of Arizona, California and Nevada, the word or words mean what the Supreme Court decision said as cited above. The use of the words does not imply an absolute amount of water but rather a limitation of use subject at all times to the availability of water.

With the active storage capacity available to the Upper Basin, including reservoirs of the Upper Colorado River Storage Project now operating or under construction, beneficial consumptive use (depletion at Lee Ferry) in the Upper Colo-

rado River Basin, including reservoir evaporation, is limited to 6.3 million af (maf) per annum, because of the required delivery in successive 10-year periods of 7.5 maf in accordance with the terms of the Compact. The net depletion, excluding reservoir evaporation, would be 5.6 maf.

If deliveries at Lee Ferry were greater than 7.5 maf per year (7.5 maf in successive 10-year periods) to insure more power generation and financial support for the Upper Basin development, the net depletion at Lee Ferry by Upper Basin development would be less than the amounts indicated above. These depletions are less than the 7.5 maf apportioned to the Upper Basin which, in turn, are less than the ultimate total requirements of the Upper Basin.

The relation between Upper Basin depletion and the reservoir storage capacity required to insure its availability is shown in Figures 1 and 2, pp. 550 and 551, the first of which is based on deliveries at Lee Ferry of 7.5 maf per year, and the second on an arbitrarily assumed delivery at Lee Ferry of 8.25 maf per year.

The principal studies described herein are based on study periods 1914 through 1964 and 1921 through 1964. The period 1930 to date has been used by the Department of Interior and by the Colorado River Board of California to determine the amount of water available for use from the lower river by Arizona, California and Nevada. No appreciable difference exists in the basic data used for the various studies, such as the principal one of virgin flow at Lee Ferry for various years. Some difference does exist, however, in respect to the net losses of water between Hoover Dam and Mexico, which is discussed subsequently.

All studies disclose without exception that any increase in the use on the lower river must now be made from water apportioned to the Upper Basin, but now unused by it. Actually, at present the aggregate demand on Lake Mead is close to 9 maf per year. It is apparent that even present uses on the lower river are dependent upon significant amounts of water released from Lake Powell in excess of those required by the Colorado River Compact.

As the Upper Basin develops there will arrive a time when its water will no longer be available for further uses on the lower river. The question is when will that time arrive. To forecast this, studies have been made using various assumed rates of depletion in the Upper Basin and various assumed rates of releases from Lake Powell. All of the studies indicate that substantial shortages, amounting to more than 1.0 maf per year before the end of the present century, will exist in the supplies required to meet total uses of 7.5 maf by Arizona, California and Nevada and to meet a delivery of 1.5 maf of water per year to Mexico. The period would be extended somewhat if Lake Mead were depleted to absolute dead storage, during long periods of drawdown.

A period of low water supply in the Colorado River Basin, such as existed from 1930 to 1964, will occur again at some time, or one which might be more severe could occur. Under such conditions, minimum releases from Lake Powell would be necessary. Simple arithmetic indicates that there will not be enough water on the lower river to sustain a delivery of 7.5 maf for the states of Arizona, California and Nevada, and to take care of the Mexican burden, as shown by the following analysis:

[In million acre-feet]

Lower river requirements:

1. Beneficial consumptive use by Arizona, California and Nevada.....	7. 500
2. Mexican treaty deliveries.....	1. 500
3. Reservoir evaporation.....	0. 730
4. Losses below Hoover Dam.....	0. 810

Total requirements..... 10. 540

Water supply for the lower river:

1. Delivery at Lee Ferry.....	8. 250
2. Net inflow Lee Ferry to Lake Mead.....	0. 675
3. Net inflow from Bill Williams River.....	0. 065
4. Release from Lake Mead (drawdown to rated power head).....	0. 365

Total water supply..... 9. 345

Deficiency 1. 195

Although an arbitrary initial delivery of 8.25 maf has been assumed in some of the studies, the amount delivered by the Upper Basin eventually will approximate 7.5 maf per year. When the delivery from the Upper Basin is 7.5 maf instead of 8.25 maf, then the deficiency will be 1.945 maf per year. If the provisions of Section (b) of Article IV of the Colorado River Compact are invoked,

Lake Mead could be drawn down to absolute dead storage which would provide about 0.60 maf additional water per year which includes the decrease in evaporation from Lake Mead. In this case the above deficiencies would be reduced by about 0.60 maf.

The obvious conclusion is that a firm water supply is not available in the Colorado River to satisfy a basic beneficial consumptive-use requirement of 7.5 maf from the main stem by Arizona, California and Nevada, plus delivery of 1.5 maf of water to Mexico. If these requirements as well as Upper Basin requirements are to be satisfied, projects must be authorized and constructed to import major amounts of water into the Colorado River Basin from sources of surplus. Such importation is important to both the Upper and Lower Basins.

STUDIES MADE

Study Period

A fundamental item in any study of the Colorado River, taking into consideration the Colorado River Compact, the Mexican Water Treaty, and the Supreme Court decision in the case of Arizona versus California, is the recorded flow of the Colorado River at Lee Ferry and the virgin flow estimated therefrom. Measurements of the Colorado River at Lee Ferry were not begun until the spring of 1921. They have been continuous since that time. However, during the negotiations of the Colorado River Compact of 1922, and later during the studies of the hydrology of the Boulder (Hoover) Canyon Project in the late 1920's, estimates of the flow at Lee Ferry were made, based upon measurements of the river at Yuma and Topock and supplemented by estimates made on the basis of recorded flow of major tributaries above Lee Ferry when such records became available. These estimates extended back to the year 1896.

For the purpose of this report, river and reservoir operation studies were made both for the period 1914 through 1964 and for 1921 through 1964. The beginning year of 1914 was used because at the time the Upper Colorado River Compact was under consideration the Engineering Advisory Committee of the Upper Colorado River Compact Commission, in making an exhaustive study of the estimates of the flow of the river, concluded that estimates of flow prior to 1914 should not be used. The period 1921 through 1964 has been used because the actual records of measured flow at Lee Ferry first became available in 1921. For some studies the period 1930 through 1964 was used. Two studies were made based on the period 1906 through 1964.

For the period beginning in 1896 the estimated virgin flow at Lee Ferry was less than the long-time average until 1903. The period following 1903 includes a generally increasing estimated flow at Lee Ferry up to 1930. From 1930 through 1964 the flow of the river has gradually declined, the 35-year period from 1930 through 1964 being the lowest period of record.

No matter what periods between 1896 through 1964 are used for particular studies, the period of low water supply beginning in 1930 and ending in 1964 cannot be avoided. It would be optimistic to assume a firm water supply any greater than that which existed during the period 1930 through 1964 plus whatever water might have been available from holdover storage at its beginning. This period represents 35 years of reservoir drawdown, which is an exceedingly long time.

The accuracy with which future water supplies and demands can be predicted depends in large measure on how closely the future flow of the river will correspond to that assumed for the purpose of the studies. It must be recognized that the magnitude and sequence of flows which will occur during the next 44-year period will not duplicate, and may not even approximate, the magnitude and sequence of flows which occurred during the past 44 years. There is evidence to indicate that river flows along with other phenomena associated with and dependent upon climatic and meteorological conditions go through periods of high occurrences followed by periods of low occurrences. However, the occurrences do not follow any regular or cyclic pattern and there is no known method for establishing or predicting the extent or magnitude of the limits of the succession of high and low occurrences. Examination of tree-ring records in the southwestern part of the United States dated back as far as the year 1250 illustrate the ups and downs in precipitation caused by nature, without giving only evidence whatsoever of regular or predictable cycles.

Increased Depletions in the Upper Colorado River Basin

A variable having an effect on the outcome of the studies is the estimated rate at which consumptive use in the Upper Colorado River Basin will increase. Figure

3, p. 552, illustrates the estimates made by the State of Arizona, recent estimates made by the U.S. Department of Interior (U.S.I.D.), those by the Colorado River Board of California, (C.R.B.), and those by the States of the Upper Colorado River Division. It may be noted that there is a wide range in the estimates of Upper Basin consumptive uses which might take place in the future. Arizona's low estimate and the higher estimates of the States of the Upper Colorado River Division bracket the others shown.

Arizona's appraisal of the possibility of increased uses in the Upper Basin may be contrasted with the statement made by the U.S. Department of Interior in 1959 in a publication entitled "The Colorado River Storage Project and Participating Projects" which is quoted below:

"The Upper Colorado River Basin may have been late in exploration, slow in settlement, and limited in development, but the Upper Basin boldly faces a new future which will see its many resources utilized on an ever-widening scale.

"The future of the Upper Colorado River Basin lies in its resources. The most important resource is water—water which is corralled and put to work rather than allowed to plunge wildly toward the sea, wasting its energy in the rapids of the colorful canyons.

"The Upper Colorado River Basin has the water—it has land to be irrigated—it has canyons with dam sites where much water can be stored and where hydro-electric power can be produced—it has petroleum, coal, and natural gas—it has oil shales and rare hydro-carbons—it has mineral resources of uranium and other atomic ores, of many strategic metals, of phosphate and other needed nonmetallic ores.

"But, these many resources are largely dormant—sleeping giants yet to be awakened. The future will see the use of Upper Basin resources on an ever-widening scale under a development program which will bring together the resources of water, power, land and minerals . . .

"The future begins to unfold for the Upper Colorado River Basin."

The Arizona estimates have not been used in any of the present studies because they are considered to be unrealistically low; they do not account for all projects under construction or now authorized for construction.

The prime factor which will affect the lower river water supplies to meet 7.5 maf of consumptive uses from the main stem in the states of Arizona, California and Nevada, will be the amount of the deliveries at Lee Ferry from the Upper Basin.

Colorado River Operation Studies

In addition to the studies made to determine the limits of depletions by the Upper Basin based on the provisions of the Colorado River Compact and available water supply, several river and reservoir operation studies were made involving the entire main stem of the Colorado River. The details of these studies are shown in the tables appearing in the Appendices to this report.

From the present to 1975, the year in which the first diversions for the Central Arizona Project are assumed, all studies were operated on a common basis. The starting content of the main river facilities is that which is estimated by the Bureau of Reclamation to occur on September 30, 1965. With study sequences commencing with either 1914 or 1921, no difficulty was experienced in filling all the reservoirs and all were spilling in 1975. For all practical purposes, the total filling of both upper and lower systems was simultaneous. A similar condition was obviously impossible under study sequences beginning with the water year 1930.

In 1975 a draft on the Upper Basin storage was sustained corresponding to alternative constant annual releases of 8.25 maf and 8.75 maf. Releases at Lee Ferry corresponding to the U.S. Interior Department estimates and to those of the Colorado River Board of California were also used for some of the studies.

Since generation of power and maintenance of rated head is important in both basin systems, the levels of rated head were used as cut-off points in several of the studies. However, a question could be raised as to whether the storage in Lake Mead could be held at rated power head and the consumptive-use requirements at that time be shorted. This would make domestic and agricultural uses subservient to power. Article IV, Section (b) of the Colorado River Compact provides:

"Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes."

The foregoing provision if strictly enforced would prohibit the holding of water in storage for the generation of power if it were needed for consumptive-use purposes.

Recognizing this contingency other studies called on storage down to a content of 8.0 maf in Lake Mead (equivalent to the level of the Nevada intake) whereas still other studies withdrew all water stored in active capacity.

Alternative schedules of depletions were used in the various studies. Included were the depletions estimated by the States of the upper division, those of the Colorado River Board of California, and the recent estimates of the Bureau of Reclamation.

Future Uses in the Lower Basin

It is not within the purview of this report to apportion shortages among the states of Arizona, California and Nevada. However, for the purpose of the studies certain assumptions were made of present and future uses by those states. It was assumed that the presently constructed projects in Arizona diverting from the Colorado River, including projects to irrigate Indian lands, will ultimately beneficially consume 1.23 maf. Inflow-outflow records indicate that at the present time the consumption by Arizona projects using Colorado River water is close to one million af per year. However, additional drainage will be required to prevent the water table from rising to the point where lands would become waterlogged on the Gila Mesa, Yuma Valley, and the North Gila and South Gila projects. Applications of water on the mesa are causing the water table to rise beneath the Yuma Valley. It is estimated that substantial amounts of water per year should be withdrawn from the ground water in this area to prevent any further rise in the water table. Additional amounts must be withdrawn from the water table under the South Gila and North Gila projects to prevent further rise in the water table in those areas. It is assumed for the purpose of the present report that, as additional drainage works are installed, additional diversions will be made from the river so that the net beneficial consumptive use will remain at about one million af per year until 1975, and with full development, aside from the Central Arizona Project, will attain 1.23 maf in the year 2000.

It is estimated that the beneficial consumptive use of water by projects using Colorado River water in Arizona, aside from the Central Arizona Project, in 1990 will be about 1.16 maf. Should the Central Arizona Project be authorized at an early date, it is assumed that it would go into operation by 1975. The last report on the Central Arizona Project indicated that its operation would result in a beneficial consumptive use of 1.2 maf per year. This, added to the 1.23 maf for the other projects on the river, results in a total of 2.43 maf, leaving for Arizona a balance of 370,000 af per year to equal the basic 2.8 maf beneficial consumptive use from the main stem apportioned to Arizona. The present studies assume that this remaining 370,000 af of water would either be used on the Central Arizona Project or some place else in Arizona by the year 2000.

It was assumed that uses in Nevada would increase gradually from present uses of 25,000 af per year to 300,000 af per year in the year 2000.

If and when uses in Arizona and Nevada increase to the extent that shortages might occur, it is assumed that California's present beneficial consumptive use would be curtailed to 4.4 maf per year. The time when this curtailment would occur is not known. For the purpose of this study it was assumed that the uses by California would be curtailed to 4.4 maf per year prior to the time storage in Lake Mead would be insufficient to support all downstream main-stem demands without dropping below rated power head.

Depletion Factor

A depletion factor was used to modify the assumed basic depletions by the States of the upper division of the Colorado River Basin. The philosophy of the depletion factor is based on the fact that during periods of low water supply in the Upper Basin all projects in operation will not receive a full water supply. Most of them will not have reservoirs, and some that have reservoirs will not have water in some years to fill those reservoirs. No rational means have been derived for varying the estimated uses by the States of the upper division because of varying water supply. The means used by the U.S. Bureau of Reclamation in its past studies, which it is assumed it is still using, are based on the assumption that the uses would vary from the normal use in a particular year by one-half of the percent that the virgin flow at Lee Ferry in that particular year varies from a long-time average of virgin flow. For the present studies the depletion factor using the U.S.B.R. formula was based on the mean virgin flow for the years 1921 through 1964, except for studies starting in 1906.

River Losses Below Hoover Dam

The Department of Interior in previous studies assumed gross losses below Hoover Dam to be 1.27 maf per year (U.S.I.D. Report on the Southwest Water Plan dated January 1964). The U.S. Bureau of Reclamation has estimated future reductions in waste, salvage of water by channel improvement, salvage of water from phreatophytes and increased drainage return from the Yuma area in the amount of 680,000 af made up of the following items:

	<i>Acre-feet</i>
Reduction in waste of water by operation of Senator Wash Reservoir----	170, 000
Salvage of water by channel improvements-----	190, 000
Salvage of water from phreatophytes-----	100, 000
Increased drainage return from the Yuma area-----	220, 000
Total -----	680, 000

The U.S. Bureau of Reclamation then assumed the net loss of water below Hoover Dam, after the foregoing savings and salvages are effectuated, will be 590,000 af, (1,270,000 af minus 680,000 af). There is no good reason to question the above-mentioned amounts of water estimated to be saved by salvage, drainage, and operation of Senator Wash Reservoir. However, it is believed that the 220,000 af of additional drainage return from the Yuma area cannot be considered as an item in reducing the losses below Hoover Dam, which will reduce the draft on Lake Mead. The 220,000 af does not represent "new water" made available to the Basin, such as the water salvaged because of channel improvements and nonbeneficial consumption by phreatophytes. The 220,000 af is an increment of the original water supply that has been stored in Lake Mead and subsequently diverted by canals out of Lake Mead releases to supply Arizona projects. This amount of water will represent a credit to Arizona and will not in the end reduce the draft on Lake Mead. Therefore the value that is being used in the present studies for net losses below Hoover Dam is 590,000 af plus 220,000 af, or 810,000 af.

The actual amount of water which might be recovered by additional drainage of the Yuma Valley and Yuma Mesa areas is not known at the present time. It is believed, however, that the potential can be as great as 220,000 af. The actual amount recovered may depend somewhat on the outcome of the review of the U.S.I.D. definitive plan for the additional drainage works by the U.S. Commissioner of the International Boundary and Water Commission between the United States and Mexico. Because this item of return flow is not considered in this report as one which brings to the river "new water" thereby decreasing the demand on Lake Mead, whatever the ultimate amount might be will not affect the conclusions reached in this report.

In respect to the Bill Williams River, the U.S. Bureau of Reclamation assumes it will be depleted down to 55,000 af. This amount of inflow below Hoover Dam has been assumed for the purpose of this report.

The above may be compared with the studies made by the Colorado River Board of California which estimates the net losses after accounting for Bill Williams River under present conditions to be 1.2 maf. It estimates a future salvage of 200,000 af, leaving a net loss of 1.0 maf. This spread in difference in estimates of future losses below Hoover Dam is given for information. No one can precisely estimate what such losses will be in the future. They depend on the amount of wastes that can be reduced, and the amount of salvage that can be effectuated by the program that is being carried out by the Department of Interior. For this report, as stated above, 810,000 af has been adopted to represent losses below Hoover Dam after the salvage program has been completed.

Storage in the Basin Reservoir

For the present studies the initial usable content of the Upper Basin reservoirs was assumed to be 3.099 maf and of Lake Mead 16.453 maf, which is the anticipated usable content as of September 30, 1965, including bank storage. Maximum usable capacity of Upper Basin reservoirs was assumed to be 29.0 maf, and 29.25 maf for Lake Mead including bank storage. In addition, 1.2 maf was reserved in Lake Mead for flood control.

The net gain between Lee Ferry and Hoover Dam was phased to correspond to recent estimates by the U.S. Bureau of Reclamation.

For Study No. 3 the Upper Basin depletions, deliveries at Lee Ferry, net gain between Lee Ferry and Hoover and losses from Hoover to Mexico corresponded to those of the Colorado River Board of California.

Studies No. 5 and 23 thru 34 differed from the other studies in that the total maximum Upper Basin reservoir content was assumed to be 32.0 maf and the depletion factor was unity. This assumed all existing reservoirs in the Upper Basin and the reservoirs of the Upper Colorado River Storage Project would operate more or less as a unit to make available water to the Upper Basin consumptive-use projects, and to enable the States of the upper division to make the required deliveries at Lee Ferry.

Results of the Studies

Upper Basin

To determine the amount of maximum depletion (beneficial consumptive use) under the terms of the Colorado River Compact that can be made by the States of the upper division of the Colorado River Basin, river and reservoir operation studies were made for the period 1903 through 1964 and for the period 1921 through 1964 to determine the relationship between required storage capacity and depletion. In the studies various amounts of depletion were assumed ranging from 3.0 maf per year to 6.79 maf per year. The results of the studies for the two study periods were identical.

Two sets of studies were made, one assuming an annual delivery at Lee Ferry at 8.25 maf and the other assuming an annual delivery at Lee Ferry at 7.50 maf. The following table indicates the results of these studies. The results are depicted graphically on the two curves shown in Figures 1 and 2. The detailed operation studies are given in Appendix C.

Even with an annual delivery at Lee Ferry of only 7.50 maf, to attain the total beneficial consumptive use (7.5 maf) allocated to the Upper Basin by the Colorado River Compact would require over 72.0 maf of active storage. This storage potential does not exist. It should be noted also that if it did exist, about 1.4 maf of depletion would be because of evaporation from the storage reservoirs, leaving a net of 6.0 maf for beneficial consumptive use by projects within the basin.

Storage capacity and Upper Basin depletions

[All values in thousand acre-feet]

Regulated firm flow	Required storage	Estimated evaporation	Available upper basin depletions for annual deliveries at Lee Ferry of—			
			8,250		7,500	
			Total	Net	Total	Net
11,250	6,766	250	3,000	2,750	3,750	3,500
12,250	10,766	350	4,000	3,650	4,750	4,400
13,250	20,388	550	5,000	4,450	5,750	5,200
13,961	35,370	820	5,701	4,881	6,451	5,631
14,250	45,586	980	6,000	5,020	6,750	5,770
15,040	72,551	1,380	6,790	5,410	7,540	6,160

¹ Mean virgin flow, 1921-64.

² Mean virgin flow, 1903-64.

In 18 of the 34 studies, details of which are continued in Appendix B, assumed future depletions (beneficial consumptive uses) were those estimated by the four States of the upper division. These studies all show an impossible situation; before the end of the study period in each case, beneficial consumptive uses would begin to be encroached upon and in some cases all such uses would be essentially extinguished to satisfy the Colorado River Compact provision that depletions at Lee Ferry shall not exceed 75 maf in successive 10-year periods. The studies were made and their results presented, by design, to show the danger of overdevelopment with present water supplies, and to demonstrate dramatically the results of those studies which are shown on figures 1 and 2, Upper Basin Depletion vs. Required Reservoir Capacity.

If credit for deliveries above 7.5 maf per year at Lee Ferry were taken, in no case would more than one year be gained before encroachment on beneficial consumptive uses would commence.

Lower Basin

It has been pointed out that the most important factor affecting the water supplies of the main stem of the Colorado River in the Lower Basin is the amount

of water passing Lee Ferry from the Upper Basin. A certain amount, in addition to the Compact obligation of 75 maf in successive 10-year periods, will be required to be delivered out of Lake Powell for a period of time to generate sufficient energy, the sale of which will be relied upon to aid in the financing of additional projects in the States of the upper division of the Colorado River Basin. One series of studies contemplated a delivery of 8.25 maf per annum at Lee Ferry. It is understood that the Secretary of Interior and some engineers of the U.S. Bureau of Reclamation consider the release of such an amount of water through the power plants at Glen Canyon Dam to be sufficient to provide funds for substantial additional development in the Upper Basin. Another series of studies was made assuming a release of 8.75 maf per annum from Lake Powell.

It is assumed such a release would be more than adequate to provide funds through the sale of electric energy to aid in the financing of additional projects in the Upper Colorado River Basin.

In one group of studies the depletion schedule of future Upper Basin development as assumed by the U.S. Department of Interior (U.S.I.D.) was used; in another set the depletion schedule as estimated by the States of the upper division of the Colorado River Basin was used. In each set of studies three conditions of drawdown of Lake Mead were assumed; the first was a drawdown which would result in 16.453 maf remaining in storage as representing the rated power head. The second assumed a drawdown which would leave in storage 8.0 maf which is the minimum content at which the present intake for the City of Las Vegas, Nevada, could be supplied. The third condition of drawdown assumed Lake Mead would be depleted to absolute dead storage.

Two study periods were assumed for the above series of studies; first, the study period 1914 through 1964, and second, the study period 1921 through 1964. For the study period 1914 through 1964, 32.0 maf of storage capacity was assumed in the Upper Basin and a depletion factor of unity was assumed.

Tables No. 1 and 2 attached hereto indicate the results of the two sets of studies described above.

CONCLUSIONS

Upper Basin

If it is assumed that the operating capacity of the Upper Colorado River Storage Project is 29.0 maf, and if the delivery at Lee Ferry amounted to 7.5 maf per year, the depletions (beneficial consumptive use) in the States of the upper division of the Colorado River Basin would be limited to 6.3 maf per annum. The net depletion, excluding evaporation from the reservoirs of the Upper Colorado River Storage Project, would be 5.6 maf. If deliveries at Lee Ferry were 8.25 maf per year, the limit of depletions in the States of the upper division would be 5.6 maf including reservoir evaporation, and a net of 4.7 maf excluding reservoir evaporation.

With a storage capacity of 32.0 maf, as assumed by some, the limitation on the net depletion (beneficial consumptive use) in the States of the upper division, excluding evaporation from the reservoirs of the Upper Colorado River Storage Project, with a delivery at Lee Ferry of 7.5 maf per year would be about 5.6 maf per year, and would be 4.8 maf per year if the delivery at Lee Ferry were 8.25 maf per year.

Without importation of water, and such modifications in the required delivery of water at Lee Ferry as would be necessary for the Upper Basin to benefit from the importation of water, it is assumed that the total net beneficial consumptive use in the States of the upper division cannot be more than 5.6 maf per year, and might not be more than 4.8 maf per year.

The addition of more reservoir capacity than will be provided by the existing and authorized units of the Upper Colorado River Storage Project would not materially increase these depletions. The obvious means for enabling the States of the upper division to make a beneficial consumptive use of 7.5 maf per year allocated to them by the Colorado River Compact (less 50,000 af allocated to Arizona by the Upper Colorado River Compact), or even greater amounts, is the importation of water from areas of surplus.

Lower Basin

What the actual future depletion will be in the States of the upper division of the Colorado River Basin is not known. The present studies were based on two future depletion schedules, one as estimated by the U.S. Department of Interior (U.S.I.D.), and the other as estimated by the States of the upper division of the Colorado River Basin. The studies indicate plainly that the

latter schedule of depletions cannot be attained with the available water supply. It is believed, therefore, that the true schedule of future depletions will lie somewhere between these two estimates. Releases from Lake Powell for the purpose of generating energy probably will be somewhere between 8.25 maf per year and 8.75 maf per year. These are in excess of that required by the Compact.

It is concluded from the results of the studies summarized in Tables No. 1 and 2 that shortages of water in the main stem of the Colorado River to supply 2.8 maf for beneficial consumptive use in Arizona and up to 4.4 maf for beneficial consumptive use in California, and 0.3 maf of beneficial consumptive use in Nevada plus 1.5 maf to Mexico will amount to well over one million af by the year 2000. The shortage could materially exceed 1.5 maf by that year. It is concluded that shortages could commence by the year 1991 and in no case would they start later than 1995 under the conditions shown in Tables No. 1 and 2.

The same general conclusions as to the shortage by the year 2000 are indicated from the results of the studies covering the period 1906 through 1965 (estimated). See Studies Numbers 21 and 22 in Appendix B.

The only exception to the above would be if Lake Mead were completely drained to absolute dead storage. Under this condition substantial shortages for the Lower Basin beneficial uses would occur sometime after the year 2000, after which they would be as severe as those indicated in Tables No. 1 and 2, and Studies 21 and 22 of Appendix B.

The beneficial consumptive use of main stem Colorado River water as made at the present time by California is something over 5.0 maf. In the studies it was assumed that California would continue this level of use until it became fairly imminent that the contents of Lake Mead, because of releases for consumptive-use purposes, would approach rated power head. It was assumed that at this point the uses by California would be cut back to 4.4 maf. Some have taken the position that this cutback should be made at the time the Central Arizona Project would go into operation, which is estimated to be about the year 1975 if the project is authorized at an early date and is expeditiously constructed. It is not considered that this position is a sound one.

Under each of the studies from which these conclusions have been derived, deliveries at Lee Ferry of amounts greater than the 75 maf in successive 10-year periods as required by the Compact, have been made. The excess amount of water is more than sufficient under the assumptions made for the studies to supply the amount which California now is using in excess of 4.4 maf. Even if California were cut back to 4.4 maf in 1975, the studies indicate the shortage in the Lower Basin would be substantially greater than one million acre-feet in the year 2000, if the rated power head at Lake Mead is to be maintained.

While the Colorado River Compact by its terms makes the generation of power subservient to the consumptive use of Colorado River water for agricultural and domestic purposes, there arises the question as to whether it would be possible and practicable to deplete storage in Lake Mead to the point that no power could be generated. Power contracts with the Secretary of Interior exist, and many industries and municipalities now are dependent upon the power generated at Hoover Dam. This poses a question that probably cannot be answered at this time.

However, it would appear that it might be unwise at this time to authorize a new project for use of substantial amounts of water from the main stem of the Colorado River in the Lower Basin when a study of stream-flow records discloses that the requirements for such a project might cause the depletion of Lake Mead below the level where it could generate power. Even then, there would be no assurance that water would be available to the project if storage in Lake Mead were entirely depleted to absolute dead storage. At that time the only water available would be the amount released at Lee Ferry plus accretions to the river between Lee Ferry and Hoover Dam. This would fall far short of enough water to sustain present uses and the new development. Otherwise the assumption would have to be made that after Lake Mead had been depleted to absolute dead storage it would rapidly fill by a succession of years of good runoff. It is considered that such an assumption is not warranted.

Finally, it would be fair to conclude that the authorization of projects in the Lower Colorado River Basin which would utilize substantial additional quantities of water would be unwise at this time unless at the same time a project, or projects, for the importation of substantial amounts of water from sources of surplus are authorized.

TABLE 1.—*Shortages to California, Arizona, and Nevada based on study period 1914-64*
 [Depletion factor equals 1 and maximum upper basin reservoir content equals 32 million acre-feet]

	U.S. Department of the Interior depletion schedule				States of the upper division depletion schedule			
	Lee Ferry delivery equals 8.25 million acre-feet		Lee Ferry delivery equals 8.75 million acre-feet		Lee Ferry delivery equals 8.25 million acre-feet		Lee Ferry delivery equals 8.75 million acre-feet	
Minimum Lake Mead.....	16.453	8	0	16.453	8	0	16.453	8
Content (million acre-feet)...								
Study year:								
1966.....								
1967.....								
1968.....								
1969.....								
1970.....								
1971.....								
1972.....								
1973.....								
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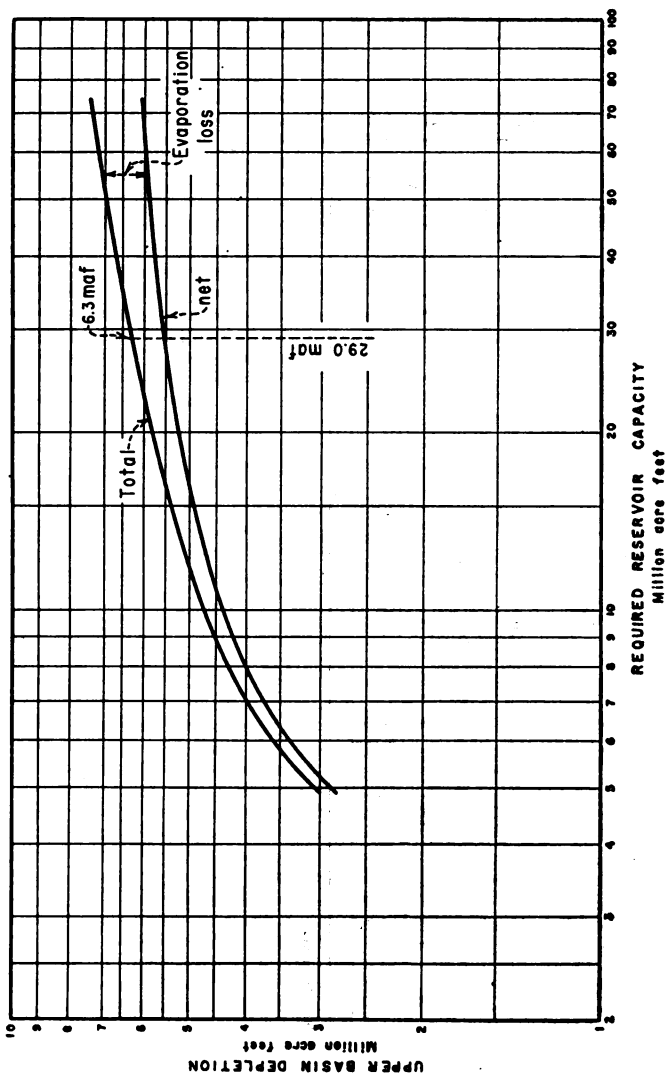
TABLE 2.—Shortages to California, Arizona, and Nevada based on 1921-84 period

	U.S. Department of the Interior depletion schedule				States of the upper division depletion schedule			
	Lee Ferry delivery equals 8.25 million acre-feet				Lee Ferry delivery equals 8.26 million acre-feet			
Minimum Lake Mead.....	16.453	8	0		16.453	8	0	Lee Ferry delivery equals 8.75 million acre-feet
Content (million acre-feet) --								
Study year:								
1952.....	16.453	8	0		16.453	8	0	16.453
1957.....	16.453	8	0		16.453	8	0	16.453
1962.....	16.453	8	0		16.453	8	0	16.453
1967.....	16.453	8	0		16.453	8	0	16.453
1968.....	16.453	8	0		16.453	8	0	16.453
1969.....	16.453	8	0		16.453	8	0	16.453
1970.....	16.453	8	0		16.453	8	0	16.453
1971.....	16.453	8	0		16.453	8	0	16.453
1972.....	16.453	8	0		16.453	8	0	16.453
1973.....	16.453	8	0		16.453	8	0	16.453
1974.....	16.453	8	0		16.453	8	0	16.453
1975.....	16.453	8	0		16.453	8	0	16.453
1976.....	16.453	8	0		16.453	8	0	16.453
1977.....	16.453	8	0		16.453	8	0	16.453
1978.....	16.453	8	0		16.453	8	0	16.453
1979.....	16.453	8	0		16.453	8	0	16.453
1980.....	16.453	8	0		16.453	8	0	16.453
1981.....	16.453	8	0		16.453	8	0	16.453

1982	452	1,150	1,205	1,247	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1983	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1984	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1985	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1986	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1987	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1988	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1989	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1990	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1991	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1992	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1993	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1994	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1995	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1996	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1997	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1998	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
1999	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2000	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2001	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2002	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2003	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2004	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2005	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2006	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2007	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2008	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592
2009	1,150	1,205	1,247	0	0	0	0	806	1,429	1,446	1,433	564	564	1,515	0	0	813	1,583	1,584	1,585	1,586	1,587	1,588	1,589	1,590	1,591	1,592

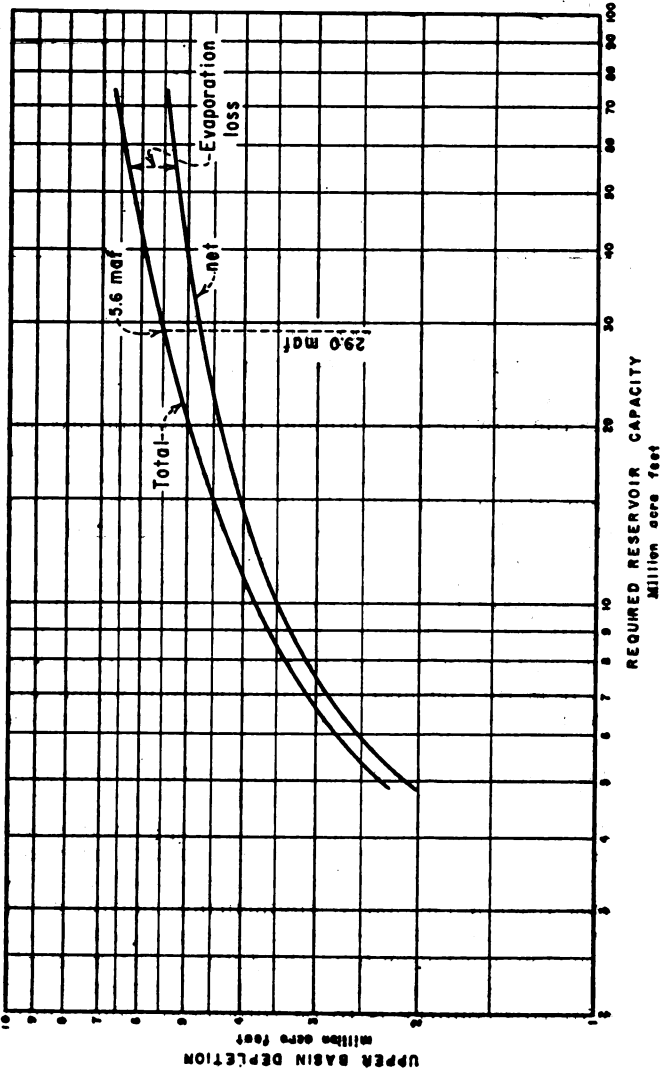
NOTE.—Shortages in 1,000 acre-feet.

FIGURE 1



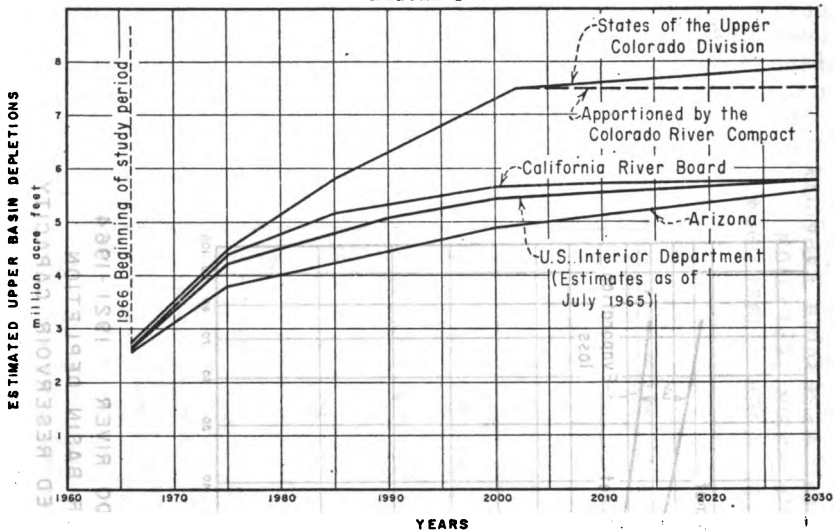
COLORADO RIVER 1921-1964
 UPPER BASIN DEPLETION
 VS. REQUIRED RESERVOIR CAPACITY
 7,500 maf DELIVERY, AT LEE FERRY

Figure 2



COLORADO RIVER 1921-1964
UPPER BASIN DEPLETION
VS. REQUIRED RESERVOIR CAPACITY
8,250 mcf DELIVERY AT LEE FERRY

FIGURE 3



ESTIMATES OF UPPER BASIN DEPLETIONS

Governor LOVE. Thank you very much.

For over 50 years the flow of the Colorado River and the uses made therefrom have been continuously analyzed by a succession of competent engineers and hydrologists in both basins. The conclusion is inescapable that the flow of the Colorado River is insufficient to support the present compact and treaty obligations, not to mention the additional demands which will occur in the next half century.

In the Upper Basin we now have projects in operation, construction or under planning, which would utilize all water available to us under the compact allocations. The situation is the same in the Lower Basin, or even more so. If there is any one thing that the seven States have agreed upon, it is for the necessity for planning which would lead to the future augmentation of the currently available water supplies.

At this time we do not know from what source such future supplies may be obtained. They will never be obtained, however, by merely authorizing projects which will only deplete those supplies now available. We are not in a position to decide whether desalinization, weather modification, importation, or any combination thereof will eventually prove to be the most feasible method of augmenting southwest water supplies. We ask only that all possible alternatives be explored so that some intelligent decision can be made in the future. The strength of our American civilization is based upon this kind of future planning.

If any segment of this country is to be foreclosed from studying the use of any natural resource which is the heritage of all the American people, then we believe that issue should now be joined.

Previously we supported the State of Arizona in recommending the construction of the Hualapai and Marble Canyon Dams. We agree with Arizona that the revenues which would be produced from the hydroelectric generating facilities proposed to be installed at those dams were essential to assist in the repayment of the central Arizona project and to provide for a development fund which would assist in the augmentation of the Southwest water supplies. Our opinion has

not changed. However, in an attempt to compromise with conflicting views, we have modified our position to recommend the elimination of the Marble Canyon Dam. We cannot modify our position, however, on the Hualapai Dam. The one hope that we can hold out to our people is that by the authorization of the Colorado River Basin project a fund will be created which will assist in the future augmentation of the Colorado River, from whatever source.

A proposal has been made to this committee by the Los Angeles Department of Water and Power which we believe would greatly enhance both the power production and subsequent revenues from the proposed Hualapai Dam and powerplant. We fully support the proposal made by Mr. Floyd L. Goss of Los Angeles and we urge that his proposal be incorporated into the pending legislation. We believe that his proposal, together with pending legislation which would revise and extend the boundaries of the Grand Canyon National Park, is a sensible and fair solution to a most difficult problem. We in Colorado will never concede that the energy produced by the falling water of the Colorado River should be wasted.

Several years of most exhausting and difficult negotiations have gone into the preparation of the language contained in S. 861, S. 1242, and S. 1409. The three bills do not differ in any material respects. None of these bills provide an immediate solution to all of the water problems of the Colorado River States. None of them contain the maximum demands of any State. They do, however, represent realistic compromises which each State should be able to support. Certain minimum provisions contained in the bills mentioned were inserted for the benefit of the State of California. Colorado supports those provisions. Whether, however, there are provisions for California, Arizona, or any other State, as contained in the three pieces of legislation, they are supported by Colorado as being an inseparable part of a single package.

Senators Allott and Dominick, through S. 1242, have expressed the position of the State of Colorado in a manner which has the complete support of our State government and of our entire congressional delegation. While there are some minor differences contained in S. 861 by Senator Kuchel and S. 1409 by Senator Moss, those differences can be easily resolved. We cannot under any circumstances support S. 1004 and S. 1013 as they are presently written.

I wish to assure the distinguished Senators from Arizona that we wish to see the central Arizona project authorized and constructed. We see nothing in the conditions that we have requested that would make that impossible. It is impossible, however, for Colorado or any other basin State to be of assistance when Arizona proposes one type of authorization in the Senate and another in the House. Under such circumstances it is probable that we all shall fail.

Gentlemen, you have been most patient in listening to Colorado's side of the pending legislation. We fully realize that the enactment of any Federal legislation is the sole responsibility of the U.S. Congress. My responsibility is to present the official view of the State of Colorado. I respect the opportunity to do so and can only hope that our views will receive full consideration during your deliberations on this legislation.

Thank you very much.

Senator ANDERSON. On page 14 you say:

We cannot under any circumstances support S. 1004 and S. 1013 as they are presently written.

This is Senator Hayden's bill that is before the committee. Is there any particular feature that makes it unattractive to you?

Governor LOVE. The reason for that firm statement, Senator, is that we in Colorado, after many negotiations, many meetings to consider this proposed central Arizona project, arrived at a Colorado position.

We said fine, but it must include those four principles that I have indicated. These bills do not include, of course, the immediate beginning on some sort of investigation, whether we call it reconnaissance or feasibility study, about augmentation of the water of the basin. They also do not include, as I understand it, the five Colorado projects which we feel are a necessary part of this legislation.

Senator ANDERSON. If the five Colorado projects were put in the bill, would that lessen your opposition?

Governor LOVE. It would perhaps lessen the opposition, but certainly I would stand by my statement that as far as Colorado's position, a bill which we would support must have the four approaches that I have heretofore stated.

Senator ANDERSON. We get into discussion sometimes as to how far the committee can go. Senator Allott.

Senator ALLOTT. Thank you very much, Mr. Chairman.

Governor, thank you very much for a very fine statement. It presents the views of Colorado in the same substance, the same context of the statement that I gave when these hearings were opened. I would like to first ask you on the material contained on page 4 of your statement. It touches the question that our distinguished chairman of the subcommittee just asked you concerning a breach of faith or by what means Colorado's position has been arrived at.

You mentioned the fact that one bill has been introduced in the House of Representatives by a Representative from Arizona, which contains the four principles which you stated were necessary. The inclusion of the more specific four principles were arrived at as I understand it from you, by not just a series of conferences but almost endless conferences between you and other Governors and other water officials and power officials, and Mr. Eckles, who is sitting there to your right, Mr. Sparks, our former great Governor, Ed Johnson, and many others, and after these many, many conferences, extending over a number of years, you feel that we arrived at an agreement with the principles and the people of the various States which constituted a joint plan of action for the development of the southwest area; is that correct?

Governor LOVE. That is correct, Senator. I certainly would emphasize that it has been a lengthy, lengthy series of meetings, and that the agreement reached represented compromises on the part of, I think, each of the States.

Senator ALLOTT. So that as in any other agreement, no matter what it is, everyone gave up something as a basis to arrive at a common ground, and upon the basis of that, you feel and our water conservation board feels that we have in effect agreed that this is what we will do.

This is the basis upon which you make the statement, but to urge their passage, referring to S. 1004 and S. 1013, would be a breach of faith on the part of Colorado.

Governor LOVE. I would think so, yes. To make it abundantly clear, I think it would be a breach of faith if we came in at this time and

simply asked for legislation for our five Colorado projects, with the operating criteria on Glen Canyon, and left out, for example, the central Arizona project. It is part and parcel of the whole package, as I have tried to stress here, that we support.

Senator ALLOTT. I have tried to express previously here, Governor, our concern and our desire to see the central Arizona project developed, but I have also tried to express our concern that every State in the basin, particularly those in the Upper Basin, also are enabled to do this.

Now, with respect to your statement on page 5, about the share of the water of the Upper Basin States, it is a fact, is it not, the Colorado contributes over 70 percent of the water accruing in the Colorado River above Lee Ferry.

Governor LOVE. Above Lee Ferry, that is true, taking into consideration those States or portions of States which are a part of the Upper Basin, and looking at the contribution each makes. Colorado produces and contributes to the river at Lee Ferry something a little bit over 70 percent of the virgin flow.

Senator ALLOTT. I have before me an excerpt from volume III of the official record of the Upper Colorado River Basin Compact Commission Engineering Advisory Committee Report, which indicates the estimated virgin flow contribution of all the States in the basin, or all the States including Arizona, but not including Nevada.

This shows Colorado's contribution as 70.14. Mr. Chairman, I would like to ask that this be included in the record at this time.

Senator ANDERSON. Without objection it will be done.

(The excerpt referred to follows:)

Virgin flow contribution

State	At Lee Ferry, Ariz.	Percent
Arizona.....	136,200	0.87
Colorado.....	10,968,900	70.14
New Mexico.....	247,900	1.58
Utah.....	2,561,100	16.38
Wyoming.....	1,724,400	11.63
Total.....	15,638,500	100.00

Source: Vol. III, official record of Upper Colorado River Basin Compact Commission Engineering Advisory Committee report; based on records 1914-45 used by compact commissioners.

Senator ALLOTT. Governor, we have had various testimony here with respect to the amount that Colorado has been able to utilize of the waters apportioned to it under the various compacts on the upper Colorado River project. You are acquainted, of course, with the Tipton report, to which you referred and which has been placed in the record, which estimates that there would be 6.3 million acre-feet available for diversion in the Upper Basin?

Governor LOVE. Yes; I am familiar with that.

Senator ALLOTT. And of course, Colorado's share of that is 51.75 percent, which would be 3,234,375 acre-feet.

Governor LOVE. Yes; I am familiar with that, but let me also make a caveat reservation, and so on. By being familiar with it, I don't at this time necessarily agree that the Upper Basin's share is less than 7.5 million acre-feet of consumptive use.

Senator ALLOTT. I understand that. This is based upon an engineering study of possible availability. None of us in the Upper Basin States would ever concede that there was less than that available for us. I

have before me a study made by the Upper Colorado River Commission, and this shows the present depletions of the Yampa and Green Rivers, the Hayden steam plant, White River, projects on the Gunnison River, those on the Colorado River, and the San Juan and Dolores Rivers to be a total of 1,786,000 feet.

Governor LOVE. Yes; those are the present depletions that are actually being used in the State of Colorado.

Senator ALLOTT. Colorado has had authorized by the Federal Government the Savery-Pot Hook for 26,000 acre-feet, the Bostwick Park, for 4,000, Fruitland Mesa for 28,000, Fryingspan-Arkansas for 70,000, the Ruedi Reservoir for 6,000, the Silt for 6,000, which adds up to an additional 180,000 acre-feet, and I have added to that the main stream reservoir evaporation of 342,000 feet, which with the present depletions and these authorized Federal projects to which I have referred totaling 482,000 acre-feet would bring the total depletions, with the new authorizations, up to 2,268,000 acre-feet. Are you in accord with those figures?

Governor LOVE. Yes. I believe those figures to be accurate, and to represent the total of the present depletions, the federally authorized projects which are not now constructed and completed, plus the main stream evaporation that you mentioned.

Senator ALLOTT. I might say that this particular document from which I am taking these figures has been introduced into the record, Governor, the first day, so it is a part of the record.

I am going to skip the third item in there for a moment, and go on to item four, which is the proposed authorization under H.R. 4671, which is sponsored by the Representatives of the State of Arizona and sponsored by many others. This shows the depletions of the Animas-La Plata in which my good friend from New Mexico is interested, of 106,000 acre-feet, the Dolores of 74,000, the Dallas Creek of 37,000, the West Divide 76,000, San Miguel 85,000, totaling 378,000 acre-feet.

Governor LOVE. Yes. These are the proposed five Colorado projects which, as you say, would provide for a consumptive use of less than 400,000 acre-feet, 378,000 to be exact, which together with the other figures indicates that we are well below the apportioned amount under the Upper Basin compact.

Senator ALLOTT. Now there is in this same document an item three, which I said I would return to, and this is entitled "Probable Future Depletions" which includes an expansion of the Hayden steamplant—I think I don't need to comment any further about the present status of that situation—The Homestake, Pueblo, Eagle, Denver, Blue, et cetera. The total of these probable future depletions is 346,000 acre-feet, but I would like to ask you, in order that we do not misunderstand the nature of these probable future depletions, these are not present depletions?

Governor LOVE. These are not present depletions.

Senator ALLOTT. They are not authorized depletions.

Governor LOVE. They are not authorized, no.

Senator ALLOTT. And they could only occur after the five projects which have been given priority by the Colorado Water Conservation Board are completed and in operation.

Governor LOVE. I would like to add that they represent nothing more than estimates of something that might occur, and I would like to further add that even if they did occur, even if they do occur, when you add them to the present depletions, the authorized projects, and

the proposed H.R. 4671 projects, we still, in total usage in the State of Colorado, are well below the amount of water apportioned to the State under the Upper Colorado River compact.

Senator ALLOTT. I was coming to that. The total then of the present depletions in the authorized projects plus the five projects in this bill, and even considering possible future use would be 2,992,000 acre-feet.

Governor LOVE. This is correct.

Senator ALLOTT. As compared with a 3,234,375 acre-feet entitlement based not on what we claim in the river, but based upon the 6.3, the very conservative estimate of 6.3 million acre-feet availability as contained in the Tipton report.

Governor LOVE. That is right.

Senator ALLOTT. Mr. Sparks, I saw you looking. Did you have something you wanted to add?

Mr. SPARKS. No, sir, you are doing fine.

Senator KUCHEL. I think it is noteworthy, Governor, to point out Colorado has tried to develop its water, and you pointed out that we had actually participated in studies and planning with the Federal Government and contributed to the Federal Government \$200,000, and had spent an equal amount ourselves on these projects.

Governor LOVE. That is right.

Senator KUCHEL. And do you hold yourself in accord, as I think you do, on page 7, but I want to make it fully clear, that Colorado holds itself ready, and you say:

We intend to fully support in the future as we have in the past those projects in other states which are necessary to insure them their full share of water.

Governor LOVE. This is certainly true, and I think it can be said without fear of contradiction that we have in the past supported the other States in the participating projects, and in development of water which is allotted to them under the Colorado River compact. I think that this is true about the central Arizona project. It is true about the Utah developments. It will be true in the future, and we intend to do everything we can to assist our sister States in their proper use of water which is properly their's under the compact.

Senator KUCHEL. I am referring to page 528 of the House hearings upon H.R. 3800 and similar bills, and in there the statement was made by the chairman of the committee to which you assented, and I quote:

In other words, the combined authorization of the Colorado Storage Act, and those since its passage are to Colorado 162,000 acre-feet—

Bear in mind these are authorizations—

to Utah 225,000 acre-feet, to Wyoming 199,000 acre-feet, to New Mexico 374,000 acre-feet, and this compares with Colorado's entitlement under the various compacts and agreements of 51.75 percent—

which is greater of course than the rest of those combined.

Now this illustrates, does it not, that under the Colorado River Storage Act, that the amount of authorizations in Colorado are less today than any other State in the Upper Basin?

Governor LOVE. That is true. The authorizations we have had to date are less than any of the Upper Basin States, and again it is as you have said contrasted with the fact that we in our entitlement are entitled to more than all of the other Upper Basin States combined.

Senator KUCHEL. I would like to underscore one other thing contained on page 9 of your statement, in which you refer to the Arizona and California situation, and make our position extremely clear. It is a

fact, is it not, Governor, that Colorado was not a party to that Supreme Court proceeding?

Governor LOVE. That is right, we were not a party. As you know, the Upper Basin States were successful by agreement, by compact, in dividing the water of the Upper Basin between the various States. This was not true in the Lower Basin, and the lawsuit, *Arizona v. California*, dealt with the division of water below Lee Ferry, and we were not a party nor do we feel that we were bound by provisions of that decision.

Senator KUCHEL. Now with respect to your statement that Colorado does not feel that the energy available from falling water in the river should be wasted, it was testified to among many, many other things by the Secretary of the Interior the other day that the feasibility of the central Arizona project should be demonstrated with a thermal plant at Page. Now would it not be a fact that if we could develop the energy available at the Hualapai Dam, and consider as you have suggested the Goss plan, which I have provided for this amendment to my own bill and that of Senator Dominick, that this could result, (1) in an accelerated payout on the central Arizona and (2) result ultimately in a much less cost or a lesser cost I should perhaps say of water to the people utilizing water under the central Arizona project.

Governor LOVE. I believe that to be true, Senator, but I also believe, as far as the basin is concerned, all of the States in the Colorado River Basin, it is important that this basin fund be instituted.

Senator KUCHEL. Governor, I want to thank you for a very fine statement. Do you have anything else?

Governor LOVE. I think not. Thank you very much, Senator.

Senator ANDERSON. The reason I asked about the four principles, is because there have been people who have suggested that it might be possible to reconcile the bills so they would be satisfactory to all of the people in the West. I am sure you know that the bill was reported to the House last year but did not pass. I think they knew that it would not pass. I may be wrong. I am only trying to say to you that where you insist on these four principles, one of which is return to the credit of the States of the Upper Division those funds that heretofore have or may be contemplated in the future power of the Hoover Dam, it might be possible, with compromise legislation, that these could be taken into consideration.

Let us hope that you will think this matter over. I am not asking you to change it, but we might find some sort of solution in which the Western States could all agree, and Colorado would have adequate protection. I am sure you will want to look at this very carefully.

Governor LOVE. That has certainly been our intent. We worked hard to attempt to arrive at a position on which at least the Colorado River Basin States could all agree and we believed in H.R. 4671 that we had such a position, in which each of the States had agreed that this properly served their interests without violating other States interests.

Senator ANDERSON. I only realize that the gentleman who sits to my right, Senator Hayden, is and has been for a long time a very important member of the Senate.

Governor LOVE. I understand.

Senator ANDERSON. And the chairman of the full committee, Senator Jackson, has some strong views. We might find some ways of harmonizing these views. I am only urging you not to be too firm on this.

Senator Jordan?

Senator JORDAN. Thank you, Mr. Chairman.

Governor LOVE, I want to welcome you to the committee and congratulate you on a very fine statement. I share the concern that our chairman expressed. Residing in the Colorado River Basin, I am hopeful that we can come out of this committee with a piece of legislation we can all support, something that will be meaningful and that can go forward without doing violence to any of the rights of the basin States.

On page 13 of your statement, you were talking about, at the top of the page—

On the Colorado Basin project a fund will be created which will assist in the future augmentation of the Colorado River from whatever source.

This is a fund from the construction of the Hualapai Dam. Do you have any idea what the amount of that addition to the fund might be over a period of years, Governor?

Governor LOVE. I can consult with Mr. Sparks here for a moment. I don't have the exact figures, but it would be my understanding that the proceeds from the sale of power from Hualapai Dam would first be used, a large part at least, to retire the payment of some of the cost of the central Arizona project, but it would also contemplate, over a period of time, the accumulation of a fund for this purpose.

Do you have any exact figures on that?

Mr. SPARKS. It depends on the negotiated price of power, but Hualapai could produce anywhere from \$1 to \$2 billion.

Senator JORDAN. Yes. In the House hearings in the colloquy between Chairman Aspinall and Secretary Udall and Mr. Dominy, the question was put by Chairman Aspinall:

Assuming the year 2025 which is a reasonable period within the consideration of the project now under study with a 50 year repayment program, do you know what the contribution of the Hualapai Dam and power facilities would be to the overall economy with power prices as they are at the present time?

Secretary Udall said: "Yes, we do."

Mr. Dominy supplied the figures:

Its contribution to the development fund would be \$370 million, Mr. Chairman, by the year 2025.

Mr. SPARKS. Sir, this is based upon the Secretary's original plan and does not incorporate the Goss proposal. That is correct.

Senator JORDAN. I didn't get that last?

Mr. SPARKS. It does not incorporate the Los Angeles proposal. Those figures were based upon the original Secretary's plan.

Senator JORDAN. Then he goes on to say—Mr. Aspinall asks this question:

What would the figure be for the contribution of Hualapai and these facilities plus the funds that could be realized from Hoover, Parker and Davis?

Mr. DOMINY. That would accumulate by the year 2025 a surplus in the development fund of \$768,166,000.

In other words, using the figures that they were using here, one might assume that the funds from Hoover, Parker, and Davis might contribute some \$400 million by the year 2025. Is that in line with your figuring?

Governor LOVE. I believe that is in line with my understanding.

Senator JORDAN. Tell me, do the Upper Basin States have an arrangement by which they would participate in any funds that might accrue from power revenues from Hoover, Parker, and Davis?

Governor LOVE. No, those are, of course, Lower Basin facilities, but it is also true that the Lower Basin States obviously have an interest in augmentation at least as important as the Upper Basin States.

Senator JORDAN. But as you have testified, even though your State contributes 70 percent of the virgin flow of the Colorado River, yet you do not participate in the revenues from the power production of Hoover, Parker, and Davis Dams.

Governor LOVE. No, as a matter of fact, we don't participate, and as we have also pointed out in the testimony, beyond that they took some of the money away from the Upper Basin fund in order to somehow equalize the power loss at Hoover while we are filling Glen Canyon.

Senator JORDAN. I don't want to inject myself in a controversy between the Upper Basin and the Lower Basin, but it seems to me you have good grounds for claiming a share of those power revenues from the downstream plants as is done in the Columbia Basin, and as the Secretary himself recommended in his testimony before the committee the other day I believe.

Governor LOVE. I appreciate the suggestion. We of course have been grateful for the act of Congress which allowed the Upper Basin fund to be created with the Storage Project Act, which has been a major help or will be a major help in the construction of the participating projects in the Upper Basin. That 70-percent figure of course, Senator, has to do with the amount of virgin flow at Lee Ferry. There is, of course, water produced below Lee Ferry too.

Senator JORDAN. Yes.

Governor LOVE. Which is not originating in Colorado.

Senator JORDAN. Well, this gets into big money. Going on with the colloquy between Chairman Aspinall and Mr. Dominy, Mr. Aspinall said:

All right then, what are the monetary benefits over the years 2047 which is the year I am using Hualapai in the power facilities?

Mr. DOMINY. That would be \$845,300,000 of development plans.

Mr. ASPINALL. What would be the benefit for Hualapai dam and power facilities plus the contributions to the development fund of Parker, Hoover, and Davis?

Mr. DOMINY. That would be \$1,849,000.

In other words, we are talking about a contribution of over \$1 billion by these downstream facilities.

Governor LOVE. That is right.

Senator JORDAN. Coming from the Columbia Basin as I do, and we have been told that the construction of Hualapai Dam would be pointing a gun at the Columbia River, it seems to me that other revenue sources might be available to you if you were participants in a basin account downstream and the power revenues from these Federal revenue constructed projects that draw so heavily on your watershed.

Governor LOVE. If I may comment on the kind of background that is implied of a "gun at the Columbia River" and so on, the thing that we are asking basically is that some investigation be made. None of us in this room, or, as far as I know, anywhere in the United States, know what the feasibility of any kind of importation out of the Columbia River Basin or any other basin would be.

We believe it is true that you compare the Colorado River with some, maybe 15 million acre-feet a year, and I understand that the Columbia

deposits in the ocean something 10 times that amount annually, something perhaps over 150 million acre-feet a year. Certainly I know that in talking to Senator Hatfield when he was Governor of Oregon, and to other Governors of the West, we have all agreed that it is not our intent or desire, or proper or appropriate that we point a gun at anybody's head.

I know that Oregon has been looking very closely at its water needs of the future. A study has been instituted and I don't believe it is yet finished. We don't ask for authorization for a diversion from the Columbia River. We think, however, sensibly in looking down the line we should know a little more about it, whether it is feasible and what the needs are and what could conceivably be done without our needing water from your State or Washington or Oregon.

Senator JORDAN. Yes. As a matter of fact, I made a statement a couple of years ago that drew a lot of fire from my own part of the country when I suggested that a study might be made.

A study will be made under the National Water Commission Act, I hope, if we get it through the House; it should be made throughout the whole country to assess the water supply against the water needs of all of the basins in the United States. And I think this would be a step forward and that is what I have in mind when I make that suggestion.

Turning to another matter, the Secretary, when he appeared before the committee the other day, Secretary Udall, was very optimistic about the possibilities of a real water supply from weather modification. In answer to a question I propounded to him, in effect, why do you talk about water importations at \$65 an acre-foot say from northern California, and possibly more from the Columbia, when by his own statement water could be made available in quantity at the right time and place by weather modification at \$1 an acre-foot. I asked him in point of time what are we talking about here, and he said 8 to 10 years, and he seemed very sure that that was a reality. Do you share that optimism, Governor?

Governor LOVE. I would be at a loss to put any time limit on the time element involved, whether 8 to 10 years is a feasible forecast. I have been most interested in talking, for example, to Dr. Walter O. Roberts, who heads the National Center for Atmospheric Research, which is headquartered in Colorado, the city of Boulder.

I talked to the Secretary recently. I have reason to believe that progress is being made in weather modification, but I certainly don't know what the time limit would be.

As you will note in the statement that I have given here, I freely and frankly admit we don't know whether desalinization, weather modification, or importation or a combination of one, two, or all three is the answer.

Senator JORDAN. Of course, every member of this committee is solidly behind the weather modification program, and the better use of waters in the basin wherever it may be, better conservation of water. These are some of the things that we look forward to with a good deal of anticipation and we do want to help you solve your problems in the Southwest.

Governor LOVE. Thank you very much.

Senator ANDERSON. Senator Hayden.

Senator HAYDEN. I have no comment to make except to compliment the Governor upon the very clear statement he has made as to the use of water in his State, not only in the Colorado River Basin, but for all water users.

Governor LOVE. That is right. Thank you very much, Senator Hayden.

Senator ANDERSON. Senator Bible.

Senator BIBLE. Mr. Chairman, I simply wanted to join in complimenting Governor Love for an excellent statement. I have some familiarity with the problems between the Upper and Lower Basin States, having been attorney general of Nevada. I don't know how many hundreds of trips I have made to Los Angeles and Phoenix, when Nevada tried to be the mediator in the quarrel between Arizona and California, and if my trips were any example of success, I am a very poor mediator.

But the hope still is very firm in my mind that this can be worked out. I share the caveat that the chairman made that positions should not become frozen, because this has been the problem since the signing of the compact in Santa Fe in 1922, and here it is 45 years later and we still haven't made the progress that reasonable men should make.

I would hope that out of the various bills that are before us, we can find areas where we can get together, and I do hold that out as a caveat. I appreciate your position, and I also appreciate the position of this great and wonderful Senator from Arizona, who has worked so hard over the years to see the central Arizona project a reality. I have always worked with the chairman of the Appropriations Committee year after year in helping to develop this, and my only expression is that I hope we can get on with the work and somewhere out of all these bills we can put the pieces together and get the job done.

I appreciate your position and I appreciate your expressions here on behalf of the State of Colorado. I am an eternal optimist, and maybe 1967 will be the year where we finally get the job done. We will certainly try.

Thank you, Mr. Chairman.

Governor LOVE. Thank you, Senator Bible.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. Thank you, Mr. Chairman.

Governor, we are certainly pleased and privileged to have you with us here today. I do thank you and your comments. You certainly recognize the critical situation in Arizona and we in Arizona recognize your desire to have your projects.

I do want to refer to page 7 of your testimony. I am sure it is very clearly stated, but just so that it will not be misunderstood or that someone will not take from context the statement where you say, "None of the other States are now using their full entitlement of Colorado River water," and then you go on to say, "We intend to fully support in the future as we have in the past those projects in other States which are necessary to insure them of their full share of water." And you premise that by saying that you are referring to the Upper Basin States.

I just wanted to make that abundantly clear that that was your feeling only regarding the Upper Basin States.

Governor LOVE. Yes. The intent of that statement is certainly the fact that Wyoming has expressed some concern, I understand, and certainly we have in the past and will continue to support, for example, Wyoming's participating projects when they do become ready for consideration.

Senator FANNIN. I was wondering, you are not in any way referring to the Lower Basin States.

Governor LOVE. No, other than the fact I would state now, of course, that we have supported the central Arizona project.

Senator FANNIN. For which we certainly thank you. We realize the support you have given and I very much appreciated the opportunities to visit with you in the past and discuss those matters with you.

In regard to the benefits from the Lower Basin funds, you realize that Arizona, Nevada, and California buy power from the Glen Canyon project and get no benefit from the Upper Basin funds.

Governor LOVE. That is right.

Senator FANNIN. So we do have some mutual arrangements which are certainly in accord with the division of water that was brought about by the compact, the river divided in the compact between the Lower and Upper Basins, regardless of the amount of water contributed by Colorado, the 70 percent you referred to. This is all taken care of by the compact; isn't that right?

Governor LOVE. That is right, it is.

Senator FANNIN. And the Upper Basin gets benefit from the Lower Basin fund if money is used to augment the Colorado River.

Governor LOVE. That is right.

Senator FANNIN. It would be of mutual benefit, in fact.

Governor LOVE. Any augmentation of water into the basin I am sure would be of benefit to the entire basin.

Senator FANNIN. To all of the States.

I certainly appreciate your comments and your statement. Although we may have a difference of opinion in some respects as to how we will reach our ultimate goal, we are certainly in agreement that we must have these projects and we must go forward with their development.

Governor LOVE. Thank you very much. That is true.

Senator ANDERSON. Senator Dominick, do you have any questions?

Senator DOMINICK. I have no questions, Mr. Chairman. I again congratulate Governor Love for what I think is a very straightforward and a very frank and very open statement of our position.

Governor LOVE. Thank you very much.

Senator ANDERSON. Senator Hatfield.

Senator HATFIELD. I am delighted to welcome my former colleague and friend, Governor Love, this morning to our committee.

Governor Love, as you recall, about 3 years ago at a meeting in the city of San Francisco the western Governors considered a resolution which was later, in the following year I believe, adopted by the western Governors in the city of Portland to establish a Western Governors Conference Water Council.

At that time there was a great deal of discussion in which you were one of the supporters of this council, to establish a program whereby the several States of the West, particularly the Continental Divide

States, but I believe we included the States of Alaska and Hawaii as well, should undertake a careful study in terms of inventory, in terms of need, both at the moment and projected needs, to try to work out among the States themselves some kind of concept as to water responsibility, and further, we urged each individual State to move on to programs which would undertake, from their own State perspective, a projection of their water needs as well as inventory.

Then, as you recall, we moved to a third level in which we undertook to support the regional concept in which the States, working in concert with Federal agencies, should, basin by basin, make inventories and projections.

You recall that we indicated that we were undertaking, within the State of Oregon, a water study which would study ultimate water need which would inject about \$1 million of taxpayers' money within the State for this purpose, and that we, as well as your State of Colorado, contributed to the cost factors of the Western States Water Council.

I have been deeply concerned as the author of that resolution in San Francisco that we not permit the water problem to develop into a political problem, whereby, by the flexing of political muscle, we make decisions, rather than by water statesmanship. I am fearful that unless the States do indicate a greater understanding as to their interrelationships as they exist, and can perhaps come to some kind of consensus among themselves, that this situation could lead into decision-making on the basis of political muscle. I do not use these statistics in an effort to scare anyone in the West, but I recall that all of the Western States, other than California, together have 31 congressional votes. The State of California has 38. So that consequently one State has more than 12 other States.

In these conferences we were always given the impression that California was going to get water somehow, somewhere. And this was not always interpreted as being a political threat, but there was always that possibility which we in the other 12 States recognize.

Now, since millions of dollars are being spent today in these studies, both on a regional basis, basin by basin, and in each State and among the several States under the Western Water Council, my question is, What progress do you feel is being made, and where do we expect to find some kind of solution, or at least consensus among the States that would help this committee, as well as focus upon the States' responsibilities to resolve some of these conflicts?

Governor LOVE. Well, I think that relatively good progress is being made with the Western States Water Council. We were, of course, pleased from the beginning.

We had been involved in the study of Colorado's needs and projections, and of course with the kind of shortages that look certain on the Colorado River, we had been doing it. To have Oregon, Washington, and Idaho really look seriously at the inventory and the projected need was a major step forward, in my opinion.

Let me further comment generally that we, too, have long been dedicated to the idea that these things should be worked out by agreement between the States, as witness the compact itself on the Colorado River.

Again you mentioned California and the number of votes and so on. I am confident that the people who drafted the Colorado River compact looked to California in that regard, too, and felt that it was best that the agreement be made by a compact between the States.

If I read more into your question than is there, why, you will forgive me, but I assume that you are saying, to some extent, Can't we rely upon this kind of agreement in the council, rather than some Federal legislation looking toward a reconnaissance or a feasibility study?

The only thing I would say there is whether it be a National Water Council or agreement between the States, and so on, these need to be a part of it, certainly, but we look at the projected figures on the Colorado River by outstanding engineers making several assumptions, but assumptions which we think are sound, and we can see in a relatively short period of time serious problems.

There are serious problems already in parts of my State, certainly in Arizona and elsewhere. Time is of the essence, as I tried to make clear. We don't ask at this time, certainly, for any authorization from the U.S. Congress that would provide for a diversion from any other basin. All we say is we need to move the planning ahead, move the knowledge ahead as quickly as possible, and even our agreement between the States, our council, which I think is making good progress, needs, in our opinion, to be supplemented by some look at this thing.

It may well be that to take water from the lower Columbia is just not feasible, I don't know. But I need to know, and I think a great many of the States in the Colorado River Basin do need to know.

Senator HATFIELD. I certainly agree with your comments there, and I think that these studies are not competitive in nature, but I think they bring a unique perspective, each one an individual study, and I support the national program and the national councils as I supported the regional and the local and State councils. But I do believe that we must certainly do all we can to escalate the activities and the studies on the part of the regions and the individual States as we are moving here at the Federal level, and I think, too, that when we talk about basin transfers and diversions, we have to be very careful in using nomenclature that has definite meaning. I grow weary of those who use the words "water surplus areas" because no one really can give a definition today of a surplus, of what is a water surplus. I would say if they call it "water maldistribution area" that might be more accurate, more definitive, but to look upon the Northwest and the Columbia Basin as a water surplus area is really not a fact that can be proven.

We have areas within our own State which get less than 10 inches of rainfall per year. In fact, two-thirds of our State gets less than 20 inches of rainfall per year, but we have proven that with water on that land we can grow crops with high production yields per acre. So as long as that exists, we can't really call it a water surplus area.

But I think these studies will help so much to clear away some of these myths about water areas or water surplus or water deficient areas. Also, let me ask you this question: Is your State, through the university or through other such agencies, doing anything in the area of water reuse or water rehabilitation or whatever you want to call it?

Governor LOVE. Yes. Not only through our universities but through other State organizations, we are continually, as we must, working

not only on the reuse of water, tertiary treatment and so on, but also attempting by statute and regulation to insure the most efficient use of water possible, because we realize that with five projects, even with some sort of augmentation, that we can forecast with certainty that we are going to have to make a more efficient and better use of the water which we presently have. We continually work to move in that area.

Senator HATFIELD. Thank you, Governor.

Senator ANDERSON. Thank you very much, Governor. Come back again.

Governor LOVE. I appreciate the courtesy of being allowed to testify. It is good to see all of you.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Mr. Chairman, I understand that the next witness is to be the former Governor of Colorado, and a three-term member of the U.S. Senate, whose position I am now honored to fill, and I hope someday to fill it as well as he did. It almost reminds me that today as I listened to Governor Love, this is almost "Governors Day." We have Governor Love, and then we have former Governors Jordan and Fannin. Senator Hansen has just stepped out, who is a former Governor of Wyoming, and former Governor Hatfield—so it is almost a Governors' picnic this morning.

So Governor Johnson, who is a member of the Upper Colorado River Commission, is the next man to be called, and I am very honored to have a man who is so well respected by the State of Colorado and by me to testify. We are not of the same political party, but over the many, many years I have known him, I have been able to count upon his counsel and advice and the integrity which is just simply a part and characteristic of him. So I guess the next witness is Governor Johnson.

Senator ANDERSON. Governor Johnson.

Senator ALLOTT. I think perhaps the record should also show that appearing with Governor Love was Richard T. Eckles, coordinator, Division of Natural Resources in Colorado; and Felix L. Sparks, director of the Colorado Water Conservation Board, which is the board that Colorado established for the conservation and development of water.

Senator ANDERSON. Governor Johnson, we are glad to have you here.

STATEMENT OF HON. ED C. JOHNSON, FORMER U.S. SENATOR AND FORMER GOVERNOR, STATE OF COLORADO; COLORADO COMMISSIONER, UPPER COLORADO RIVER COMMISSION

Mr. JOHNSON. Mr. Chairman and members of the Interior Committee of the Senate, we have been honored today with the presence of Senator Hayden. I had the privilege of serving with Senator Hayden for 18 years in the Senate, and I have great respect, admiration and affection for him, and I am pleased and feel that all of us have been honored by his presence here today. I wanted to thank Senator Allott for his very nice and kind words. I appreciate them very much.

It wasn't determined until 3 days ago that I was to testify before this distinguished committee. I immediately tried to put together a state-

ment to make before you. The stenographer handed me this copy of my statement yesterday afternoon at 3 o'clock and then I boarded the plane at 4:20. I have had no opportunity to confer with other folks in Colorado. I have been living down in the wonderful State of Arizona since February 1, and I haven't had an opportunity to discuss my statement with anyone. So, this statement is my own, and no one is responsible for what I say here, except myself.

I want to say that I concur and agree with the statement that was made by Governor Love here this morning. I am in hearty accord with the policy that has been adopted and laid down by the officials of the State of Colorado with respect to this whole question, and I am honored and pleased beyond expression to be permitted to testify before you today. I am happy and honored that Senator Peter Dominick is here. He is a great student, and I would like to be his professor for a few minutes.

Senator DOMINICK. I will be delighted.

Mr. JOHNSON. On March 13, 1967, Congressmen Morris K. Udall, John J. Rhodes, and Sam Steiger of Arizona issued a puzzling joint statement with respect to the central Arizona project. As an officer of the Upper Colorado Basin Commission, I take serious exception to this statement. While I am satisfied that the intentions and purposes of the three able Congressmen are sincere, I am convinced that their statement is a direct and open challenge to the Upper Basin commission. I feel strongly that it is a threat to upper basin control of the 7,500,000 acre-feet of Colorado River water apportioned to the upper basin by the Colorado River Compact. The upper basin desires to be friendly and helpful to the central Arizona project but we do not propose to destroy the Upper Division in doing this.

The States of the Upper Division fully realize that Arizona needs additional supplies of water desperately. Her economy and her future is tied to water. But the same thing is true of the States of the Upper Division also. Two-thirds of the water that is produced in the Colorado and Wyoming mountains is permitted by them to go down the river to take care of Arizona, Nevada, and California. Their need for water is just as great as is the need of the lower States and they have been and now are generous with their water-dependent neighbors.

In many respects the water needs of Arizona and the upper States is strikingly similar. Arizona has a prospective central Arizona project and Colorado has a central Colorado project. Half of my time is spent in Arizona and so I see both sides of this highly competitive picture.

The populations of Colorado and Arizona are increasing at a fantastic pace and every additional citizen and every additional development calls for more and ever more H_2O . In fact, both the States are threatened now with an internal water crisis.

For instance, Colorado, Utah, and Wyoming have an immense undeveloped shale oil potential that staggers the imagination. It must have an adequate supply of water to operate and in due course it must operate in the national interest. Water must be set aside and assigned now for this new venture. The only real answer to thirst always has been and always will be and is, water. Colorado and Arizona are equally thirsty. An understanding observer might think they would join forces and overwhelm and bowl over all opposition, but it is not

quite that simple. The catch is that both of these ambitious and high-spirited communities have their thirst-hungry eyes focused on the same identical Colorado River water. Thus, we may have a king-sized conflict in which both States may lose. And I am convinced that unless both of these States who are big, see big and act big and work closely together in this great crisis both will succumb to dismal failure.

Today there are more than a dozen legislative proposals pending in Congress to bring water to the desert in the great Southwest, but the administration, misrepresented as it is, and that is my opinion only, by the present Secretary of Interior, declines to look beyond the bankrupt Upper Colorado River for the precious water we must have.

Actually, there is an abundance of unused water in this western international region but most unfortunately there is also a total dearth of reasonableness, good will and cooperation with respect to surplus water. The wicked dog in the manger policy sits at the throttle in Washington, D.C., like a child at play. They speak of birthday presents but they dodge realities. The Columbia River is dumping over 100 million acre-feet of water annually in the Pacific Ocean, and northern California, with a reported 5 million acre-feet surplus, has not been asked by the administration to surrender its surplus nuisance water, not only surplus, but it is nuisance water in the way of flood, in the national and international interest.

The Grand Junction, Colorado Daily Sentinel on March 27, 1967, carried this story:

A water-surplus area offering water to a water-deficit area in this arid and semi-arid region is almost unheard of. But that is exactly what the Yel River group of Northern California representing 11 counties has done. However, the last word on this front I have had is "Controversy in California makes any evaluation of Northern California's offer impossible."

Those are rather familiar expressions.

Since time began, as all of us are aware, the Pacific coastal streams, plus the Colorado River system, in their respective flows, have accommodated practically the entire supply of potable water of the Far West. In scope this Western area is regional, interstate, and international. It encompasses vast arid deserts and limited areas of heavy rainfall.

These magnificent desert valleys have a tremendous production potential when moisture is added through irrigation. In the West such development is achieved through single, one by one irrigation projects. These projects are economically sound and feasible but they require an enormous capital investment which only Congress is powerful enough to undertake.

When usable water can and does perform such a realistic, singular, and remarkable miracle it is strange that every drop of surplus rainfall wherever it may occur does not reach the thirsty desert sooner or later. It is certain that this unique and pitiful situation must come to an end. The deserts of the Southwest ask for only 7 percent of the Northwest's waste water which is being dumped in the Pacific Ocean, each day, but Secretary Udall would even deny them the privilege of an engineering study to determine the feasibility and the out-of-pocket cost of such a diversion.

Furthermore, the United States of America is committed by international treaty to deliver annually 1,500,000 acre-feet of usable water

to our good Latin American neighbor, the Republic of Mexico. There is a national obligation involved which sooner or later the Secretaries of State and Interior must respect and embrace. It is not and should not be the exclusive task of only seven States to meet the Mexico burden.

The Federal policy of the United States under the leadership of President Johnson is to be generous with Latin American nations and that is the way it should be. United States and Canadian water should not be the lonesome exception in our good neighbor program. Yet in this single instance instead of assuming this water obligation as the legitimate and lawful obligation of 50 States, Washington has made it the burden of the seven States of the Colorado River Basin. In fact this heavy burden has been imposed upon our people as being the No. 1 water right of the Colorado River, and the Secretary of the Interior, whose specific duty it is to look after our water problems maintains a stony silence. These seven struggling Colorado River Basin States cannot use one drop of Colorado River water until the delivery of 1,500,000 acre-feet has been made to Mexico at the border. It is water right No. 1 on the Colorado River.

Returning once again to the joint statement of the three eager Arizona Congressmen. On page 1 of their statement they say:

And in 1963 the Supreme Court of the United States ruled that Arizona is entitled to two million eight hundred thousand acre-feet of Colorado River water per year to help meet its water needs.

The Supreme Court made no such "ruling." This Court put its ruling on this issue in the form of a Supreme Court decree and this is what is said in that decree:

If sufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy 7,500,000 acre-feet of annual consumptive use in the aforesaid three States, then—

Don't overlook that word "then," that is the key word to this whole situation—

then of such 7,500,000 acre-feet of consumptive use, there shall be apportioned 2,800,000 acre-feet for use in Arizona, 4,400,000 acre-feet for use in California, and 300,000 acre-feet for use in Nevada.

The 2,800,000 acre-feet of water apportioned conditionally to Arizona by the Supreme Court includes all of the water Arizona takes out of the main stream of the Colorado River. This would include Arizona water under contract with the users; mainstream water consumed by Arizona Indian tribes; water legally or illegally seized by squatters along the Colorado River; and all mainstream water consumed by Arizona. It, of course, would include the water Arizona is obligated to deliver to Mexico under the provisions of the Mexican Treaty. A million acre-feet below Lee Ferry is lost annually through evaporation, and unfair as that may be under the Colorado River compact Arizona is held responsible along with California and Nevada.

Supreme Court decree, this is what the Supreme Court said on that point:

B4 Page 313. Any mainstream water consumptively used within a State shall be charged to its apportionment, regardless of the purpose for which it was released. (376 U.S. 340, Mar. 9, 1964.)

Furthermore, when the Upper Basin consumes all of the water apportioned to her by the Colorado River compact, as she will, the lower basin will not receive 7,500,000 acre-feet of mainstream water each year. The total amount of water the lower basin will receive then according to an optimistic appraisal will vary from 5,500,000 to 7,500,000 annually.

Decree: State of Arizona, Plaintiff v. State of California, et al., Defendants.

The opinion is found in 373 U.S. 546.

The decree is found in 376 U.S. 340, March 9, 1964:

DECREE

(B) Page 312:

(1) If sufficient mainstream water is available for release, as determined by the Secretary of Interior, to satisfy 7,500,000 acre-feet of annual consumptive use in the aforesaid three States, then of such 7,500,000 acre-feet of consumptive use, there shall be apportioned 2,800,000 acre-feet for use in Arizona, 4,400,000 acre-feet for use in California, and 300,000 acre-feet for use in Nevada;

(2) * * *;

(3) If insufficient mainstream water is available for release, as determined by the Secretary of the Interior, to satisfy annual consumptive use of 7,500,000 acre-feet in the aforesaid three States, then the Secretary of the Interior, after providing for a satisfaction of present perfected rights in the order of their priority dates without regard to State lines and after consultation with the parties to major delivery contracts and such representatives as the respective States may designate, may apportion the amount remaining available for consumptive use in such manner as is consistent with the Boulder Canyon Project Act as interpreted by the opinion of this Court herein, and with other applicable federal statutes, but in no event shall more than 4,400,000 acre-feet be apportioned for use in California including all present perfected rights;

Any mainstream water consumptively used within a State shall be charged to apportionment, regardless of the purpose for which it was released;

And on page 16 of this joint statement by the three Arizona Congressmen this declaration appears:

We seek only to obtain and put to use that water which the United States Supreme Court has said belongs to Arizona.

And once again the Supreme Court's conditioned provision, "if sufficient mainstream water is available . . . etc." is omitted. Some way or another they don't like those words, but they are in there. They are part of it. They cannot be omitted. They must be considered.

It simply cannot be denied that Arizona's consumptive use of 2,800,000 acre-feet of main stream water was apportioned to her conditionally. The Supreme Court requires that the water be available and the 2,800,000 acre-feet of main stream water is not available.

Only July 30, 1965, R. J. Tipton, a well-known, highly rated and thoroughly experienced engineer who specializes in water problems, rendered his official report to the Upper Colorado River Basin Commission. Pertinent references in that report are reproduced here.

During the latter part of May, 1965 the firm of Tipton and Kalmbach, Inc. was retained by the Colorado Water Conservation Board to make a study of the water supplies available from the Colorado River for use in the Lower Colorado River Basin, and to determine whether such supplies would be available at all times to satisfy uses by the States of Arizona, California and Nevada as defined in the decision of the U.S. Supreme Court in the Case of Arizona v. California, et al., 373 U.S. 546. Subsequently * * * it was concluded that the studies would be sponsored by the Upper Colorado River Commission rather than by the Colorado Water Conservation Board. The studies have been made and a report prepared which embodies the results of the studies.

The decision of the United States Supreme Court in the case of *Arizona vs. California et al.* 373 U.S. 546, considered that the contracts with the Secretary of Interior and the three states of the Lower Basin, Arizona, Nevada and California, and individual entities thereof, constituting an apportionment of 2.8 million acre-feet of water to Arizona, an apportionment of 0.3 Maf to Nevada, and a limitation of 4.4 Mat to California effect a valid apportionment of the first 7.5 Maf of mainstream water in the Lower Basin. All apportionments by the terms of the contracts are subject to the availability of water.

This entire situation poses a problem to the States of the upper division of the Colorado River Basin. Uses in the Upper Basin may not have progressed to the point that all waters apportioned to it by the Colorado River Compact, or to the limit imposed by nature, are being used at the time the Central Arizona Project goes into operation if it is authorized and goes to construction. In other words, there might be some unused water destined for use in the Upper Basin passing Lee Ferry which, if used in the Lower Basin, would pose a problem when those waters subsequently were needed by Projects in the Upper Basin. Actually, at the present time some of the uses in the Lower Colorado River Basin on the mainstream are being made only because of unused flows in the Upper Basin passing Lee Ferry.

The obvious conclusion is that a firm water supply is not available in the Colorado River to satisfy a basic beneficial consumptive-use requirement of 7.5 Maf from the main stem by Arizona, California and Nevada, plus delivery of 1.5 Maf of water to Mexico. If these requirements as well as Upper Basin requirements are to be satisfied, Projects must be authorized and constructed to import major amounts of water into the Colorado River Basin from sources of surplus. Such importation is important to both the Upper and Lower Basins.

Finally, it would be fair to conclude that the authorization of projects in the Lower Colorado River Basin which would utilize substantial additional quantities of water would be unwise at this time unless at the same time a project or projects, for the importation of substantial amounts of water from sources of surplus are authorized.

Mr. Tipton was convinced by his studies, and he made an impartial study of this whole question, he was convinced after making this study that there simply was not enough water left over at the present time for central Arizona.

From tables developed in the Tipton study the following table was put together. It is significant.

Average virgin flow:	Acre-feet
Last 44 years.....	13, 951, 000
Last 35 years.....	12, 967, 000
Last 10 years.....	12, 031, 500
In 1955.....	9, 188, 000
In 1954.....	7, 667, 000
In 1959.....	8, 562, 000
In 1961.....	8, 360, 000

Dated: November 2, 1965.

I saw some figures this morning that in the last 44 years the average production of water by the State of Colorado is just under 11 million acre-feet, just under 11 million, in the one State of Colorado. This is an interesting table. It was worked out from the data that was provided by Mr. Tipton.

I am convinced beyond any question that if Congress would employ an impartial nonbiased group of competent highly rated engineers and assign them to make a study of the supply of water in the Colorado River they would reach the identical conclusion reached by Royce J. Tipton, that there is not enough water available to Arizona to operate the central Arizona project. And the job that we should be doing, that this committee should be doing, that this Congress should be doing, is to increase that water until there is water enough to operate

the central Arizona project, because that project is vitally needed.

On December 11, 1965, Royce J. Tipton, the International Water Engineer and Water Authority, in explaining his opposition to the central Arizona project on the grounds that there was little or no water available for this project quoted the Bureau as being in agreement that there would be an extreme shortage of water in central Arizona.

With the delivery at Lee Ferry of 8.25 million acre-feet annually, the Bureau's studies indicate that the water supply for Central Arizona would only be 380,000 acre-feet per year, so the Central Arizona Project would hardly get its foot in the door before the water supply would be reduced by 75 percent.

Then Mr. Tipton, who brought in that report, in his report observed :

Of course, my studies did show a deficiency.

Let me say that any study of this whole situation will reach that same conclusion, too.

On February 21, 1967, the Upper Colorado River Basin Commission held a special official meeting in Salt Lake City. All of the commissioners and their staffs were present and each of them spoke frankly and publicly with respect to legislative proposals pending in Congress. That was the purpose of that special meeting. As vice chairman of that commission it is my privilege to report here excerpts from the official transcripts of that session.

Upper Colorado River Commissioner H. T. Person, of Wyoming, said :

Wyoming takes the position of opposing all legislation now pending authorizing projects in the Colorado Basin.

Require that the two reservoirs, Marble and Bridge, be authorized.

Require Reconnaissance studies of all possible methods of augmenting the Colorado River water supply.

In addition require enough water be imported from Northern California streams to take care of the Mexican Treaty water burden. We know there is sufficient surplus water in Northern California to do this. It would correct the water supply situation on the Upper Colorado Basin.

The language with respect to the 4.4 million acre-feet should be made clear that it is not a priority being granted by the Upper Basin States.

Until we have an importation authorized no new projects should be authorized in the Upper Basin.

And of course we would want the operating criteria and Hoover power deficiencies taken care of as they were in H.R. 4671.

Felix L. Sparks, Director of the Colorado State Water Board, said :

We have no basic disagreement with Wyoming's position with the exception that we cannot buy any moratorium on Upper Basin development pending importation into the Colorado River System. We would be simply cutting our own throats.

Commissioner H. T. Person :

What is wrong with authorizing the importation of 2.5 million acre-feet from Northern California? It takes care of a national obligation. (The annual delivery burden of 1,500,000 acre-feet to Mexico).

Director Sparks of the Colorado Water Board, speaking for the Colorado Commission, said :

Nothing is wrong with it, professor. If it appears there is any chance to get it done, we will be right along with you.

Commissioner Person :

Then we wouldn't have to oppose any more authorizations in the Upper Basin if we could get that.

Sparks:

If you could convince Northern California . . . we are with you. As a matter of fact, some effort is being made in California as you know, to do that very thing, a very substantial effort, and perhaps this is the way out.

Sparks:

If Arizona persists in its present course as now evidenced by this Senate activity, we are going to pursue the point that there is no water supply for the Central Arizona Project. It is rather asinine to try to construct that project without looking at the long-range possibilities for importing water into the Colorado River System. And if the Secretary of the Interior or anybody wants to hide their head in the sand, we are going to jerk their heads out because it is very obvious to anybody who has studied the Colorado River System that the Central Arizona Project is virtually almost dry from the time it is constructed—the water is just not there. And the interpretation of the Lower Basin of the Colorado River Compact creates a present shortage to the Upper Basin of over two million acre-feet of water.

So no one in Arizona can come crying to us and say "why can't we get our share," when the very interpretation Arizona places on the Compact, they want to take over two million acre-feet of water away from us under our 7,500,000 acre-feet allocation * * * and this is what any study will show under their interpretation.

Commissioner Jay Bingham, Utah:

The State of Utah takes a constructive approach in helping to provide additional water to meet the needs of the State of Arizona. Utah's support can be assured if the following legislative safeguards are provided * * *.

It is essential that ways be explored to meet the future water deficiencies that are certain to develop on the Colorado River. Utah's support of legislation authorizing further development in the Lower Basin is contingent upon Congressional authorization of studies to augment the water supply of the Colorado River Basin.

Along with other augmentation studies the minimum condition acceptable to the State of Utah is a reconnaissance report on investigations of a plan to import water from sources outside the Colorado River Basin. Utah believes that a feasibility study should be authorized for import of 4.5 million acre-feet of water from the north coastal streams of the State of California with 2.0 million acre-feet designated for uses en route and 2.5 million acre-feet allocated to the satisfaction of the Mexican Treaty obligation and water losses in the Lower Colorado River Basin.

In order to assure repayment for importation of water it is essential that the high Bridge Canyon dam be built and power revenues from this source be added to other available sources of revenue in a Lower Basin development fund to meet the costs of augmenting the water supply of the Colorado River.

It is essential that new legislation should include equitable criteria for the coordinated long-range operation of Colorado River Storage reservoirs. Such criteria is important to the State of Utah in that it provides legislative recognition of vital provisions of the Colorado River Compact and the Colorado River Storage Project Act.

(a) The legislation must make it clear that the intra-Lower Basin provisions protecting existing uses against shortages until 2.5 million acre-feet of imported water is assured shall in no way add to the Lower Basin claim against the Upper Basin or adversely affect the interests of the Upper Basin which could be assured in the absence of import.

Commissioner Bliss, New Mexico—and this is very pertinent—said this:

I agree that we need an importation of water, that it must come, and very possibly a solution is to bring it in from California because California itself is interested in getting additional water into the area. What their quid pro quo might be in such a deal, I don't know. It might be to go back to the point of again getting the consent of Arizona to their 4.4 million as a priority in exchange for bringing Upper California water into the area, particularly to satisfy the

Mexican Treaty obligation. But I do not think that the Upper Basin should cease its efforts to obtain additional Upper Colorado River Projects in accordance with the Compact allocation.

I think New Mexico's position would be that we do not object to the various items in the program. We could support a bill which went somewhat less than the total distance that H.R. 4871 went, for example.

I think we have all got to work together on the matter and I think it is up to the four States if possible to come to some agreement or some set of criteria which we could all agree upon.

Sparks, Colorado:

I would like to see the staff of this Commission work actively with the States; and we assure you in Colorado we are not going to be bitter at any of the other States for their position because we have a great deal of sympathy for everything that has been stated by the other States, and we would like to achieve the same things they do. When it comes down to opposing the bill because of certain things, our position is not quite as extreme as the other States, and perhaps a little more extreme, however, than New Mexico.

But I think we are essentially here together and I would certainly hope that the Commission staff is free to follow this legislation and keep working among the States so that we can achieve the greatest possible unity. I don't think we are far apart at this time.

I quote the statement that I made:

After reviewing the testimony of the four Upper Basin Commissioners in their Special Meeting of February 21st in Salt Lake City, it is my judgment, that if sufficient water should be imported into the Colorado River, from Northern California, by replacement or other wise, and delivered to Mexico at the mouth of the Colorado River to satisfy the terms of the Mexican Treaty, to the extent of at least 1,500,000 acre-feet of water annually, the Central Arizona Project would be supported in Congress enthusiastically by the seven Colorado River States.

Why don't we go about this question at the point where we should be working, and not as to get enough water so that central Arizona can operate? We seem to skip that.

Furthermore, it would solve the desperate water shortage on the Colorado River for at least 25 years.

That is 750,000 acre-feet of water that has to be supplied by the upper basin and the 750,000 acre-feet that has to be supplied by the lower basin. Their part of it could be used in the central Arizona project, and we would have this thing out of the way for a long, long time.

I am informed that such a diversion would cost one billion dollars. That is a lot of money, but in international adjustments, costs are secondary.

On March 27, 1967, the Daily Sentinel, published in Grand Junction, Colo., reported that the Eel River Flood Control and Water Conservation Association on March 25 had wired Congressman Wayne N. Aspinall the following telegram:

The Association respectfully recommends that the House Interior Committee consider California's North Coast as the initial source of water to be developed to offset the prospective shortages in the Lower Colorado River Basin occasioned by the Mexican water treaty and the limitations of the Colorado River Compact, recognizing that other sources would have to be developed later to satisfy all of the anticipated water requirements of the Basin. All of these sources could be integrated into a phased regional system for the benefit of the Western States at substantial savings in cost.

The Eel River group said it was speaking "on behalf of 11 northern California counties which represent the source of 40 percent of the total fresh water of the State (California)."

That is a gentle hint. That ought to be accepted as a very persuasive hint by all of us, by the backers of central Arizona and those who want to see the Lower Basin and the Upper Basin go forward and make progress.

For many years the generous supply of extra water in the Lower Basin has been highly pleasing to everyone. However, it occurs only because the Upper Basin has stood still. This water supply was created by a provision of the Colorado River compact, which reads:

Paragraph (E), Section 3 Colorado River Compact:

The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses.

Paragraph (e) water has given the Lower Basin temporarily an extra 2 million acre-feet of water on an average, for many years. However as the Upper Basin develops the use of her water, paragraph (e) water will gradually diminish to zero. For instance, the Colorado River storage project, and reference has been made to it today as one of the great steps that have been taken on the Colorado River, Colorado River storage project, through evaporation, since its reservoirs were built has diminished paragraph (e) water in the Lower Basin by nearly a million acre-feet a year. That ought to wake us up. That ought to wake the southern division up.

If Congress builds central Arizona on paragraph (e) water, and that is what the proposal before this committee is. That type of high finance in the business world would mean the jailhouse.

But what of the Arizona Congressmen who would build a billion-dollar project on disappearing water? They even boast about their lousy and facetious scheme. They are proud of it. They think it is smart. They think they have solved something. Please turn to page 16 of their joint statement and see for yourselves what they plan "not to do."

May I quote the three Congressmen again:

By this proposed bill we do not seek to obtain water at the expense of other States in the Colorado River Basin, or for that matter, from the Northwest, from California, or from any other source outside the Colorado River Basin.

That is a notable confession. But where will the three magicians get the millions of acre-feet of water that central Arizona must have? Their bold statement eliminates all the sources of water but one and that one exception simply has to be paragraph (e) water. If the Upper Basin should stand dead still paragraph (e) water might hang on a few years, until evaporation caught up with them, but sooner or later it must sink to zero. And you are talking about building a project on the basis of that sort of flimsy feasibility.

Is that a logical basis for project construction? I am not opposed to central Arizona. What I oppose is the failure to provide any water for central Arizona. With apologies to the three Congressmen, I think such a policy is cowardly and dishonest.

I thank you very much.

Senator ANDERSON. Governor, that is a very mild statement.

Mr. JOHNSON. I am glad to see the distinguished chairman of the committee here now. I have great affection for him. I disagree with him a little on some points, but he is a great Senator.

Senator ANDERSON. I don't think that the Arizona people are trying to steal some water from the rest of them.

Mr. JOHNSON. Thank you very much.

Mr. SPARKS. There are some other questions.

Mr. JOHNSON. Well, you sit here and tell me what the answers are.

Senator ANDERSON. Governor, I am glad to let these others ask questions. I have a good many questions to ask about this compact. I remember a coincidence when you tried to pass a bill. I thought the upper Colorado storage bill, which I had the pleasure of signing, was a pretty good document. Senator JACKSON.

Senator JACKSON. Governor, I want to extend to you for all the members of this committee, a very warm and friendly welcome. We are delighted to have you back here, and it is good to see your vigorous good self. Frankly, I want to compliment you for a very forthright statement. It is kind of refreshing for someone to come in here and say exactly what he thinks the upper Colorado States ought to have. I must say that we in the Pacific Northwest, of course, have some serious misgivings about this matter, which you can fully appreciate, I am sure.

For example, you know they started out, Governor, to ask for just a tiny bit, 2.5 million acre-feet. I am sure you are aware that after they got to decorating the Christmas tree over in the House side, they were up to a little over 30 million acre-feet. This is one of the problems, isn't it?

Now, the second point I want to make is that we think there ought to be a national study of this whole water problem by an objective jury. We don't want a directed verdict. I gather, frankly, and I must say it is refreshing, coming from you, that you have indicated you need this water and then you want to have a study. I mean, it sounds as if you had directed the jury to come in with a finding. You know that procedure.

What we are looking for is an objective jury that has not been ordered to bring in a directed verdict, and that is the National Water Commission. Frankly, this study could have been on the way a long time ago if so many people didn't find so many spooks in the National Water Commission. It could have been passed last year, and a study could have been underway.

Many people think that someone was sound asleep here. We passed it twice in the Senate, Governor. So, all we are looking for as you would, because you are a very forthright, fairminded individual, all we want is an objective jury. We don't want a directed verdict. That is all. Do you want to comment?

Mr. JOHNSON. Thank you, Mr. Chairman. If we could just get Mexico off our back, if we could take care of the obligation that has been imposed upon the Colorado River people and if some other States, the other members of the United States, could take care of that 1,500,000 acre-feet, we could get along for quite a long time. We could certainly build central Arizona out of the water that the Lower Basin has to contribute to Old Mexico.

And if you can place a limitation on the importation of water to the extent of the Mexican burden, it would take care of things for a long, long time. Then we could work it out with the National Commission on some basis or other.

But how we are going to go ahead and authorize central Arizona without any water is more than I can understand. In Colorado once we built an expensive bridge, a mile and a half, a highway, and it seems to me that this is something along that same line, of building a great project in a great ditch, as Senator Hayden called it, from the Colorado River to central Arizona.

Senator JACKSON. I take it that was your predecessor or someone else in the governorship before?

Mr. JOHNSON. OK, I have made my statement.

Senator JACKSON. Governor, it is delightful to see you in such good health here. Obviously you are, because you still have your good sense of humor, and you still have your direct and forthright way of speaking your piece. But that is always refreshing, isn't it?

Mr. JOHNSON. Thank you. You are very kind, and I hold all of you Senators in very great affection.

Senator JACKSON. You are still a member of "The Club."

Mr. JOHNSON. Thank you.

Senator JACKSON. Senator Kuchel?

Senator KUCHEL. I give you my apology. I have been down in the Appropriations Committee meeting this morning, Governor. I have had a number of constituents who are speaking to justify expenditures of public moneys in California, and I regret exceedingly that I did not hear you. I think you know of my respect for you. I enjoyed serving in the Senate with you when I first came here.

Would you favor the type of bill that Senator Allott, Senator Moss, and I introduced, if you tied down a specific directive for water importation to the extent of the Mexican burden?

Mr. JOHNSON. That bill, of course, was a compromise bill. They were trying to go as far as they could in gaining support, and under the circumstances I go along with that bill. I don't think that it reaches perfection on all points, but it is a step forward, and I have endorsed that position and I am in accord with it here today.

Senator KUCHEL. That is all. Thank you very much, sir.

Senator ALLOTT. Governor, I join the others. I can't help but call to the attention of the committee again the summary report of the central Arizona project with Federal prepayment power arrangements, dated February 1967, published by the Department of the Interior and the Bureau of Reclamation. It seems to me that the figures in there are fairly illustrative of what we are talking about.

Senator JACKSON. I am going to ask Senator Allott to continue the hearings. We shall not quit at 12:30, so the Colorado witnesses can leave. I will ask him to chair the hearings for that purpose. I am sorry, Governor, I did not mean to interrupt.

Senator ALLOTT. Referring to this report, it shows that in the year 1975 there would be available for the central Arizona project 2,142,000 acre-feet, but it also shows it by the year 2030 that amount would fall to 822,000 acre-feet: or if it is limited by the 2,500-cubic-feet-per-second aqueduct, the figure available would go from 1,650,000 acre-feet in 1975 to 676,000 acre-feet in the year 2030.

In other words, I think this illustrates very adequately your position that the basic structure of the central Arizona project has to be based upon water to which the Upper Colorado River Basin is en-

titled, and that when the Upper Colorado River Basin is developed, all of the water they speak of will not be available for the central Arizona area.

Senator FANNIN. Will the Senator yield? I would like to remind the Senator that this takes into consideration a 4.4 guarantee to California, which is not in effect, so I do not think it should be considered.

Senator ALLOTT. We don't want to get into the quarrel between Arizona and California. It does take that into consideration. But the facts are that when the Upper Basin—Colorado, Wyoming, New Mexico, and Utah—are able to take care of its water and put it to beneficial use, all of the water planned for the central Arizona project will not be available.

Governor, I want to thank you very much for your appearance here. I might say with respect to the chairman's remarks, and I am sorry he has left, but he knows I would say this anyway, with respect to the National Water Commission, I think everyone has taken note, and he would take note, that when I offered an amendment to make the study of the Colorado River Basin a matter of first priority with that particular Commission if and when it is established, that he was among those who voted against the inclusion of that amendment, which I thought was so very vital, if a National Water Commission was established.

Senator Fannin.

Senator FANNIN. Thank you, Mr. Chairman.

Governor, it is a pleasure to see you again and have you here before the committee, and with all that vim and vitality you have, you have garnered a nice tan down in Arizona, and we are very pleased to see that Arizona has been so good to you, and of course, we are always very pleased to have you in our State of Arizona. We just wish that you would spend more than half time in Arizona.

I am pleased, too, with part of your statement. I am concerned about the other part, Governor. I am sure that you will understand that. But as far as the Mexican burden is concerned, I agree it should be a national obligation, and I am also pleased that you recognize the great need we have in Arizona for water.

Senator ALLOTT. Thank you.

Thank you very much, Governor. We appreciate your being here. I want, at this time, to express my appreciation to the distinguished chairman of the Interior Committee, and also the Subcommittee on Water and Power Resources, for this opportunity to continue these hearings, even though we may extend past the lunch hour, in order that the various people who have plane reservations and who have been here and waited all week in order to testify, may be accommodated.

I am going to, therefore, suggest for the benefit of all that the rather short statements of the various conservancy districts may be and will be inserted in the record in their entirety, and if it is necessary, or if it is possible, perhaps they may be briefed, but I will leave that up to the decision of the individual districts.

The first of the witnesses in behalf of the La Plata Water Conservancy District, Mr. Jack Kroeger, who is board member and president of the San Juan Basin Association of Soil Conservation Districts, accompanied by Mr. Robert Taylor, board member; district judge

William Eakes, who is now on the district bench in Colorado, a very valued and honored member, and formerly a very active participant in water matters; Mr. Fred Kroeger, attorney and member of the Colorado Water Conservation Board, and Frank S. Maynes, counsel for the district.

Gentlemen, we welcome you.

STATEMENT OF JACK KROEGER, BOARD MEMBER AND PRESIDENT OF THE SAN JUAN BASIN ASSOCIATION OF SOIL CONSERVATION DISTRICTS; ACCOMPANIED BY ROBERT TAYLOR, BOARD MEMBER; DISTRICT JUDGE WILLIAM EAKES; FRED KROEGER, MEMBER OF THE COLORADO WATER CONSERVATION BOARD; AND FRANK S. MAYNES, COUNSEL FOR THE DISTRICT

Mr. KROEGER. Thank you, Senator Allott. I would like to thank you for holding this committee open so that we can catch our plane. We certainly appreciate it.

Mr. Chairman and gentlemen of the committee: My name is Jack R. Kroeger, and I am appearing here today as a member of the board of directors of the La Plata Water Conservancy District of Colorado.

I want to ask your favorable consideration for the legislation which would authorize, among other important projects, the Animas-La Plata project in my area. Although our water district was organized under the laws of the State of Colorado in 1944, I have been a member of the board only a short period of time. However, I have spent my entire life as a farmer and rancher in our area and I know the great need for the Animas-La Plata project.

For 46 years our family has tried to farm the deep, sandy loam soil which lays so well for irrigation. My father came to the San Juan Basin of Colorado in 1885 and spent years of his life in an effort to solve the problem, which has always plagued us—not enough water at the right time. Yesterday, when I left home, my crops were again drying up. We have not been able to irrigate a single day this year. The early water priorities must use what water is available for stock watering purposes.

Unless we have rain in abundant amounts I, as well as my many friends and neighbors, will again suffer almost total loss of our crops. We must, if we are to continue farming, find a way to store our vast water resources so that the water will be available when we need it, and there will not be any more years like 1934, 1939, 1946, 1956, and all the other years our people remember so well. Our only hope to solve our water problems is the Animas-La Plata project.

The history of our project shows 50 years of financial and individual sacrifice in an effort to make a dream come true. The great economic losses which we have periodically experienced, together with the heart-ache and discouragement, have only served to strengthen our determination and desire to have the Animas-La Plata project constructed.

The first real break for the Animas-La Plata project came when it was included in projects to be studied for feasibility in the Colorado Storage Project Act of 1956. Both the State of Colorado and our water district worked together with the Bureau of Reclamation for many years to complete the feasibility report.

As you may know, the project report of 1966 shows a feasible project with a favorable benefit-cost ratio. When the Animas-La Plata project is constructed, it will supply urgently needed water to our ever-expanding agriculture economy. It will provide a long-range dependable water supply for our cities and towns and the availability of water will insure the continued growth and development of the industrial potential of this great Four Corners area of the United States, especially the vast coal deposits in southwest Colorado and northwest New Mexico.

The development of coal deposits would be of particular value to the Southern Ute Indian Tribe, helping them to supplement their agriculture and livestock economies and provide needed employment opportunities for the tribal members.

We have every confidence that the Animas-La Plata project is feasible and beneficial from both an economic and engineering standpoint. The La Plata Water Conservancy District and its members would like nothing better than to help pay their share of the cost of the much-needed irrigation water. We have the ability and desire to enter into a repayment contract at the appropriate time.

The cities, towns, and private industry in our area have always strongly and actively supported this project. We have no doubt that they will do their share in this regard. I am certain that after having spent so many years in a determined effort to have this project constructed, the people in our area will gladly accept both the benefits and burdens of guaranteeing success for the Animas-La Plata project.

In closing, I would like to say that we also support the authorization of the other water projects in our State. These projects will do as much for their areas as our project will do for us.

It has been an honor and pleasure for me to appear before this committee and I appreciate and thank you for the opportunity of presenting this statement.

Senator ALLOTT. Thank you very much for that statement in support of this project, which has been so long and so badly needed.

I have known all of the gentlemen at the table for a long period of time, and I congratulate you on your efforts. I would like to clear up, for the sake of the record, one point.

You appear here as a member of the La Plata Water Conservancy District.

Mr. KROEGER. Yes.

Senator ALLOTT. And that means that under the laws of the State you are constituted in such a way as to contract fully for the repayment of your share of this project?

Mr. KROEGER. Yes; this is right.

Senator ALLOTT. Do any of you other gentlemen want to add anything to this? If not, thank you all very much for your patients. You have been here all week. You have been very helpful. I appreciate it.

Mr. KROEGER. Thank you, Senator.

Senator ALLOTT. The next district to appear is the West Divide Water Conservancy District, represented by Mr. Frank Delaney, former commissioner of the Upper Colorado River Commission for the State of Colorado, and one of our most esteemed members of the bar, particularly with respect to water matters, a member of the State planning commission under three Governors, a cattle rancher, and he is of

course, outstanding; accompanied by Mr. William B. Jackson, who is president of the district.

Mr. Delaney.

STATEMENT OF FRANK DELANEY, FORMER COMMISSIONER OF THE UPPER COLORADO RIVER COMMISSION FOR THE STATE OF COLORADO, ACCOMPANIED BY WILLIAM B. JACKSON, PRESIDENT OF THE DISTRICT

Mr. DELANEY. Mr. Chairman and gentlemen of the committee, I have sat here for a number of days and listened to the testimony which has been submitted by various witnesses, and I have concluded that many of the facts which I attempted to set forth in my statement have been placed before this committee much more forcibly and ably by other witnesses.

For that reason, I am going to ask leave to submit the statement of Mr. Jackson who appears with me, and who is president of the West Divide Water Conservancy District, an organization that was created to sponsor and to contract with the United States for the maintenance, operation and payment, repayment in part, of the cost of the construction of certain features of that project.

Senator ALLOTT. Without objection it will be inserted in the record in full.

Mr. DELANEY. I am also going to ask to submit the statement I have prepared for the record, and with your permission, Mr. Chairman, I would like to comment on a few special phases of the statement as applied to this particular water district.

Senator ALLOTT. You will be permitted to do that, of course, Mr. Delaney. Proceed in your own way. Your statement will be inserted in the record in full and you proceed to comment in your own way. Mr. Jackson's statement will follow yours in the record at the end of your remarks.

Mr. DELANEY. Turning to page 4 of the statement, we have referred to the fact that in the Colorado River Storage and Participating Act, the fact was recognized that Colorado had furnished a large share of the water of the Colorado River, or that rises in the State of Colorado, and as a result there was allocated to Colorado 46 percent of the revenue to be derived from power generation of the several reservoirs authorized by said act, if and when the advances made by the United States to defray the cost of power had been returned with interest.

In that bill, the five projects for which we now ask authorization were specifically mentioned. A congressional plan for the future development of the upper basin States was embodied in that legislation. Anyone who reads the legislation must conclude that it should be the privilege of each of the States who are to participate in that basin fund to determine and decide how the surplus money is to be spent.

Going to the next page, the problem which now gives us concern is that the U.S. Bureau of the Budget has made certain recommendations concurred in by the Secretary of the Interior and by the administration, as we understand it, to approve the authorization of only two of the five Colorado River projects; namely, the Animas-La Plata and

Dolores, and to defer consideration for the other projects until a National Water Commission, not yet in being, has been given the stamp of approval to the manner in which Colorado is to use its share of water, notwithstanding the fact that the Congress of the United States has already approved the program included in the Colorado River Storage and Participating Act, as outlined above.

We feel that that recommendation is not based upon good, sound logic, and an understanding of the place that this particular project would stand in the development of Colorado as a whole, and particularly, our part of Colorado.

We do take this position, as stated on page 6, that we support the bill that you have introduced, Senator Allott, and similar legislation, but we point out, or attempt to do so, and I think we have been able to call certain facts to your attention, indicating that this particular project is of tremendous importance to the development of the oil shale industry, that it will immediately provide about 77,500 acre-feet of water for that industry, and that if the Secretary of the Interior is proposing to spend a good many millions of dollars, I think over \$101 million, to make certain investigations as to technology and other features pertaining to the development of the oil shale industry, certainly, some consideration should be given to setting aside and earmarking a supply of water for that development.

I think it is conceded by all those who are familiar with the subject at all that there is a very considerable amount of water required for the development of the oil shale industry, and as to a very considerable part of that deposit which lies in the State of Colorado, I am sure that this project offers the best source of the initial supply for the commencement of that great development.

There is another feature there. Senator Allott, you would understand, because you are a lawyer in the State of Colorado. The Colorado River Water Conservation Districts, in cooperation with the sponsoring district, the West Divide Water Conservancy District, have obtained considerable decrees for this water right. Under the Colorado law, we must show due diligence. We must make expenditures in the financing and the construction of that project.

If the Congress was now to say that this particular project would be deferred until a national water commission had passed upon the desirability of the project, we think that it would greatly jeopardize those rights, and we might not be able to maintain them under Colorado law. That is why we think it is essential that this project should be authorized along with the other projects, all these projects, as set forth in your bill.

We thank you very much for the opportunity to appear.

Senator ALLOTT. Thank you, Mr. Delaney. I particularly appreciate your pointing out to this committee the fact that this was mentioned in the Upper Colorado Project Act, and that there is at least a strong moral obligation, if there is not strong legal basis, and I believe there is, to justify the authorization of this act at that time, and also your comments about any acquiescence to letting this project go until some ethereal and yet to be created national water commission, giving it an opportunity to study it, if and when it is consummated and formed, might very seriously prejudice the steps you have already

taken, and they are foresighted steps, and I compliment you and Mr. Jackson both, to assure that water, which is going to be a very vital and necessary part of the oil shale development in order that the oil shale deposits of our great country may be developed.

Mr. Jackson, do you have anything you wish to add?

Mr. JACKSON. No, sir. I think Mr. Delaney is very well qualified to answer all of my questions and his too.

Thank you.

Senator ALLOTT. Thank you.

Senator FANNIN?

Senator FANNIN. No questions.

Senator ALLOTT. Thank you very much, gentlemen. Before you leave, Mr. Delaney, you made it perfectly clear, I think, in your statement, but I want to ask you this specific question:

Under the laws of Colorado, the West Divide Water Conservancy District is organized under a special statute of Colorado and has the powers under the laws of the State of Colorado to contract and obligate for the purchase of this water?

Mr. DELANEY. It has that power, Senator Allott. It is authorized to do so, and that is the very purpose for which it was organized.

Senator ALLOTT. Thank you very much.

Mr. DELANEY. And it stands ready to make such a compact.

Senator ALLOTT. Thank you, Mr. Delaney.

(The statements referred to follow:)

STATEMENT OF FRANK DELANEY

Mr. Chairman and gentlemen of the committee, my name is Frank Delaney. I reside at Glenwood Springs, Colorado, and have been a resident of Western Colorado for more than 60 years. I appear here today in a dual capacity; I am attorney for the West Divide Water Conservancy District, and I am also a landowner and rancher on lands situate within and which will be served by said Project if the same is ever constructed.

The views I express are personal views, but are in accordance with the views of the District which I represent. Said District supports the enactment of the legislation pertaining to the Colorado River Basin Project, as set forth in Senate Bill No. 1242 by Senator Allott and Senator Dominick.

A brief reference to the interest of the State of Colorado in any plans to make use of the waters of the Colorado River system is certainly interesting and might be helpful to understand the pending legislation.

The area of the State in which I reside and in which the five Colorado Projects referred to in section 501a of said Bill¹ are located produces about 9 million of the 11½ million acre-feet of the stream flow which, during the past 42 years, on an average annual basis, has reached Lee Ferry, the point at which a part of the water of the Colorado River is to be measured for purposes of division of water between the Upper Basin and the Lower Basin for consumptive use in the Upper Basin States and in the lower Basin States, as those terms are defined in the Colorado River Compact.²

While Colorado produces approximately 70% of the water of said stream flow, the use of water in Colorado is circumscribed and limited by the Colorado River Compact, the Upper Colorado River Compact and the Mexican Treaty. As everyone now knows, the Compact Commissioners who wrote the Colorado River Compact assumed that the average stream flow of the Colorado River at Lee Ferry was at least 18 million acre-feet. This was a grievous mistake.

¹ West Divide, Dallas Creek, San Miguel, Dolores and Animas-La Plata. See House Documents 438, 434, 435, 436 and 412, 89th Congress, 2nd Session.

² Article III of said Compact relates to the division of water. Article II defines the terms mentioned above.

It appears now that the amount of water of which Colorado can make consumptive use is limited to approximately 2,700,000 acre-feet.²

The most competent and outstanding hydrologists of the west have studied this matter of stream flow, and we assert with confidence that they agree that Colorado has allocated to it, under any reasonable interpretation of the compacts above mentioned, sufficient water to supply the requirements of the five projects in Colorado named in said Bill. As time and additional measurements made it apparent to the officials and water agencies of the State of Colorado that all of the rosy expectations which we entertained at an earlier date could not come to fruition, we became concerned about the supply of water upon which Colorado could depend.

As a result of this concern, our distinguished citizen Edwin C. Johnson, former three-term Governor and three-term United States Senator from the State of Colorado, in cooperation with the governors and administrative agencies of the other three Upper Basin States, and with the able assistance of Congressman Aspinall and other senators and congressmen, eventually secured an agreement upon legislation which was afterwards enacted in the 84th Congress, as the Colorado River Storage and Participating Projects Act.⁴

While Colorado gets the consumptive use of about 25% of the water which originates in Colorado for her own intrastate use, the equitable claim of her position as the principal producer of the water of the Colorado River was recognized in said legislation by allocating to Colorado 46% of the revenue to be derived from power generation of the several reservoirs authorized by said Act, if and when the advances made by the United States to defray the cost of power had been returned, with interest. In that Bill, the five projects for which we now ask authorization were specifically mentioned. A Congressional plan for the future development of the Upper Basin States was embodied in that legislation. Anyone who reads the legislation must conclude that it should be the privilege of each of the states who are to participate in that basin fund to determine and decide how the surplus money is to be spent.

Colorado has made that decision through its official water administrative agency and through the Chief Executive of the State of Colorado. This Governor Love or R. T. Eckles, Coordinator of the Division of Natural Resources of the State of Colorado, will clearly advise you.

The problem which now gives us concern is that the United States Bureau of the Budget has made certain recommendations, concurred in by the Secretary of the Interior and by the Administration, to approve the authorization of only two of the five Colorado River projects, namely the Animas-La Plata and Dolores, and to defer consideration for the other projects until a National Water Commission, not yet in being, has given the stamp of approval to the manner in which Colorado is to use its share of water, notwithstanding the fact that the Congress of the United States has already approved the program included in the Colorado River Storage and Participating Projects Act as outlined above.

We shall attempt to demonstrate that such a recommendation is unequitable and unfair. If there is a logical reason for deferring the authorization of any of the projects mentioned in the pending legislation, then the same logic or lack of logic would certainly pertain to and require deferment of authorization of all of the projects mentioned in the said Bill. However, we believe that such a deferment is not in the national interest, nor is it in the interest of the State of Colorado. This we shall try to demonstrate.

Because we are more familiar with the West Divide Project than any of the others, *although they all stand on an equal footing from the standpoint of the policy of the State of Colorado*, we shall illustrate our argument by references to the West Divide Project.

In the letter of the Assistant Director of the Budget, accompanying the report on this project submitted to the House of Representatives during the con-

² (a) See address by Northcutt Ely, April 6, 1967, at Fourth Oil Shale Symposium of Colorado School of Mines, Denver, Colorado.

(b) Depletion of surface water surplus west of Continental Divide by Raymond D. Hill of Leeds, Hill and Jewitt of Los Angeles, to Colorado Water Conservation Board under H. B. 457 (1953) and also paper presented at American Society of Civil Engineers at Sacramento, December 7, 1954.

(c) Tipton and Kelmbach Report to the Upper Colorado River Commission—date 1965.

(d) U.S.G.S. Water Supply paper, pages 526 and 527.

⁴ Public Law 485—84th Congress, 70 Stat. 105, 43 U.S.C.A. 620 to 620(o). See Section 5 of said Act creating the "Basin Fund" and making allocation of earnings from power.

sideration of H.R. 4671 of the 89th Congress,⁵ the Assistant Director summarized the features of all five projects, and in each of four of the projects—with the exception of the West Divide Project—he set forth the percentage of water allocated to irrigation which would be repaid by the irrigators. He referred to the high cost of irrigation per acre of land, but neglected to mention the fact that the irrigators of the West Divide Project would repay 24% of the irrigation cost, which is the highest percentage of repayment of any of the five projects; it is more than 10% higher than the Animas-La Plata. The benefit cost ratio of the West Divide Project is higher than one of the two approved by the Secretary.⁶

One of our undeveloped resources is the oil shale deposits, 85% of which are Federal lands and a big proportion of which are in the Piceance Basin in Colorado. The northerly boundary of said oil shale area is adjacent to the southern perimeter of the westerly part of the area in the West Divide Project. Its potential has been recognized by many outstanding authorities as one of the great national resources. The Secretary of the Interior has recently recommended the expenditure of \$101 million for various phases of investigation and accumulation of technical knowledge with respect to the production of shale oil from oil shale. However, up to date, he has not made any plan or commitment for the supply of water for this great prospective development. The area contains a potential production of at least 480 billion barrels of shale oil from the beds averaging 25 gallons of oil per ton of oil shale.⁷

According to the authorities, the minimum requirements of water for this prospective development as far as is known to present technology will be a minimum of 250,000 acre-feet and a maximum of 500,000 acre-feet. Where is this water going to come from? Has the Secretary of the Interior ever answered the question?

The West Divide Project would make available for that great prospective development 77,500 acre-feet of water at the outset. The mesa lands on the lower reaches of the Project are in such proximity to the oil shale deposits that it is self-evident a great part of the oil shale development will be in this area to be served by the West Divide Project.

"As those communities increase and grow they will take over the mesas and bench lands now devoted to agriculture and the project water originally allocated for irrigation will be converted and changed to urban use with practically no additional cost."⁸

This change from irrigation to urban uses would, in my opinion, add an additional 30,000 acre-feet of water to the domestic requirements of the oil shale development. The Project might eventually furnish in the neighborhood of 120,000 acre-feet for M & I uses.

From a national standpoint this is the most important project of any of the five, and ranks in overall importance with the main Central Arizona Project itself. The money that the Secretary of the Interior and the Government are expending for oil shale development will be money thrown down a rat hole unless steps are taken to supply water for oil shale development.

The Colorado River Water Conservation District, which might be termed the parent organization of the West Divide Water Conservancy District, has secured decreed rights to use the water needed by this Project. Under Colorado law such a right cannot be maintained unless due diligence is shown in the financing and construction of the project works. We have attempted to collaborate with the Bureau of Reclamation by the expenditure of substantial sums of money to enable the Bureau to make a favorable feasibility report on this Project.

We find ourselves in a difficult position to preserve said rights if the Congress at this time says that further action on this Project should be deferred until a National Water Commission, which has not yet been created, approves or disapproves the plan which Congress already approved in 1956 by the enactment of Public Law 485. We hope the Administrative and Executive officers and Congress will not delay earmarking a part of the water needed to work the oil shale

⁵ House Document No. 434, page v, dated April 30, 1966.

⁶ The benefit cost ratio of the West Divide Project is 1.12 to 1 direct or 1.98 to 1 indirect; Animas-La Plata 1.1 to 1 direct, 1.73 to 1 indirect. See House Document No. 434, 89th Congress, pages v and vi cited above.

⁷ Raymond D. Sloan, Manager, Oil Shale Project, Humble Oil Company. Address before Colorado Water Users Association at Las Vegas, Nevada, December 2, 1965.

⁸ Hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, 89th Congress, 2nd Session on H.R. 4671 and similar bills. Serial No. 89-17—Part II, p. 1265.

deposits the U.S.A. owns, until pressure builds up to assert the claim of Federal ownership of water. Such a course would surely open another Pandora's Box of evils.

We urge that all five projects have been designated by Colorado as the projects on which a part of her share of the basin fund is to be used, and we do not believe that any other authority, state or national, should have the veto power on what Colorado asks pursuant to prior Congressional approval. We regret very much that the unanimity of the four Upper Basin States has been strained and maybe destroyed by the dogmatic position taken by the Secretary of the Interior and the Administration. We feel the position of those agencies is not in the best interests of oil shale development or the promotion of a great national resource. We urge enactment of the water law substantially in accord with Senate Bill No. 1242.

This project is supported by municipalities and other organizations throughout our area.*

We ask you to consider the same.

STATEMENT OF WILLIAM B. JACKSON, DIRECTOR, WEST DIVIDE WATER
CONSERVANCY DISTRICT, STATE OF COLORADO

Mr. Chairman and Gentlemen of the Committee, I am William B. Jackson from Glenwood Springs, Colorado. I am Chairman of the Board of Directors of the West Divide Water Conservancy District. My appearance today is on behalf of myself as an individual rancher whose property would be under this project, and as a duly appointed representative of the West Divide Water Conservancy District.

The Colorado River Storage Project and Participating Projects Act (Public Law 485) includes provision for the West Divide Project located in west central Colorado, which will directly serve the area along the Colorado River adjacent to some of the largest oil shale deposits in the world. It includes in its purposes the supplying of municipal and industrial water to the oil shale industry as well as to agriculture.

A great deal of thought has been given to the long-term development of the waters of the western slope of Colorado, and action has been taken by resolution and otherwise by the Congress, the State Legislature, the Colorado Water Conservation Board and the Colorado River Water Conservation District, and others, to assure that sufficient water would be left available in the natural watersheds of the western slope to permit reasonable expansion and industrialization of this area. It is clear that failure to take definitive steps now could well leave the oil shale industry and agriculture with less water than required to insure this development.

Authorization and construction of five Colorado projects, namely: The Animas-LaPlata located in Colorado and New Mexico; the Dolores, Dallas Creek, San Miguel and West Divide, all of which are in Colorado, was first considered by the 89th Congress as a provision of H.R. 4671. The Administration, through the Bureau of the Budget and the Secretary of the Interior, has recommended the deferral of three of these Colorado projects, the West Divide, Dallas Creek and San Miguel, pending the establishment of the National Water Commission and completion of its review of related water problems. In the case of the West Divide Project, this recommendation appears to have been based upon three points, as expressed in a letter addressed to me by the Assistant Secretary of the Interior, Mr. Kenneth Holum. These three points are:

1. The high investment cost per acre of the irrigated land to be developed;
2. The advisability of developing new irrigated acreage in a potentially water-short area; and
3. That the need for municipal and industrial water does not appear imminent.

In answer to these points, we must admit that the unit cost per acre is high. But is not an investment that will return \$1.98 for each \$1.00 invested, plus paying interest at the rate of 3½%, a good investment? This figure is arrived at by using the Bureau of Reclamation benefit cost ratio of 1.98:1.00; or if we use the Bureau of the Budget benefit cost ratio we still have a return of \$1.16 for each \$1.00 invested, plus interest. This is still a pretty good return.

* Resolutions to that effect appear at pages 1265 through 1278 of the hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, 89th Congress, part II, on the then-pending H.R. 4671.

Irrigation costs of \$51,344,900 not paid by irrigation or from ad valorem tax revenues would be paid from revenues apportioned to Colorado, and I would like to emphasize "apportioned to Colorado," from the Colorado River Storage Project. The necessary revenues would be available to Colorado prior to the dates required according to a repayment analysis of the Colorado River Storage Project and Participating Projects of January 27, 1965. (West Divide Project, Colorado, Feasibility Report, March, 1966. Page 61).

In answer to Point 2, if Mr. Holum is referring to the West Divide area as a potentially water-short area under present conditions, without the West Divide Project, he is in error. We are a water-short area period. If he is referring to after the construction of the West Divide Project, with its storage features, he is again in error. Over the seventeen-year study period, 1945 to 1962, as conducted by the Bureau of Reclamation, the project would have delivered 95.3% of the estimated irrigation requirements. This would be considered tolerable under general irrigation practice. (West Divide Project, Colorado, Feasibility Report, March, 1966. Page 41.)

As to Point 3, the municipalities of Grand Valley, DeBeque, Rifle, Silt and Glenwood Springs have pledged to subscribe for approximately 36,000 of the 77,500 acre feet of water that are set aside for municipal and industrial purposes. The needs of DeBeque, Grand Valley, Rifle and Silt are imminent. By this time this project can be completed, some fifteen years hence, the needs of these municipalities will be critical and the needs of Glenwood Springs will be imminent. The West Divide Water Conservancy District and the Colorado River Water Conservation District have pledged themselves to subscribe for the entire amount of municipal and industrial water.

As to the Administration's recommendation of deferral pending the establishment of the National Water Commission, we do not feel it should be the purpose of the National Water Commission to dictate to the State of Colorado what its internal water developments should be as long as those projects are economically feasible and clearly within Colorado's allocation of water under the Colorado River Compact.

We are convinced that the conclusions arrived at in the feasibility report as to the need for municipal and industrial water are decidedly on the conservative side. In reports prepared by the University of Colorado and Cornell University several years ago pertaining to the oil shale industry and development in this area a much greater population and demand for municipal and industrial water was foreseen. As the demand for municipal and industrial water increases additional agricultural lands and water will be annexed by municipalities and industries. It appears that the water requirements for one acre of agricultural land and one acre of urban land are approximately equal.

Water is the lifeline of all future development in the semi-arid area in which we live regardless of whether this development is agricultural or industrial. The West Divide area has good lands and can raise good crops, and can support large population centers with proper utilization of water resources. Storage is the answer. A conditional decree for storage of water on the Crystal River has been granted the Colorado River Water Conservation District.

The agricultural economy in the West Divide area is based primarily on livestock. Such specialty crops as cherries, peach and apples are produced on lands in the western part of the West Divide Project area. As the population of this area increases it can be expected that truck garden type crops will also be included and that the fruit industry will expand.

The project will provide much needed and favorable recreation facilities. Provision has been made to improve stream fisheries in all possible ways. The development of all potential recreation sites on public lands will have a capacity of 109,500 visitor days annually.

We have the support and good wishes of the communities in and near the District, the three counties involved in the District, the various official water organizations of the State of Colorado, the Governor, and the State Legislature of Colorado. We also have the official endorsement of National Rivers and Harbors Congress. We are ready to enter into a repayment contract with the United States for this project as soon as it is authorized.

H.R. 3300 as introduced by Congressman Aspinall and Senate Bill 1242 as introduced by Senators Allott and Dominick are of great importance to the western states and to the United States. Development of our water resources is the only way we can grow and prosper. The five reclamation projects in Colorado included in this legislation are a step toward that development.

It has been a pleasure to appear before you and for the reasons mentioned and many more too numerous to mention, I strongly urge that you do everything possible to expedite the authorization and construction of the West Divide Project.

Senator ALLOTT. The next witnesses are from the Tri-County Water Conservancy District. Mr. Robert K. Lewis, Montrose, Colo., is president of the district, and he has been ever since the district was organized in 1957. He has farmed and ranched in Montrose County for over 25 years. He is accompanied by Mr. Robert Field, manager of the district, and by Mr. Jack Hughes, counsel for the district. All of these gentlemen I have known for a long time. We welcome you here. Will you proceed in your own way.

STATEMENT OF ROBERT K. LEWIS, PRESIDENT, THE TRI-COUNTY WATER CONSERVANCY DISTRICT, STATE OF COLORADO; ACCOMPANIED BY ROBERT FIELD, MANAGER, TRI-COUNTY CONSERVANCY DISTRICT; AND JACK HUGHES, GENERAL COUNSEL

Mr. LEWIS. Thank you, Mr. Chairman and Senator Fannin. It is my understanding, that our full written statement will be included in the record.

Senator ALLOTT. Without objection the full written statement will be inserted in the record and you may proceed to comment upon it if you wish.

Mr. LEWIS. I have just one item I would like to underline a little. I have made quite a condensation of my written statement.

Senator ALLOTT. All right.

Mr. LEWIS. I am going to further condense it, with your permission. The Tri-County District has acquired an interim supply of water through contract with the Padre Valley Users Association for domestic water. This interim supply of domestic water made it possible for the district to apply to the Department of Housing and Urban Development for an advanced planning loan with which to do a detailed engineering study of the domestic water system of the valley.

The study has been completed as of April 27, 1967, and forwarded to the Department for their approval. The initial system is expected to be in service within 2 years, and will require a minimum of 1,000 acre-feet of water per year. The city of Montrose, has contracted with the Tri-County for use by an exchange by a maximum of 5,000 acre-feet of water per year for domestic purposes, to supplement the city's existing water supply.

This contract becomes a part of the 15,000 acre-feet of a municipal and industrial water to be available from the Dallas Creek project when it is constructed. Added to this within the next 24 months, Tri-County will construct its initial domestic water system which will use a minimum of 1,000 acre-feet of water per year which also becomes a part of the 15,000 acre-feet of water to be available from the Dallas Creek. So, you see Tri-County now has a specific and contracted use of up to 6,000 acre-feet of water per year from municipal and industrial water available in the Dallas Creek project when it is constructed. This emphasizes clearly the need on the part of the people of the area for the Dallas Creek project.

I would like to add that all those contracts carry the clause that when Dallas Creek is constructed, this water is to be taken from the Dallas Creek project.

I believe, Mr. Chairman, because of your courtesy in staying with us, that I will not add to this but I will be very happy to answer what questions I can.

Senator ALLOTT. I want to ask you the same general question I have asked the others, and that is that the Tri-County Water Conservancy District is authorized under the laws of the State of Colorado to make a contract for repayment, and is willing to do so?

Mr. LEWIS. It is.

Senator ALLOTT. I also particularly appreciate your calling attention to the fact that the Dallas Creek project is one of the participating projects named in the Colorado River Storage Act in 1956, and was given priority with respect to completion of planning reports.

Mr. LEWIS. That is correct.

Senator ALLOTT. This is a very potent thing. Do any of the rest of you gentlemen wish to make any statement?

Mr. Hughes?

Mr. HUGHES. Senator Allott, I would just like to support what Mr. Delaney said with regard to the west divide project, and the same thing is true with regard to the Dallas Creek project. We have made filings on the water rights for them, and have obtained conditional decreases, and that if the projects do not move forward, we may be in real difficulty in maintaining our appropriations for the projects.

Senator ALLOTT. When you say appropriations, you mean appropriations of water.

Mr. HUGHES. Yes, sir; the water.

Senator ALLOTT. I don't want to get that mixed up with this dollar appropriation here in the Senate.

Mr. HUGHES. Thank you.

Senator ALLOTT. Thank you.

Mr. FIELDS. I have nothing further to add.

Senator ALLOTT. Senator Fannin?

Senator FANNIN. Thank you, Mr. Chairman. I just wish to commend the gentlemen for the statement and for being here. I will read the complete statement at a later time.

Senator ALLOTT. Thank you very much, gentlemen, for your attendance and your support.

(The prepared statement referred to follows:)

STATEMENT OF ROBERT K. LEWIS, PRESIDENT, THE TRI-COUNTY WATER
CONSERVANCY DISTRICT, STATE OF COLORADO

Mr. Chairman and Gentlemen of the Committee, I am Robert K. Lewis and reside in Ouray County, Colorado. I am a rancher and landowner, and for the past 25 years, I have run either sheep or cattle operations in Ouray County and adjacent areas.

The Board of Directors of the Tri-County Water Conservancy District has officially designated me to appear before you on behalf of the Board and the people of the Tri-County District. I have served as president of the Tri-County Water Conservancy District since it was formed in September of 1957. The District was organized pursuant to the laws of the State of Colorado and upon petition of the people residing in the District. The purpose of its organization was to create an official sponsoring, contractual and operating entity for the partici-

pating projects of the Colorado River Storage Project located in this area, and specifically the Dallas Creek Federal Reclamation Project. Dallas Creek was one of the participating projects mentioned in the Colorado River Storage Project Act of April 11, 1956, and given priority with respect to completion of planning reports under that Act.

The Dallas Creek Project is today proposed to be authorized under Senate Bill 1242 and related bills. My appearance here today is in support of Senate Bill 1242 and related bills, which include the Dallas Creek Project and four other Colorado Projects. However, my testimony will be especially in support of the Dallas Creek Project.

We are extremely pleased with the report on the Dallas Creek Project by the Bureau of Reclamation concerning its feasibility and feel that they are to be commended for the fine work that they have done in bringing the years of study and field work together in such a detailed and clear report. Our Board members have reviewed the report carefully and have taken the report to the people in the form of public meetings in the service area of the District. Almost without exception, the people have expressed their feelings that the Dallas Creek Project is the most important future development of the area and I cannot emphasize enough its major economic importance to them. They have strongly given their approval and endorsement. I would like to say at this point that the District is anxiously awaiting the authorization of this project and I have been directed to tell you that the District is ready, wholeheartedly willing and able to enter into a properly negotiated contract for the repayment of allocated project costs.

It has been recommended that the Dallas Creek Project be deferred pending a study by a National Water Resources Commission. I wish to state emphatically that we do not support such a recommendation and we do not feel that it is within the province of a National Water Commission to attempt to allocate the use of water within a State. The Dallas Creek Project use of water would be within the apportionment of water made to the State of Colorado by the Upper Colorado River Basin Compact and there is no justification for further delay in this respect for the Dallas Creek Project or for the other two Colorado Projects mentioned in such deferral recommendation.

I am very familiar with the Dallas Creek Project area and its needs. I own property under the project as proposed and I will receive both supplemental water and water for full service irrigation. In addition, at my home ranch, which is on the Uncompahgre River near the Montrose-Ouray County line, I will be a beneficiary of the Municipal and Industrial water to be provided for the Uncompahgre Valley through the Dallas Creek Project. I can tell you that this will be a blessing, as I must now haul water by tank to my home for our domestic use. I will enlarge more on this at a later point in my statement.

The Project area is largely an agricultural area with the production of livestock, chiefly beef cattle and sheep, being the main enterprise. The irrigated farm lands are used for the production of pasture, hay, oats, and barley with the aftermath being utilized as winter clean-up pastures for livestock. There is a relatively small acreage devoted to sugar beets and other cash crops. The surrounding lands are used mainly for spring, summer and fall grazing of cattle and sheep. There is a small acreage of non-irrigated farm land that is dry-farmed. This land has been used mostly for the production of wheat. However, this type of farming has proven to be uneconomical due to lack of rainfall and is therefore of little economic importance. This land will be under the Dallas Creek Project and would be placed under irrigation, in which case the production of wheat would be eliminated and the production of feed and forage type crops would take its place.

Our Dallas Creek Project area has two severe problems at the present time and therefore divides itself into two problem areas. The southern area principally in Ouray County suffers severe mid- and late-season irrigation shortages. The northern area, consisting mainly of Montrose and Delta Counties, is in very dire need of additional municipal and industrial water. This is not only a problem for the towns and cities which have outgrown or are outgrowing their present domestic water supplies, but for the farmers and ranchers who have in the most part always been without a safe and adequate domestic water supply.

There are approximately 17,000 acres presently irrigated in the Dallas Creek Project irrigation service area. However, water supplies are inadequate for full productivity. Most of the lands have adequate water in the spring, but as I have mentioned before, suffer severe mid- and late-season shortages. No storage is presently available for regulation of the abundant spring water supplies. The

lack of full productivity brought about by the erratic water supply has tended to make the economy of the farmers and of the related service industries unstable. There is an urgent need for additional and dependable irrigation supplies to improve and stabilize the economy of the area. Adding to the economic instability of the farmers and ranchers, grazing privileges on public lands have been decreased in recent years. This has added to the need for more farm grown feed.

In the northern service area of the Dallas Creek Project, additional municipal and industrial water is needed to meet existing and anticipated needs. A few of the rural residents have wells or have constructed pipelines to convey their water from springs or nearby communities. Most of them, as I do, have to haul their water in tanks from nearby communities and stores it in cisterns. Many times, the cisterns are not properly built and maintained and present a continual health hazard. Wells also are confronted with a contamination problem due to population increases in the suburban areas. There is estimated to be less than 5,000 acre feet of water available in piped systems for the municipal and industrial service area. Residents are continually plagued with water shortages and limitations on use must be imposed. There is absolutely no reserve provided for future growth. A significant population increase is forecast in the years ahead for this area particularly in the vicinity of the community trade centers. This increase is expected as a result of the continuously growing popularity of the area for vacationers. The impact of the Curecanti unit of the Colorado River Storage Project, just 40 miles to the east of the Dallas Creek Project area, is beginning to be felt at this time. The first reservoir of the unit is now being filled and is becoming a major scenic, boating and fishing attraction. The Bostwick Park Project, just 20 miles to the east, is scheduled for construction activities this year and will also attract visitors and add to the population increase of the area.

The Tri-County Water Conservancy District has worked diligently to see that sufficient municipal and industrial water was included in project plans and has provided the Bureau of Reclamation on a statement of intent to use and pay for, with interest, the municipal and industrial water to be made available in Dallas Creek. The municipal and industrial water supply problem in the Uncompahgre Valley was becoming quite critical and as early as 1962, the Directors of the District began an investigation of an interim supply of water for use in an Uncompahgre Valley-wide domestic water system until such time as the requested municipal and industrial water was available from the Dallas Creek Project. Such an interim supply of water was made available to the Tri-County Water Conservancy District through the cooperation of the Uncompahgre Valley Water Users Association which is the operating entity of the Uncompahgre Project, one of the oldest reclamation projects in the United States. 16.12 cfs of early priority water has been made available of the Tri-County Water Conservancy District under contract by the Uncompahgre Valley Water Users Association and the United States for the period of time between now and when the 15,000 acre feet of M & I water is available from Dallas Creek. At that time, the interim water supply contract will be cancelled.

This interim supply of domestic water made it possible for the District to apply to the Department of Housing and Urban Development for an advance planning loan with which to do a detailed engineering study of the proposed Uncompahgre Valley domestic water system. This loan was granted and the study has been completed as of April 27, 1967, and forwarded to the Department for their approval. The initial system which contemplates serving only those areas without a domestic water supply at the present time and a small town in the central service area, is expected to be in service within two years and will require a minimum of 1,000 acre feet of water per year. The City of Montrose has contracted with the Tri-County Water Conservancy District for use, by exchange, of a minimum of 1,500 acre feet up to a maximum of 5,000 acre feet of water per year for domestic purposes to supplement the City's existing water supply. In effect, the City of Montrose will be using within the next 12 months, 1,500 acre feet of water, which under contract becomes a part of the 15,000 acre feet of water to be available from the Dallas Creek Project when it is authorized and constructed. In addition to this, within the next 24 months, the Tri-County Water Conservancy District contemplates constructing an initial domestic-water system for the Uncompahgre Valley which will use a minimum of 1,000 acre feet of water per year which becomes a part of the 15,000 acre feet of water to

be available from the Dallas Creek Project. The Tri-County Water Conservancy District now has a specific and contracted use for 6,000 acre feet of water per year to be taken from M & I water available in the Dallas Creek Project when it is constructed. This emphasizes clearly the need on the part of the people in the area for the Dallas Creek Project.

Another important aspect of the domestic water service throughout the Valley is that it will provide some relief for the very high operation costs providing water for livestock in the winter. This relief will accrue to the old established Uncompahgre Project, operated by the Uncompahgre Valley Water Users Association. This project furnishes irrigation water to the northern area of the Dallas Creek Project area, and despite the very high cost of maintaining canals and irrigation structures, have provided winter stock water where natural streams, springs or wells are not available. With the installation of an area wide domestic water system, most of this winter operation could be eliminated and provide a substantial savings to the Uncompahgre Valley Water Users Association.

It should also be pointed out that the water that has been made available for domestic use by the Uncompahgre Valley Water Users Association pending the construction of the Dallas Project has been made available at considerable sacrifice to the farmers and irrigators under the Uncompahgre Project. At the present time there is a shortage of water to the farmers and irrigators under the Uncompahgre Project in the months of July, August and September and the depletion of the farmers water supply by taking care of the domestic water needs creates a hardship on the farmers and ranchers. It is essential to the economic life of the Uncompahgre Valley that the Dallas Creek Project be constructed as soon as possible to release the water for irrigation purposes which is presently being utilized for domestic purposes.

In closing, I would like to state that it is the feeling of our Board of Directors who are representatives of the area and of the people, that we believe that the Dallas Creek Project is a good project, that it is feasible from both an economic and an engineering standpoint, and that it will benefit not only those of us who will see it come into being, but will benefit generations beyond. Our opinions are not those of qualified experts, but are opinions based upon our observations as residents of the area and users of the water and land resources.

It has been a distinct pleasure for me to appear before you today as a representative of the Dallas Creek Project area and I want to thank you for your courtesy and consideration in listening to the views that I have expressed. I believe that the Dallas Creek Project should be authorized and that it will be a credit to our land. Thank you.

Senator ALLOTT. Next is the Dolores Water Conservancy District, Mr. W. T. (Jack) Vinger, chairman of the district, farmer and businessman in Dolores County, Colo., for over 40 years a member of the Board of County Commissioners of Dolores County. He is accompanied by Mr. Ivan Patterson, who is secretary for the district.

Mr. Vinger, your statement is short. You may either read it or we will insert it in the record, and you may comment on it as you see fit.

STATEMENT OF W. T. (JACK) VINGER, PRESIDENT, DOLORES WATER CONSERVANCY DISTRICT, STATE OF COLORADO; ACCOMPANIED BY IVAN PATTERSON, SECRETARY, DOLORES WATER CONSERVANCY DISTRICT

Mr. VINGER. Thank you, sir. My name is Jack Vinger. I am president of the Dolores Water Conservancy District of the State of Colorado. Our district was organized in November of 1961, pursuant to the laws of the State of Colorado, to act as the official sponsoring, contractual and operating entity for the proposed Dolores Federal reclamation project in southwestern Colorado.

The Dolores project represents a plan to utilize the presently unused water of the Dolores River in southwestern Colorado.

Local interests have been interested in securing additional irrigation water since 1912, and many groups have worked on the project through the years.

We are ready to enter into a repayment contract with the United States for this project at any time after the project is authorized.

Since the Dolores Water Conservancy District was organized in November 1961, considerable progress has been made. The Bureau of Reclamation has completed feasibility studies on the project and report a benefit-cost ratio of 1.96:1, in their report of January 1966.

A 265-foot-high dam, 10 miles downstream from the town of Dolores will create a storage reservoir of 325,000 acre-feet water capacity, with active storage of 150,000 acre-feet. The 175,000 acre-feet of inactive storage will create a large permanent lake which is sure to become an attractive recreational area.

The 150,000 acre-feet of active storage will provide irrigation water for:

	<i>Acres</i>
1. Supplemental irrigation service land in Montezuma Valley area-----	30,500
2. Full irrigation service land Montezuma Valley-----	9,450
3. Cahone Mesa and Dove Creek areas-----	26,000
Total -----	66,000

Under item 1, there is a definite need for this supplemental irrigation water, as the present irrigation facilities depend mostly upon direct streamflow which is usually just enough to bring fruit, hay and other farm crops almost to maturity. This supplemental water will provide water to put the finishing touch to an almost mature crop, insuring successful crops every year.

Under item 2, much of this land is in and near the Ute Mountain Indian Reservation, south of Cortez, Col. The Ute Mountain Indians could use irrigation water to produce forage and winter feed for their livestock.

Under item 3, the Cahone Mesa area is desirable for fruit production, while the Dove Creek area is now dependent on rainfall with barely enough moisture to produce pinto beans and wheat. Irrigation will permit more diversity of crops and livestock production.

In our files are many letters from chambers of commerce, Rotary clubs, conservation groups, school districts, and from Boards of County Commissioners of Dolores and Montezuma Counties, from the mayors of the city of Cortez, the towns of Dolores and Dove Creek; all urging early authorization and completion of the project. Included are copies of some of these letters.

Our Dolores Water Conservation District board of directors are more aware of the need for this project than the above groups, since most of our members are farmers and can see the need every day.

The immediate benefit will, of course, be the stimulation of the area's depressed economy that will be brought about by local employment during the construction phase, and by influx into the area of personnel connected with construction.

As soon as irrigation water is available there will be an immediate increase in productivity of farmlands. Farming activity per acre unit will become increasingly concentrated and will in turn result in reduction of average farm size, more farming opportunities, such as

production of fruits and vegetables, and more farm home construction.

There will be more business opportunity to process and market the added production. Farm crops will become more diversified. An increase of feed, fruit, and livestock production will occur. Increase of trade to outside areas will benefit the economy of outside areas, as well as that of the local area.

Vegetable and fruit production will provide seasonal employment for the Navajo and Hopi Indians, whose reservations are just a short distance south of the project.

Recreational activities such as boating, fishing, camping, and hunting will be greatly increased. These attractions will not only bring vacationers and associated revenue to the area, they will also benefit towns and cities along highways in all directions from the Dolores River project. Need for additional housing and other facilities to accommodate nonresidents will provide expanding opportunities for small business ventures.

One of the greatest potential benefits to the immediate area and to the surrounding areas is the provision and development of a reliable and adequate water supply to support present and future community requirements, plus additional water readily available to attract and support new industry.

This project will be of special importance to the city of Cortez, the town of Dolores, and the town of Dove Creek, as their present municipal water supplies are limited. It is especially important to the town of Dove Creek who now pump their water against a 900-foot head out of the Dolores River Canyon. This is expensive and limits their water supply to the capacity of the high pressure pumps.

The impounding of this water will also have beneficial effects on other dams in the Colorado River Basin as the waterflow from this dam will release clean, clear water, thereby reducing the amount of silt that would accumulate in Lake Powell.

The local direct and indirect benefits that will result from this project are estimated to exceed over \$4 million annually. This will be good for this corner of Colorado, for the entire State, and the Nation.

There is another social reason for this project, and for projects of this kind. An objective view of the social ills of our Nation reveals that thousands of people are leaving the farms annually, to improve their social and economic status. Young people are forced to leave farming communities because there are no opportunities for them.

This migration to the cities is creating an oversupply of unemployed, poorly trained to compete with the hordes already there. This is creating social and economic problems for the cities and our Nation.

Projects such as the Dolores River project will provide employment opportunities for our young people, preventing the social and economic problems stated above.

We urge you to give favorable consideration to this project as it will permit this area to grow and prosper as other parts of the Nation are progressing.

Our secretary-treasurer is present to assist in this presentation and to furnish any further information that the committee might require.

Senator ALLOTT. That is fine.

Mr. VINGER. The nature and purpose of our project is simple. It involves the impoundment of unused waters rising in the drainage area of the Dolores River in the southwest corner of Colorado. All of these waters originate in Montezuma and Dolores Counties. The point of this statement is that this proposal contemplates only the conservation and use of waters originating wholly within the project area.

This is to be accomplished with Federal funds simply to reimbursement by the water user in the Upper Colorado River Basin fund. The cost of the project is estimated to be \$47 million, but more than \$41 million of these costs are reimbursable.

Senator ALLOTT. I would like to underscore that. Out of the \$47 million cost, \$41 million would be repayable.

Mr. VINGER. Yes, sir.

Senator ALLOTT. Thank you.

Mr. VINGER. The major feature of the project is the McSee Dam and Reservoir, which impound some 360,000 acre-feet of water. This reservoir would provide an extraordinary recreational facility adjacent to Mesa Verde National Park, and the Four Corners area. Significant also, in this regard is the fact that the State of Colorado has pledged a contribution in excess of \$600,000 for the cost sharing of separable facilities to serve recreation, fish, and wildlife.

Of primary importance are the provisions in the project to supplement municipal and industrial waters for the city of Cortez and the towns of Dolores and Dove Creek. These practical considerations need a slight elaboration here.

The town of Cortez will receive 4,900 acre-feet of supplemental water. The town of Dove Creek will receive 1,200. The town of Dove Creek is presently pumping water out of the subsurface of the Dolores River, some 9 miles from the town at a pumping head of 1,900 feet. It is estimated by the town of Dove Creek that their pumping costs alone are between 40 and 50 cents per thousand gallons of water delivered into their system.

It will be noted on page 2 of the formal statement, that irrigation water will be provided for some 56,000 acres of land. Approximately one-half of this acreage will receive supplemental water later in the growing season on an exchange basis with the Montezuma Valley Irrigation Co. This exchange will provide an assured irrigated supply for the full growing season on lands that have been under irrigation for the past 50 years. The remaining so-called full service land of approximately 35,000 acres will be receiving water for the first time.

I should like to emphasize here that these are not new lands going into agricultural production for the first time. These are lands presently being farmed as dry lands. The principal crops being produced are wheat and beans, both under the commodity support programs. The availability of irrigation water will permit diversification of these lands to production of feed, storage, livestock, and fruit, which is a much higher beneficial use.

The social and economic benefits that would accrue for this project need no illumination. Our area is sorely depressed, as are most non-urban areas, with their economies built primarily on agriculture. But I emphasize these agricultural facts to dispel the idea that this project, if authorized, would run counter to the national effort to curtail production of farm products in the surplus category.

Included in the full service lands are some 1,500 acres that will go on the Ute Indian Reservation of Mountain Ute. The urgency and need for these waters on this land has been adequately testified to by the chief of the Ute Mountain Tribe, Jack House, in the hearings of the House on H.R. 4671 of last year, on pages 1216 and 1217. The development of recreation in the area will provide needed diversity in the total economy, and I underline total.

Ours is a good project. We have waited long to present our case but we urge favorable consideration of Senate bill 861 and/or Senate bill 1242.

Mr. Chairman, I would like to request that the remaining members of our board and the Dolores Water Conservancy District who are here in the room be put in the record. Their names, if I may, are Ed Smith, Paul Ferry, Floyd Cox, and H. Gilliland, and Jack Kincaid. Their presence here only indicates their extreme concern and desire for this project.

I have also for the record letters from members of the Board of County Commissioners, Dolores and Montezuma Counties in Colorado, the towns of Cortez, Dolores, and Dove Creek, and other citizens which reflect the vital interest in this proposed project, I ask that these be entered in the record.

Senator ALLOTT. Without objection.

Mr. VINGER. To close, I would like to emphasize, that we, the Dolores River Conservancy District, were formed for the express purpose of serving as a contractual agency to purchase the water that will be provided by this contract when built. We want the project. We are ready, willing and able, and desire very much to see this come to fruition. We appreciate very much the opportunity to appear here, and especially the efforts to continue through the noon hour to accommodate us. Thank you very kindly.

Senator ALLOTT. Thank you very much, Mr. Vinger. There are so many items in your statement that I would like to comment on, having known this area for so long. I do want to say this: I doubt if there is another area in the State of Colorado, which, from a shortage of water standpoint, needs it worse than this particular project. You would agree with that, I know.

Mr. VINGER. Yes, sir.

Senator ALLOTT. And it is an area also in which the general recreational assets are relatively low, particularly as they pertain to water.

Mr. VINGER. Yes, sir; that is true.

Senator ALLOTT. Thank you, I am only going to desist because of the shortage of time. Senator Fannin?

Senator FANNIN. Mr. Chairman, I would just like to commend Mr. Vinger for the comprehensive statement he has presented. In order to conserve time, I will not ask questions. I have listened to his statement with a great deal of interest.

Senator ALLOTT. When your statement is read, together with your comments, it constitutes a very strong support for it. Thank you.

Mr. VINGER. I want to underline one fact there in the prepared formal statements, and that is the cost-benefit ratio of our project is 1.96 to 1.

Senator ALLOTT. Which is very high for these days.

Mr. VINGER. Thank you.

Senator ALLOTT. Thank you very much; sir.

(The letters referred to follow:)

CITY OF CORTEZ,
Cortez, Colo., April 25, 1967.

Re: Dolores River Project.

BOARD OF DIRECTORS,
Dolores Water Conservancy District,
Cortez, Colo.
(Care of Ivan Paterson).

GENTLEMEN: The City Council of the City of Cortez in representing the 7500 citizens, is unanimous in its endorsement of the proposed Dolores River Project. We would urge that you take whatever steps appear necessary to insure an early completion of this project. The City of Cortez has, for many years, been faced with a rather severe water problem.

The City of Cortez presently has limited decreed water rights on the Dolores River. These rights are inadequate for the future expansion and development of the City. In recent years studies have been made by the City to develop a more nearly adequate water supply and economics have deemed such expansion not feasible.

The City of Cortez is surrounded by a great abundance of raw materials for industrial uses as well as scenic beauty which has enhanced the tourist trade in recent year. Limited water supply has made it difficult to expand these, the major industries of this area.

Cortez serves a trade area which is populated by approximately 30,000 people. Many of the vast majority of these people are so situated that their lands and property will be directly affected by the Dolores River Project. The economy of this area is primarily agricultural in nature and is supplemented by the tourist industry, the wood products industry, the mining industry and other small manufacturing industries. All of these industries will of necessity be benefited by the completion of the Dolores River Project.

Several years ago the City of Cortez engaged a firm of professional city planners to make a study of the long range plans. Their report provided guide lines for the orderly and systematic growth of the city to a population of 40,000 citizens. All phases have been implemented with the exception of the water program. The 4,900 acre feet of water allocated for the City of Cortez in the Dolores River Project will meet the requirements of the proposed growth plan. Further, the city is in a financial position to meet its obligations to this project.

The city government of Cortez is willing and ready to assist the board in any manner to develop this project.

Very truly yours,

BYRL JOHNSON, *Mayor.*

TOWN OF DOLORES,
Dolores, Colo., April 25, 1967.

I. W. PATTERSON,
Secretary, Dolores Water Conservancy District,
Cortez, Colo.

GENTLEMEN: It is the Town's understanding that at this time our project on the Dolores River is being considered by the United States. The Town of Dolores through its Board of Trustees wishes to be of any help and assistance to you that is possible in an effort to obtain this long needed project for our area.

It is a well known fact that the needs in this community are extremely great for the conservation of water in order that it may be put to a greater beneficial use not only from the standpoint of community needs which have increased and will continue to increase over the years because of increased population and increase in individual consumer use, but also the need to bring into production areas of fertile soil adjoining our Towns and in the district area, which but for water would flower and bloom and provide a basic backbone for this community. However, because of periods of drouth, business recessions and financial difficulties for the members of our community have been numerous causing many people to "pull up stakes" and leave. Such a situation is not healthy from the standpoint of municipalities or the area in general.

We firmly believe that the construction of the Dolores River Project will to a great extent relieve such substandard situations. Any further assistance we can give to you, please feel free to call upon us for.

Very truly yours,

ARTHUR L. NIELSON, *Mayor*.

TOWN OF DOVE CREEK,
Dove Creek, Colo., April 20, 1967.

Re: Dolores River Project.

DOLORES WATER CONSERVANCY DISTRICT,
Cortez, Colo.

(Attn: I. W. Patterson, Secretary-Treasurer).

GENTLEMEN: The Town of Dove Creek, Colorado, a Community which will be greatly benefited by the Dolores River Project, requests early Congressional consideration and action upon the above mentioned project.

During the past seven years the population of the town has decreased by approximately forty percent, and there has been some thirty businesses in the area closed as a result of a declining economic situation. This decline has been caused primarily from a drop in farming and uranium operations in the immediate area of the Town.

It is the opinion of our entire business community that the completion of the Dolores River Project would revitalize this area.

The present water source for the town is an extremely expensive one and very limited. The Project would provide additional water for the Town and would, of course, assure a permanent source and supply of water needs.

The great need in this area for this Project cannot be over emphasized.

Yours very truly,

M. C. DEAN, *Mayor*.

BOARD OF COUNTY COMMISSIONERS,
DOLORES COUNTY,
Dove Creek, Colo., April 20, 1967.

DOLORES WATER CONSERVANCY DISTRICT,
Cortez, Colo.

GENTLEMEN: It is our understanding that the Senate hearings on the Upper Colorado River Project are coming up in the very near future.

As you are aware, the Dolores River Project is included within the proposed legislation and the Board of County Commissioners of Dolores County desire to go on record approving the project and advising you that the Board will take any action necessary to support the project.

This project, if authorized and completed, would provide the stimulus necessary to reverse the downward economic trend which has prevailed in this area since 1961. The principal economic base of the County is agriculture and livestock, with a limited amount of mining in the Rico area. The Project, when completed, will be located in a portion of the West end of the County. Dolores County is approximately 58 per cent public lands.

We will not take the time in this letter to set forth all of the problems faced by the people in Dolores County and the operations of county government; however, we feel it is important to point out to you the importance and relief which the Dolores River Project would provide.

The tax base of the County has fluctuated from 5.1 million in 1957 to a high of 6.1 million in 1961, with an estimated valuation of 4.9 million for 1966. The county levys for General Fund purposes has fluctuated from 10.00 mills in 1957 to 16.00 mills in 1963 with a current levy of 16.00 mills. If Dolores County had enjoyed the 6 per cent annual economic growth common in Colorado for the years 1962 to 1965, the present valuation would be 7.7 million and our current General Fund Budget could be funded by a levy of 9 mills instead of 16.00.

Authorization of the Dolores River Project with attendant construction spending in the area will not only provide jobs and increased economy in the business community, it will enhance the present valuation of many vacant business establishments and allow for new private construction necessary to provide services for an increased population.

Agriculturally, the lands in the project area will probably be divided into small farm units (some farms are now 2,000 to 3,000 acres in size) with addi-

tional improvements being added to the land. Farms will take on the identity of small family operated units devoted to production of diversifical crops and livestock. Presently, wheat and beans are the only commodities grown on the lands, both in farm support programs. By a division of the farms into smaller economic units with a constant and guaranteed supply of water, and diversification of crops and livestock, the general economy of the area would be greatly enhanced as well as stabilized.

Not to be overlooked is the tremendous recreational potential in the project. The 58 per cent of Dolores County lands now in federal ownership is presently being used for big game hunting, fishing and related outdoor activities. The formation of a lake immediately adjacent to these lands for fishing, camping, boating and other related activities would certainly provide a true tourist "Mecca" in the Southwest area of Colorado.

We urge your very best effort to provide early authorization of this very vital project.

Sincerely yours,

MYRON JONES, *Chairman.*

BOARD OF COMMISSIONERS,
MONTEZUMA COUNTY,
Cortez, Colo., April 21, 1967.

I. W. PATTERSON,
*Secretary-Treasurer, Dolores Water Conservancy District,
Cortez, Colo.*

DEAR SIR: The Board of Commissioners of Montezuma County urges that everything be done that is possible to expedite the authorization of the Dolores River Project. We regard the construction of this project to be of the most vital interest to the people of both Montezuma and Dolores counties.

Of the many advantages to be derived from this project will be the substantial increase of productivity over the entire agricultural field, a broadening of the tax base, a material increase of the assessed valuation, a tremendous asset in the field of recreation and a supply of domestic water for the entire area.

Again, may we urge that everything possible be done to obtain the authorization of this project.

Very truly yours,

C. K. HERNDON, *Clerk.*

DOLORS COLO., April 27, 1967.

DOLORS WATER CONSERVATION COMMITTEE.

GENTLEMEN: I am a fruit farmer $4\frac{1}{2}$ miles south of Dolores, Colorado. The farm I own is under the "West" lateral of the Montezuma Valley Irrigation Company. I have lived on this farm for 13 years. I am 42 years old and have heard talk of the "Dolores Dam" for the past 26 years.

Fruit farming is a lot different in regards to the need for water, than many other crops now grown in this area. Most of the time fruit trees do not require water until late June, and most years by the time we should start to irrigate our water supply is cut from 50% to 75%. This can create a problem that is more serious than many realize, as apple trees start about the first of August setting next years crop.

I am sure that if it were investigated we would find that more water is run over the ground by fruit farmers early in the season trying to build up a water table to help carry through into the fall months. Whereas if there was adequate flood water stored that could be called for when needed, as much as $\frac{1}{2}$ to $\frac{1}{3}$ of the amount of the water now used could be saved. This fact alone speaks for itself.

We are told by the Buyer's of our fruit, that the fruit from this area has keeping and flavor qualities that surpass anything they have ever known.

We are fortunate to live at a altitude with warm enough springs to give us an above average crop percentage.

It does not take imagination to see that this area could become a most important fruit and vegetable area if we had more water.

Sincerely,

EVERETT E. TIRBITTS.

Senator ALLOTT. The San Miguel Water Conservancy District, Mr. Tillmon Reed, vice president of the district, and president of the San Miguel Basin Soil Conservation District, and Mr. D. Lew Williams, former member of the State Senate of Colorado when I was Lieutenant Governor, and an old friend, and he is a member of the board, and a board member of the Southwestern Colorado Water Conservation Board.

We welcome both of you here, and thank you very much.

STATEMENT OF TILLMON REED, VICE PRESIDENT, SAN MIGUEL WATER CONSERVANCY DISTRICT, AND PRESIDENT OF THE SAN MIGUEL BASIN SOIL CONSERVATION DISTRICT, ACCOMPANIED BY; D. LEW WILLIAMS, MEMBER OF THE BOARD OF THE DISTRICT, AND BOARD MEMBER OF SOUTHWESTERN COLORADO WATER CONSERVATION BOARD

Mr. REED. Thank you, Senator. I have a prepared statement here that is very short, and with your permission, I will go through it.

My name is Tillmon Reed. I am a rancher, and with my wife and family, reside 6 miles southeast of the town of Norwood, Colo. This community is the center of the San Miguel Basin, of which the boundaries are the Uncompaghe Plateau on the north, the San Juan Mountains on the southeast, and the La Sal Mountains on the west. The principal stream system in this basin is the San Miguel River and its tributaries.

For the past 11 years, I have been president of the San Miguel Basin Soil Conservation District which consists of $1\frac{1}{4}$ million acres. At the first annual meeting of the district in March 1965, I appointed a committee to study ways in which the district could further the San Miguel irrigation project. It became apparent that a logical first step would be to organize a water conservancy district.

I have been a vice president of the San Miguel Water Conservancy District since its formation in 1957. This district, which encompasses 337,600 acres, is ready, willing, and able to enter into a repayment contract with the Federal Government. This district was formed without any opposition. To the best of our knowledge this has never been accomplished in another district in the United States.

As vice president of the district, we were formed with the idea of contracting water. We are ready, willing, and able to enter into a repayment contract with the Federal Government for this water.

Senator ALLOTT. Thank you.

Mr. REED. This project has the wholehearted support of the people of the entire San Miguel Basin. They have proved this by their initiative to collect local funds to further the project, thus enabling matching funds to be obtained from the State of Colorado and the Bureau of Reclamation. Countless man-hours have been expended, as well as about \$1 million in funds of the Federal Government and about \$250,000 in funds of the State of Colorado.

This project has been on the boards for some 50 years; first by private enterprise and then by government agencies, and Mr. Williams who is sitting beside me has been one of the great stalwarts of this

project. His first public work on water development was in 1933, first then he was a young county commissioner, then as a State senator and later a member of the State water board. In 1943 as a State senator, Mr. Williams was sponsor of the bill creating the Southwest Water Conservation District, of which he later became a member. All of his work has been envisioned by the thought that some day an adequate water supply would be available to enable people to derive an adequate income.

Our income is derived from the sale of livestock products—beef, lamb, and wool. This is dependent upon the amount of feed and pasture we are able to produce, which in turn is dependent upon the runoff of some side tributary streams of the San Miguel River. This runoff varies from year to year, and at times, as this year appears to be, is very short. Except for a small acreage of land located along the main San Miguel River, the irrigated land of the project area is located on mesas at elevations of several hundred feet above the river. The greatest need of the San Miguel Basin is a reliable water supply for irrigation, municipal, and industrial development.

Most of the production from this area enterprise is shipped out for processing. Some weaner calves and lambs are shipped to other towns of western Colorado for feeding, but most of our products are shipped to Denver and other large city markets, both east and west. The increase in crop production we foresee, resulting from the use of the project water, is an increase in production of the common livestock feeds. We may be able to finish livestock in this area and not have to sell everything at the time of weaning. Since we have very little production of the common surplus crops, we see no way that this project can add to a national accumulation.

About 17 years ago, the growing of malting barley was introduced into the San Miguel Basin, and a receiving station established at Norwood. In the peak years of 1956 and 1957, an acreage of about 1,000 acres produced in excess of 2 million pounds. However, in view of the fluctuating water supply, it was extremely difficult to grow a barley which would meet the malting standards of the company, and in 1964 the receiving station was closed. In this manner, the only cash crop available to the area, was lost. I feel certain, that with a dependable water supply, this could be restored to a real good crop for the people of the basin.

Over the years, we have continually added to and improved our irrigation system by the construction of reservoirs for the storage of water, and canal betterments have made improvements in the efficiency of the diversion and the use of our limited supply of water. Within the last 30 days, local water users have voted to increase the Gurley Reservoir, our main source of water, 20 percent. This will be a cost of \$200,000 to \$300,000 to the irrigators. This work is to be accomplished by local initiative and the borrowing of money for construction, and the repayment of the same over a period of years.

Since the channel of the San Miguel River, our only source of unused water, is very deeply entrenched, requiring large-scale construction for its use as a source of water, we have reached the limit of our private development and are now requesting Federal assistance for additional development. Engineering study work has been completed

by the Bureau of Reclamation, which will permit the delivery of this water to the farmable lands of the area. Once the water is available to the land, it will broaden the tax base of all governments—school, local, county, State, and Federal. We are now asking your assistance in the construction of this long-awaited, well-planned, large-scale project.

In my opinion this is the great American tradition, to pass on to the next generation something better than the preceding generations were able to provide. As to our own family, we have a girl, 15; a boy, 13; and another boy, 21 months old. Whether or not they follow my profession, my goal is to give them assistance, both moral and financial, in whatever profession they show sincere interest. I feel that it would be great if they would have the chance to follow their chosen field right in their own hometown; and this project will sure add to that possibility.

In closing, I would like to say it has been a real pleasure and an honor to be able to appear before your committee.

Senator ALLOTT. Thank you very much, Mr. Reed, for a very, very fine statement. I might say that the statement I made with respect to the Dolores project a few moments ago is every bit as applicable and true with regard to this one.

This is one of the areas that badly, and I mean very badly, needs water development. And certainly I am in complete sympathy with it. Mr. Williams, do you have anything you would like to add?

Mr. WILLIAMS. Due to the lateness of the hour, and my paper is short and I don't believe I will go into it, but I have a comment that I would like to make on this storage.

This was brought up yesterday. Senator Jordan drew attention to the fact that we had four times as much storage as the average runoff up there of the river.

I think it ought to be part of the record that the storage that we do have is all for the benefit of the lower basin, and in Colorado we only have one of our rivers controlled at the present time, the Gunnison. We have the Colorado and the Yampi and the Las Animas, the San Miguel, and the Dolores Rivers that need these flood controls, and if we do get additional water through weather controls, we will need the reservoirs to hold that water.

Senator ALLOTT. In other words, what you are saying is that if additional water results from weather modification, you are going to need these reservoirs in order to derive the proper benefits.

Mr. WILLIAMS. Yes, the only way it will be any good to the upper basin is to hold it over for the years of need. I think that should be a part of the record.

Senator ALLOTT. Thank you very much.

Lew, you also have a statement here. I will, without objection, ask that it be included in the record as if given in full by you, in addition to your remarks.

Mr. WILLIAMS. It goes into the minerals and things of that kind in the area.

Senator ALLOTT. Thank you very much, gentlemen.

Senator Fannin.

Senator FANNIN. No questions, Mr. Chairman. I want to commend you for very capably presenting your case.

Senator ALLOTT. Thank you.

(The statement referred to follows:)

STATEMENT OF D. LEW WILLIAMS, RANCHER, NORWOOD, COLORADO

Mr. Chairman and Gentlemen of the Committee, my name is D. Lew Williams. I was born near Norwood, Colorado on March 4, 1901 and have spent my entire life in the San Miguel area. I have been a rancher all of my life and I am also actively engaged in mining operations.

I am a member of the South West Water Conservation District Board and a former member of the Colorado Water Conservation Board; a former County Commissioner and former State Senator. While in the State Senate I sponsored legislation, with the help of the then State Senator Wayne Aspinall, to create the South West Water Conservation District.

I have been working on various programs to get water from the San Miguel River on to the land around Norwood, Colorado since 1933, and I was instrumental in getting investigative work started on the San Miguel Project by Judge Stone, the first director of the Colorado Water Conservation Board.

I also served four years as Water Commissioner for District 60, the district of the San Miguel River and all its tributaries. As Water Commissioner, I administered the water rights according to the priority order, which is established by District Court decree. I believe that water adjudication within a state is a state right and should be administered by that state.

We have a good water run in May and part of June while the early runoff is on, but the streams are low in July, August, and September when water is needed to finish the crops. The answer is reservoir storage to catch the early runoff for late season use. The San Miguel Irrigation Project is the only chance for the area to get storage enough to insure a sound agricultural economy. In my opinion, the project is sound, and every landowner under the project is ready and willing to comply with the Bureau of Reclamation requirements.

The main storage for the Project will be the Saltado Reservoir, located on the San Miguel River, about fifteen miles down river from the town of Telluride, the county seat of San Miguel County. Telluride is a famous mining camp of the early days of gold and silver mining, and is one of the most beautiful spots in the entire world. It is situated at an elevation of 9,000 feet, bordered on three sides by mountains rising to 14,000 feet, and there is a good oiled road leading in to Telluride. It is fast becoming a favorite spot for summer visitors and artists.

These mountains are the head waters of the San Miguel River. The town of Norwood is located thirty-five miles west of Telluride, at an elevation of 7,000 feet. Norwood is a livestock and farming town, and several breeders of purebred Hereford and Angus cattle have ranches in this area. Some of the finest purebred sheep ranches in the nation are located here. The entire Project area is ranching country.

Another town in the San Miguel Basin is Naturita, twenty miles west of Norwood, with an elevation of 5,300 feet. Naturita is an uranium and vanadium town, and some of the finest potential irrigated land under the Project, is located south and west of town. Nucla is a farming and livestock center, located five miles north of Naturita. Uravan, a mining town, is located fifteen miles northwest of Naturita, and the largest uranium-vanadium mill in Colorado is located at Uravan.

These towns are all in need of a good municipal water supply, and the project is the only source for additional water. The uranium-vanadium mining employs many of the ranchers part time, making it possible for many of them to hold on until we get a firm supply of water.

In the Project area, there are deposits of coal, gypsum, phosphate, magnesite, bauxite, lithium, and salt. These natural resources will require so much water that they probably cannot all be developed at the same time. The area is served by good oiled roads, a large R.E.A. electric plant, and a large natural gas pipeline goes through the area. The ultimate development of these resources is hinged to the securing of an adequate water supply. With the construction of the proposed Dolores and San Miguel Projects, all natural stream flows of the Dolores River drainage will be controlled and developed for the ultimate use of agriculture, municipal useages, and industry.

We have everything but water to make the San Miguel Basin a prosperous area. I have tried to give the committee a picture of our Project, and our problem which is shortage of water, and wish to express our hopes for a favorable decision from the committee. I thank you for allowing me to appear before you gentlemen.

Senator ALLOTT. The last conservancy district to appear here today is the Central Colorado Water Conservancy District, Mr. C. H. Starks, president of the Citizens State Bank; Mr. Mills E. Bunger, consulting engineer, former mining engineer, of the Bureau of Reclamation; David J. Miller, attorney, of Colorado, and a former member of the Colorado Water Conservation Board.

All three of these gentlemen I have known for a great many years, and we welcome you here.

I should like to gratefully acknowledge the presence of other members of the Central Colorado Water Conservancy District who have traveled so far to attend these important hearings: Rollo Shaklee, James Sirios, Merl Dunham, William E. Howard, R. V. Rouse, Ed Kerbs, William Scott, Wayne McNeil, James Erger, and Al Krogh. Welcome gentlemen.

STATEMENT OF CHARLES H. STARKS, PRESIDENT, CENTRAL COLORADO WATER CONSERVANCY DISTRICT; ACCOMPANIED BY MILLS E. BUNGER, CONSULTING ENGINEER; AND DAVID J. MILLER, ATTORNEY, OF COLORADO

Mr. STARKS. Thank you, Senator.

I am Charles H. Starks. In the interest of time, I will simply state that we support your bill and the five Colorado projects included in it.

We do seek activation of the Blue River South Platte study to use Colorado's share of the Colorado River. We ask that the full prepared statement be inserted in the record.

Senator ALLOTT. Without objection, your statement will be inserted in the record, and you may proceed to comment, any one of the three of you, as you see fit.

(The statement referred to follows:)

STATEMENT BY C. H. STARKS, PRESIDENT, CENTRAL COLORADO WATER CONSERVANCY DISTRICT

Mr. Chairman, Central Colorado Water Conservancy District was organized September 15, 1965, under the Water Conservancy Act of Colorado C.R.S. '63, 150-5-1 to 150-5-50 by order of the District Court of Weld County, Colorado. We shall refer to the district as Central. Included within the boundaries of Central are a total of 255,000 acres of land of which approximately 108,000 acres are irrigated. This district lies north and east of Denver, Colorado in Adams and Weld Counties. The area of the district commences near the Town of Henderson, Colorado and extends north and east to a point approximately one mile south of Kersey, Colorado. Irrigation systems within the district are the Barr and Milton Lake Divisions of the Farmers Reservoir and Irrigation Company, the Henrylyn Irrigation District, the Burlington Ditch, Reservoir and Land Company, the Fulton Irrigating Ditch Company and the New Brantner Extension Ditch Company.

The objectives of Central are:

1. The adoption of an all-Colorado Water Plan to apply all of the water to which Colorado is entitled under all interstate compacts for beneficial use within Colorado.

2. Declaration and determination that the Upper Basin States are entitled to

an equal one half share of the waters of the Colorado River and that Colorado's share is, after deducting 50,000 acre feet allocated to Arizona, 51.75% of 7,450,000 acre feet or 3,855,000 acre feet annually, and that the surplus and shortage shall be shared annually, one-half to the Upper Basin, and one half to the Lower Basin.

3. Bring water from the headwaters of the Colorado River by transmountain diversion to the South Platte Basin;

4. Promote the construction of Two Forks Reservoir on the South Platte.

5. Secure conservation storage in Chatfield Reservoir;

6. Perfect the use of the conservation storage that has been set up in Cherry Creek Reservoir;

7. Retain an interest in Narrows Reservoir for upstream exchange and for removal of the call of early water rights below Fort Morgan upon junior water rights within the district, and for river regulation and management.

8. Coordinate the operation of the proposed transmountain diversion with Two Forks Reservoir, Chatfield Reservoir, Cherry Creek Reservoir and Narrows Reservoir; and

9. Development of the maximum amount of power the water will produce so that power will pay a major portion of the project cost, and thereby decrease the cost of the water users;

10. Construction of Forks Reservoir on Clear Creek for flood control conservation storage, joint use, power and recreation.

11. Construction of Van Bibber on Clear Creek;

12. Reactivate the Blue River South Platte Project investigation by the Bureau of Reclamation. The Bureau of Reclamation made a comprehensive study in 1948 on transmountain diversion from the Eagle, Piney, Blue, Sheephorn, Williams and Fraser to the Colorado Water Conservation Board.

13. To secure optimum use and reuse of waters from the Western slope as well as water originating in the South Platte Basin.

14. We fully support the five Colorado projects in the Allott Bill.

NEEDED AN ALL-COLORADO PLAN

Central urges the creation of an All-Colorado Water Plan to apply all of Colorado's water to a beneficial use for the benefit of the State of Colorado as a whole and for each of the areas in Colorado.

Colorado's objective is the development of Colorado's land, water and related resources to the optimum benefit of the people of all of Colorado, the western states and the nation as a whole.

Colorado's share of the Colorado River is 3,855,000 acre feet under the Colorado River Compact and the Upper Colorado River Compact. An All Colorado Water Plan must use all of it.

Bert Hanna, Denver Post staff writer, urged a statewide approach in his article of August 2, 1966. The All Colorado Water Program should provide for optimum use of stream flow and ground water as well as their coordination. The All Colorado Plan must make a realistic evaluation of the future development of Colorado not only for increased population on the eastern slope but the development of the western slope as well.

The All Colorado Water Plan under the Constitution of the State of Colorado must recognize the vested rights of existing decrees, final and conditional, statements of claim, as well as rights of the use of ground water.

The All Colorado Plan should provide optimum beneficial use for all purposes on both the eastern and western slope. It should recognize and provide for the future development of the natural resources of the western slope including oil shale development. Such a plan must recognize the Colorado doctrine of prior appropriation but should seek such modifications of the doctrine as would promote optimum use, water conservation and basinwide planning for each of the Colorado's River basins.

The All Colorado Water Plan must recognize the constitutional preferences to the use of water in the following order: domestic, agricultural and manufacturing purposes. It should provide for changes of use from irrigation to municipal and industrial purposes and the recapture and reuse of municipal and industrial waters not only for the municipalities and industrial areas but also for the irrigated areas of the state.

REACTIVATION OF BLUE-RIVER SOUTH PLATTE PROJECT

Central seeks the reactivation of the once completed Blue-River South Platte Project study for bringing water from the headwaters of the Eagle, the Blue, the Piney, Sheephorn Creek, Williams Fork and Fraser to the South Platte Basin. The project was recommended by the Bureau of Reclamation to the Colorado Water Conservation Board in 1940 and 1945 and again in 1948. More than one million dollars has been spent by the Bureau on the study. It should be updated.

The new study should recognize the construction of Cherry Creek Reservoir, Dillon Reservoir and Roberts Tunnel, all completed essentially as planned by the Bureau. The Denver Water Board should be compensated for the use of its facilities.

The study should integrate: Chatfield Reservoir, now under construction; Narrows Reservoir, once authorized and now pending reauthorization; ground water recharge of the Kiowa and Bijou Valleys; pending flood control on Bear Creek and Clear Creek; basin wide flood control; recreation; the construction and planning, public and private, on the Western Slope; the new units under the Colorado River Storage Project Act; and the actual construction and planning, both public and private, in the South Platte Basin.

The reactivated Blue-River South Platte study should provide for adequate replacement storage to the western slope. Such replacement storage should require western slope beneficiaries to assume that part of the financial burden within their ability to repay including the increase in ability to repay upon growth of the municipalities and the anticipated industrial areas incident to western slope resource development.

Central realizes that the most, if not all of its proposals, have been made repeatedly. Some steps to achieve them have been accomplished. To some these proposals may appear utopian; to others, dreams so far distant that they are not worthy of consideration today. To still others the achievement of the necessary cooperation between the western and the eastern slopes, the City of Denver Water Board, the metropolitan areas outside Denver and the irrigation interests in the South Platte Basin may appear impossible. There must be full cooperation between the western and the eastern slopes of Colorado to accomplish the stated objectives. We cannot, and we must not, fail to meet the challenge.

Mr. STARKS. I have no further comment. Possibly, Mr. Miller or Mr. Bunger would like to comment.

Mr. BUNGER. I am Mills E. Bunger, consulting engineer for the Central Colorado Water Conservancy District. I spent 15 years with the Bureau of Reclamation, and before that I had located some of the gaging stations, the first gaging stations, on the tributaries of the Colorado River.

In my duties, one of my duties with the Bureau of Reclamation, was to determine the feasibility and make the surveys of the central Arizona project. I wish to submit a few remarks on the Colorado River Basin problems.

Mr. Chairman, it would appear, offhand, that if there were put into the discussion of these problems a lot less dispute and a great deal more commonsense sprinkled with a little more engineering, these problems could be solved shortly.

Physically, the old Colorado River is rolling along pretty much as it has done for centuries past. Beginning in the year 1900, the water runoff of the Colorado River was in a wet cycle which lasted until 1930. Then the runoff entered a dry cycle that lasted some 31 years. Beginning in 1962, the virgin flow was; 1962, 16,770,000 acre-feet; 1963, 8,149,400; 1964; 8,517,600; 1965, 16,985,300; plus 3 million acre-feet of bank storage in Lake Powell; 1966, not computed yet; 1967, with the snowfall as it is, a runoff of 16 to 17 million acre-feet is being predicted. We can at least hope that a wet cycle has started.

The year 1922, when the Colorado River compact was written, was in a wet cycle; so the commission considered it equitable to divide the Colorado River: 7,500,000 acre-feet to the lower basin for economic beneficial consumptive use in perpetuity, and 7,500,000 acre-feet for economic beneficial consumptive use in perpetuity for the upper basin. The lower basin water was divided 4,400,000 acre-feet to California; 300,000 acre-feet to Nevada; and 2,800,000 acre-feet to Arizona.

The Bureau of Reclamation engineers in the Department of Interior 1959 brochure, "Keystones: The Upper Colorado Dams," stated that the average yearly runoff—virgin flow—of the Colorado River at Lee Ferry was 15,638,000 acre-feet; this was increased to 16,973,000 acre-feet in the lower basin. These figures were accepted by most everyone until Arizona attempted to make use of 1,200,000 acre-feet out of her 2,800,000 acre-feet allotment.

In arguing that there was no water left in the Colorado River some claim that 1,500,000 acre-feet allotted by the compact with Old Mexico would have to be supplied by the upper basin. This contention entirely disregards the fact that the actual stream flow records show that the 60 years ending in 1959, that there was an average of 9,473,000 acre-feet available in the lower basin. When California deducts her 4,400,000 acre-feet there is left 5,073,000 acre-feet to be used within the lower basin.

Water cannot be consumed or destroyed; King Solomon, hundreds of years before Christ wrote in Ecclesiastes, chapter 1, verse 7:

All the rivers run into the sea but the sea is not full, from whence the waters come thither they return again.

The return flow from the use of 5,073,000 acre-feet of water will far exceed the Mexico Treaty's commitment. Those claiming the river is bankrupt then deduct the evaporation of all the reservoirs in the Colorado River Basin as completely lost to the basin.

Weather engineers state that the Colorado River Basin is supplied with precipitation by winds picking up moisture from the Gulf of California and the Pacific Ocean and traveling from the Southwest in a northeasterly direction picking up any evaporation from lakes or other wet surfaces and precipitates it, when the cooler air is met, such as exist on mountain ranges.

Engineers, in plotting the boundaries of the Colorado River Basin, have found, especially in the upper basin, that it is surrounded by mountain ranges. That this moisture-laden air mentioned above precipitates most, if not all, of its moisture within the basin was proven 2 years ago when for some 6 weeks there were severe floods in Arizona such as the rains at Scottsdale, snow at Flagstaff, heavy snow in the San Juan Mountains, and rains at Grand Junction, Colo.

There were no storms at all outside the basin. It seems quite evident that had not the Colorado River been a closed basin, nature could never have concentrated enough water to have excavated the Grand Canyon as she has done.

For the evaporation from reservoir surfaces to be completely lost to the basin nature would have to supply winds, especially for that purpose, changing the direction of the prevailing winds 90° to the direction which the engineers have found they do blow, that is, from the southwest in a northeasterly direction.

Now here is where commonsense should come into play. Let Arizona introduce a bill to construct her central Arizona project. All she is doing is trying to make use of a portion of her 2,800,000 acre-feet allotment; a thing California did years ago, using up her entire allotment, and what Colorado also must do.

Let Colorado introduce a bill for the construction of her five projects and even include the Juniper so the people in northwestern Colorado can also have a project.

We of the Central Colorado Water Conservancy District are here to support the five Colorado projects on the western slope and to urge that some provisions be made for transmountain diversions for the benefit of the people of northeastern Colorado. This could be taken care of by inserting into the Colorado's bill an authorization for the Bureau of Reclamation to revive the Blue River South Platte project, on which a complete report was made by the Bureau in 1940 and submitted to the Office of the Commissioner of Reclamation in Washington. The new authorization should provide for the extension of the original project which had a benefit cost ratio of 1.4:1, and to also include replacement storage. The water supply tables of the USGS, and the Bureau of Reclamation prove that the average virgin flow of the Colorado River exceeds 15,600,000 acre-feet annually.

We have the charts to show that it would almost be impossible for nature to carry the evaporation from the reservoirs clear out of the basin.

The upper basin compact states that consumptive use shall be determined by the inflow-outflow method. We can show that diversion and use of water within the Colorado River Basin itself consumes very little water. The facts are that the only water actually consumed by either the upper or lower basin is the water transported out of the basin.

Using the dry cycle to prove there is a great shortage of water disregards the wet cycle. The Bureau of Reclamation had to use the wet cycle to justify the Upper Colorado Basin storage project. The 48 million acre-feet of storage authorized for this project was needed to regulate the excess flows. If this has been cut to 37 million, then the upper and lower basins should together ask Congress to increase the storage to the 48-million acre-feet.

If new bills are introduced, as previously suggested, Colorado can get back of the Arizona bill for the central Arizona project. Arizona and western Colorado, as well as eastern Colorado, can get behind the Colorado bill that asks for the construction of the six projects on the western slope and the immediate consideration of the Blue River South Platte project by the Bureau of Reclamation for the eastern slope with replacement storage for the western slope.

The Vietnam war cannot last forever and when it ceases, or the cost decreases substantially, the economy of the country will need projects like these to hold it up.

So let us all cooperate fully to get all the projects ready for construction.

Here is why I state commonsense should be entered into this. All that Arizona was trying to do was to get constructed the central Arizona project to make use of the 1,200,000 acre-feet as a part of her al-

lotment. Then, Colorado should have introduced a bill to build these five projects that she proposes, and we urge that there be included in that a provision for transmountain diversion, such as the Blue River South Platte project.

Senator ALLOTT. Thank you very much, Mr. Bunger. I thank all of you gentlemen for being here. Mr. Miller is a fellow lawyer, and I think one of the first acquaintances I made after I actively started practicing law myself. It is good to have you here.

Mr. MILLER. It is a privilege to be here. We appreciate your kindness. Thank you very much.

Senator ALLOTT. Thank you gentlemen very much for your very informative and comprehensive statements, which I am sure will be considered by the committee at considerable length.

May I at this point, without objection, insert in the record a statement of the Colorado River Conservation District before the Water and Power Resources Subcommittee of the Interior and Insular Affairs Committee, and also a statement of R. S. Shannon, Jr., president of the Denver Board of Water Commissioners of the State of Colorado, before the Subcommittee on Water and Power Resources.

(The statements referred to follow:)

STATEMENT OF R. S. SHANNON, JR., PRESIDENT, DENVER BOARD OF WATER COMMISSIONERS, STATE OF COLORADO

Mr. Chairman and gentlemen of the committee, I am President of the Board of Water Commissioners of the City and County of Denver in the State of Colorado. This Board provides the municipal water supply for Denver and its metropolitan area. More than half of the people in Colorado live in this area and the Board serves two-thirds of these people.

Denver's water system was started and grew in its early years on the basis of water derived from a fluctuating stream called the South Platte River, which flows through the city. This stream also supplies many other users. Because of the limited supply of water in the South Platte River, Denver has had to turn to other sources of supply. Over half of Denver's current water supply must come from the tributaries of the Colorado River. Some of the Colorado River tributaries have been reached by Denver, at great expense, through three transmountain tunnels, which are the well-known Moffat Tunnel, the August P. Gumlick Tunnel, also known as the Jones Pass Tunnel, and the Roberts Tunnel, just completed, which is considered to be one of the world's great engineering feats. Construction of the Roberts Tunnel, together with Dillon Dam and Reservoir located at the intake end of the tunnel on the Blue River, a tributary of the Colorado River, required an expenditure by this Board of a sum in excess of 75 million dollars. This complex was completed and put into operation within the last four years. The water supply derived through the use of the Roberts Tunnel and related facilities, together with other transmountain water from other tributaries of the Colorado River, supply over half of the present needs of the City and County of Denver and its metropolitan area. Future growth in the metropolitan area will be dependent upon additional water from the Colorado River tributaries and will require further extensions and improvements of Denver's present system to reach additional waters of tributaries of the Colorado River, requiring additional large expenditures by this Board.

Because of the dependence of Denver and the metropolitan area upon water from the Colorado River and its tributaries, this Board has been extremely interested in and concerned with the legislation which is presently before this Committee. Years of patient study and negotiation to attempt to solve the water supply problems of not only this agency and state but all of the upper and lower basin states affected by the Colorado River have produced the content of the legislation before this Committee in the form of Senate Bill 1242.

One of the significant concepts which evolved from the negotiations on the interstate problems was the provision (Sec. 501(a) of S. 1242) for the authorization of five reclamation projects which would use the waters of the Colorado

River in western Colorado. The proposal for the authorization of those projects brings into focus an unresolved question affecting the stability of the eastern Colorado economy now dependent upon water from the Colorado River. The Denver metropolitan area is a part of this eastern Colorado economy.

The problem centers on the meaning and import of Senate Document No. 80, 75th Congress, 1st Session, as that document defines the conditions of operation of that part of the Colorado-Big Thompson reclamation project known as Green Mountain Reservoir which is located on the Blue River, one of the major tributaries of the Colorado River. Denver's rights to the use of the waters of the Blue River, created by the people of Denver at a cost of more than 75 million dollars, are closely tied in with the operation of Green Mountain Reservoir under Senate Document No. 80, by reason of the incorporation of certain provisions of that document in the decree of the United States District Court for the District of Colorado which evidences Denver's rights in the Blue River. That decree does not purport to interpret Senate Document No. 80, but makes its terms the governing principles for the operation of Green Mountain Reservoir, whatever those terms may mean.

Doubt having arisen as to the true intent of paragraph (i) of that section of the document entitled "Manner of Operation of Project Facilities and Auxiliary Features" and in order to set at rest any such doubt which might cause internal disharmony within Colorado, representatives of water users and development agencies throughout the state agreed on what had been meant by those terms when they had originally been the subject of consideration in Congress. This harmonious interpretation was so universally received throughout the state, that both houses of the Colorado Legislature, without a dissenting vote, adopted the agreed interpretation as the official policy of the State of Colorado just as that interpretation was adopted unanimously by the Colorado Water Conservation Board, the official water development agency of the State of Colorado, composed of representatives of all the river basins in the State whose deliberations were, at the time, presided over by the Governor as Chairman. This officially approved interpretation is offered to the Congress for adoption as Section 501(e) of Senate Bill 1242.

The construction of the five proposed Colorado projects would materially benefit western Colorado and could only help produce substantial, though incidental, benefits to eastern Colorado and the Denver metropolitan area.

The major developments of western Colorado reclamation projects, now in their completion stage, found their strongest support from a state-wide organization sparked by the Manager of the Denver Chamber of Commerce and totally supported by the Denver Board of Water Commissioners of which I am the current President. Even today, we take the view that there must be positive action by Congress for broadly based development of Colorado's water resources, giving full protection to varying and even conflicting interests. Thus, we feel justified in insisting that Colorado development occur only under conditions that afford such protection to all elements of the state and that to accomplish this purpose, the construction of the five proposed reclamation projects in Colorado should be authorized by the Congress only on condition that Section 501(e) as contained in Senate Bill 1242 is also enacted by Congress into law. Such an enactment would be consistent with conditions already created by the Congress and intrudes on no other area of Federal authority.

STATEMENT OF THE COLORADO RIVER WATER CONSERVATION DISTRICT

This statement is made on behalf of The Colorado River Water Conservation District, hereinafter referred to as "District", by its Secretary-Engineer, Philip P. Smith, and counsel, Kenneth Balcomb, both residents of Glenwood Springs, Colorado. The District is a quasi-municipal corporation established by an act of the Colorado legislature in 1937, and geographically comprises twelve full counties and about one-half of three additional counties in northwestern and west central Colorado. It contains almost thirty percent of the total land area of the state, and lies entirely within the natural basin of the Colorado River. There is included in the district, all of the Yampa River except for a small portion of the Little Snake River in Wyoming, all of the White and Colorado Rivers in Colorado, all of the Gunnison River and that part of the Dolores River in Mesa County, Colorado.

All of Colorado's vast fossil fuel resource known as oil shale is contained within the geographic boundaries of the District. It is noteworthy that the Piceance Basin unit of this resource is the richest and most extensive of the deposits contained in the three state area of Colorado, Utah and Wyoming.

Also within the boundaries of the District are tremendous deposits of bituminous coal and the most productive oil field in Colorado. Some areas of the District are famous for the high quality fruit produced on extensive acreages along the Colorado River between Rifle and Grand Junction and on the North Fork of the Gunnison River near Paonia and Cedaredge. These fruits include peaches, apples, apricots, cherries and pears. Almost all of the crop land in the district is devoted to the production of non-surplus agricultural commodities.

This committee is now considering legislation in several bills relating generally to the further development of water resources of the Colorado River. Among these is S. 1242 introduced by our Colorado Senators, the Honorable Gordon Allott and the Honorable Peter Dominick. We are here in support of S. 1242 and similar bills such as S. 861 introduced by Senator Kuchel of California, and S. 1409 introduced by Senator Moss of Utah, but we cannot support S. 1004 introduced by Senator Hayden of Arizona and S. 1013 introduced by Senator Jackson of Washington, since the latter two proposals do not contain provisions proposed in the first three bills noted which are considered by us to be essential to the continued development and prosperity of Colorado and the other Upper Basin States, as well as to the nation as a whole.

We consider that any such legislation must contain at least these four features: Authorization of the five Colorado Reclamation Projects, namely, West Divide, Dallas Creek, Animas-La Plata (partially in New Mexico), Dolores and San Miguel; a study of methods and means of augmenting the flow of the Colorado River; the construction of Hualapai Dam (formerly Bridge Canyon Dam) to provide a source of revenue to defray the cost of augmenting the flow of the river; and, criteria for the operation of reservoirs constructed pursuant to the Colorado River Storage Project Act of 1956. These requirements will be the subject matter of the balance of this statement.

It has always been assumed by us that Colorado could control the disposition of its share of Colorado River water as well as its share of revenues available from the Basin Fund established by the Colorado River Storage Project Act. It therefore came as a shock to us that the Administration was recommending deferral of three of the five Colorado projects, namely, West Divide, Dallas Creek and San Miguel, until a yet-to-be-established National Water Commission could report thereon. How such a commission could disregard Colorado's expressed preferences is difficult to understand, especially when the factual basis for the Administration's decision is in error.

Applicable portions of the correspondence between the District and the Interior Department, as spokesman for the Administration, are as follows:

THE COLORADO RIVER WATER CONSERVATION DISTRICT,
Glenwood Springs, Colo., February 25, 1967.

President LYNDON B. JOHNSON,
The White House,
Washington, D.C.

DEAR MR. PRESIDENT: This letter is written in behalf of the Colorado River Water Conservation District, a quasi-municipal body formed by statute of the State of Colorado in 1937. It geographically embraces all of 12 counties and about $\frac{1}{2}$ of 3 additional counties of Northwestern and West Central Colorado.

The primary purpose of the State in organizing the District was to provide an agency to conserve and protect the waters of the Colorado River and its tributaries for beneficial uses within the District. To this end the District has always cooperated with the local populace, various municipalities and many private corporations interested in the development of the extensive resources of Western Colorado. It has also cooperated with other entities, particularly the United States Bureau of Reclamation, in formulating and promoting plans to develop for beneficial uses in Colorado the State's entitlement to the waters of the Colorado River.

H.R. 4671, 89th Congress, 2nd Session, otherwise known as the Colorado River Basin Project Act, proposed among other things the authorization for construction of 5 potential reclamation projects in Western Colorado. H.R. 4671 did not get out of committee and authorization of these same 5 projects has again been proposed in H.R. 3300, 90th Congress, 1st Session, introduced by our esteemed

Congressman Aspinall. All 5 of these projects are very important to the future growth and welfare of Colorado and the nation.

The February 17, 1967 issue of the Grand Junction, Colorado "Daily Sentinel" carried a headline news release under its Washington Bureau byline, stating that, "The administration has given the green light to" (the authorization of) "the \$109.5 million Animas-La Plata Project in Colorado and New Mexico and to the \$46.6 million Dolores Project in Colorado. But it asked for deferral of action of 3 other Upper Basin projects—the \$37.7 million Dallas Creek, the \$99.8 million West Divide and the \$67.8 million San Miguel Projects in Western Colorado. The official administration position on the 5 projects was stated in a report which the Interior Department delivered Wednesday to the House and Senate Interior Committees. The report was in response to a bill by representative Wayne N. Aspinall, D-Colo., to authorize the Central Arizona Project and the 5 Upper Basin projects."

The failure of the administration to recommend the West Divide, Dallas Creek and San Miguel Projects has caused immense concern in Western Colorado and particularly in this District. In our opinion there is no excuse for the recommended deferral since the benefits to be derived from each of the 5 projects appear to be so similar and so great. We would like to point out that as an example the West Divide Project will require about 7 years to construct. In addition to the irrigation of some 40,000 acres of productive land, this project will be capable of supplying high quality water in large amounts for municipal and industrial uses. Secretary Udall has recently indicated that there will be a burgeoning oil shale industry in an area adjacent to this project within that period of time. Since water for municipal and industrial uses will be essential to the development of this vast and tremendously valuable fuel resource, the West Divide Project is not only very important to us locally but to the nation as a whole.

In addition to extensive and highly desirable irrigation development, the Dallas Creek and San Miguel Projects will also supply water for municipal and industrial uses in strategic centers of population. The Dallas Creek Project will make available high quality domestic water in the Uncompahgre Project service area, one of the first Reclamation developments of the West.

We, therefore, respectfully urge the administration to reconsider its position in regard to deferred action on these 3 projects and recommend them for authorization as a part of the current "Colorado River Basin Project Act".

Sincerely yours,

PHILIP P. SMITH, *Secretary-Engineer.*

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C.

DEAR MR. SMITH: Thank you for your letter of February 25, 1967, to President Johnson expressing the Colorado River Water Conservation District's request for the Administration's support for the Dallas Creek, West Divide, and San Miguel Projects in Colorado.

When the authorization of construction of these projects was first considered by the 89th Congress as a provision of H.R. 4671, the Administration recommended the deferral of the projects pending the establishment of the National Water Commission and completion of its review of related water problems. This recommendation was based upon considerations of the high investment cost per acre of the irrigated land to be developed; the question of the advisability of developing new irrigated acreage in a potentially water-short area; and, in the case of the West Divide and San Miguel Projects, the fact that the need for municipal and industrial water supplies does not appear imminent. It was felt that the thorough review by the Commission of all aspects of water use and demand in the area would permit more sound decisions concerning the appropriate future developments.

This position has been carefully reexamined in regard to the current proposed legislation. The same considerations still exist, and we have recently reaffirmed the Administration's prior position in our comments on H.R. 3300, now before the Congress. A copy of our report of February 15 to Chairman Aspinall on that measure is enclosed for your information.

We appreciate your interest in and support for these developments. We sincerely believe, however, that the timely establishment of the National Water Commission and the availability of its comprehensive review of the regional

and national water resource problems will ultimately result in the best program of water and related land resource development for western Colorado.

Sincerely yours,

KENNETH HOLUM,
Assistant Secretary of the Interior.

THE COLORADO RIVER WATER CONSERVATION DISTRICT,
Glenwood Springs, Colo., March 11, 1967.

President LYNDON B. JOHNSON,
The White House,
Washington, D.C.

DEAR PRESIDENT JOHNSON: Our letter of February 25, 1967, addressed to you was referred to the office of the Secretary of the Interior, and was answered by Mr. Kenneth Holum, Assistant Secretary, under date of March 7, 1967. Our letter to you requested that you change your position upon the deferment for authorization of the Dallas Creek, West Divide, and San Miguel Federal Reclamation projects in Colorado. This letter is written in response to Mr. Holum's letter of March 7, 1967 above referred to.

Mr. Holum refers to the fact that the administration has recommended the deferral of the three projects above noted pending the establishment of the National Water Commission and the completion of that Commission's review of related problems. He then proceeds to list the reasons for this recommendation, which, together with the answer thereto, are as follows:

1. The high investment cost per acre of the irrigated land to be developed in these projects.

Answer. By Section 620 D of 43 USCA the Colorado River Storage Project Act, the revenues from the Basin Fund are divided in sub paragraph (e) thereof forty-six percentum to the State of Colorado.

The use by Colorado of the power revenue allocation to its irrigated lands should be solely the choice of the State of Colorado, and Colorado is backing the authorization of these projects unanimously.

2. The advisability of developing new irrigated acreage in a potentially water short area.

Answer. The allocation of water to the five Colorado projects is clearly within Colorado's entitlement to the waters of the Colorado River, and Colorado's use of these waters should be solely a matter of state concern. As above indicated, Colorado is backing the authorization of the five projects unanimously. The sponsors of these projects have acquired, under state law, applicable water rights needed for their development.

3. The lack of imminence of need for municipal and industrial water supplies in the West Divide and San Miguel projects.

Answer. It should be first noted in response to this particular objection that no immediate need appeared for domestic and industrial water allocations under the Animas-LaPlata Project, the latter having been recommended for authorization by the administration. In addition, especially in view of Secretary Udall's recent announcement concerning the imminent development of oil shale and other minerals found in place with oil shale, the almost immediate need for municipal and industrial water supplies from the West Divide project is undeniable. The towns of Silt, Rifle and DeBeque on the Colorado River have already indicated to the Bureau of Reclamation their immediate requirements for supplemental municipal water supply, irrespective of the future oil shale requirements.

Nothing in the comments of the Bureau of the Budget released April 30, 1966, indicates that there is any lack of need for industrial and municipal water under the San Miguel project. We are not informed of the requirements of that particular project in this regard.

If it is acknowledged that the state of Colorado has the right to determine how its allocation of water and power revenues will be used within the boundaries of the State, we are totally at a loss to understand the comments of the Bureau of the Budget dated April 30, 1966 relating to the deferment of the authorization of these projects until a National Commission could determine where the water would best be used in the entire Colorado Basin. If it is acknowledged by the administration that Colorado has a right to determine these matters, there is no justification for the deferment of the projects.

It should also be noted that the Colorado River Water Conservation District is comprised of an area having an assessed valuation of approximately \$400,000,000.00. The Board for this District has obligated that entity to assure subscription of the municipal and industrial water supplies of the West Divide Project.

In your letter to Congressman Aspinall of February 15, 1967, the administration indicates it is committed to the authorization of the Central Arizona Project to allow Arizona to utilize its full entitlement from the Colorado River. If this be true, the State of Colorado is just as entitled as is the State of Arizona, to use its full entitlement of the Colorado River. We do not say that development of these five projects will result in the use by Colorado of its full entitlement, but, nonetheless, we insist that Colorado is entitled to determine how it will use whatever entitlement it may have from the Colorado River, and that the water supplied needed for these projects is within our entitlement.

It is also noted that the letter of February 16, 1967 raises no new reasons for the deferral of the three above mentioned projects.

We are unable to see, at this time, how a yet to be established National Water Commission can possibly control Colorado in the use of its entitlement of water from the Colorado River.

Respectfully yours,

PHILIP P. SMITH, *Secretary-Engineer.*

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C.

DEAR MR. SMITH: Thank you for your letter of March 11, 1967, to President Johnson concerning the potential Dallas Creek, San Miguel, and West Divide Projects in Colorado.

You have pointed out in your letter that the repayment of the exceptionally high irrigation investment in these projects would be assisted with Colorado's share of revenues from the Upper Colorado River Development Fund. You also pointed out that Colorado's apportionment of Colorado River water is adequate to provide for the depletions which would be made by the projects. We agree that both of these statements are correct, and we also agree that the views of the State of Colorado must be paramount in deciding among the possible uses of such water and development fund apportionments.

We must point out, however, that the construction of any Reclamation project, although it is substantially repaid from various revenues over time, requires current expenditures of Federal funds. Such investments are limited in total magnitude and decisions must be made by the executive and legislative branches of the Government as to the most beneficial application of funds at any particular time. The executive branch also has a responsibility in administering the Reclamation program to promote the well-planned, far-sighted use of the Nation's vital water resources.

In exercising these responsibilities, the Administration has recommended that Dallas Creek, West Divide, and San Miguel Projects be deferred. We believe that the National Water Commission's findings concerning the overall water problems of the Nation will be valuable in determining the optimum future development of water conservation projects in Colorado and elsewhere. We also believe that there is no urgency for the construction of these projects. If the demand for oil shale industrial water develops early, the West Divide Project could be reexamined with particular regard to that need and recommended for authorization of construction. The Dallas Creek and San Miguel Projects appear to be unrelated to oil shale development at this time.

We sincerely believe that the deferral and reconsideration of these projects will prove to be to the ultimate benefit of the State of Colorado in promoting the best use of its most vital resource—water.

Sincerely yours,

KENNETH HOLUM,
Assistant Secretary of the Interior.

After the decision was made by the Administration, and announced by the Secretary of the Interior, to recommend deferral of the three Colorado Projects named above, many letters, statements, resolutions and other communications were directed to President Johnson and Secretary Udall protesting such position.

An informative example of these communications from an internationally recognized expert on oil shale, is as follows :

CAMERON & JONES, INC., ENGINEERS-CONSULTANTS,
Denver, Colo., February 27, 1967.

HON. STEWART L. UDALL,
Secretary, Department of the Interior,
Washington, D.C.

DEAR MR. SECRETARY : It has come to my attention that of five proposed Federal projects for water development on Colorado's western slope only two, the Animas-LaPlata and the Dolore projects are in your early action program. I fully agree with the belt-tightening effort the President has instigated and without doubt a deferral of certain projects is wise.

May I state my opinion however, that the West Divide project, as potentially the best source of water for oil shale development, should be allowed to proceed. In your testimony last week before Senator Jackson's Senate Interior Committee you quoted figures of 20,000 acre feet per year for a 1,000,000 barrel per day oil shale industry. Although the number was qualified to indicate this to be a process requirement only, the needs of the communities, supporting industry, etc., will multiply this usage by a factor of 10.

You also mentioned in your testimony that present sources of oil will carry us through this century, implying that we have no need to develop oil shale and other supplemental sources of oil. This is a matter of further concern to me since I know of no one involved with supplying oil who holds this viewpoint. I can tell you with certainty that major petroleum suppliers are proceeding on development plans that are aimed at shale oil production within the next five years and obtaining an accrued supply of good quality low cost water is a problem.

Let me urge you to review carefully the priority you have given Colorado's water projects and restore the West Divide projects to the immediate program.

Very truly yours,

RUSSELL J. CAMERON, *President.*

The second and third requirements relating to Hualapai Dam and Reservoir can be considered together. We have no objection to, indeed, we support, legislation to authorize the construction of the Central Arizona Project. However, such approval and support is predicated on there being available to Arizona a sufficient quantity of water to allow continued operation of the project without reliance on Upper Basin non-use of its share of water of the Colorado River. We know that if the project is authorized on any other presumption, it will seriously threaten continued development of the Upper Basin because of the project's dependence on water allocated to the Upper Basin. Since the Upper Basin is promised relinquishment of its water planned for initial use by the Central Arizona Project when such water is needed in the Upper Basin, a serious investigation of augmentation of the flow of the river by the import of water from outside sources is a must. We recognize that desalinization of sea water in large quantities and weather modification offer possible substitute sources but import studies cannot await refinement of these approaches. We recognize that importation will be expensive, and therefore the surplus power revenues from Hualapai Dam and power plant constitute a logical and proven source of supplemental financing.

The fourth requirement relates to the operation of the storage facilities authorized by and constructed under the Colorado Storage Project Act. Irrespective of how you interpret the compact division of waters of the Colorado River, storage of water is necessary to provide a continuing and dependable source of water and power so essential if the Upper Basin states are to make beneficial use of their apportioned share of the water of the river.

The Colorado River Conservation District appreciates the indulgence of the committee in holding these hearings and in affording it the opportunity to present this statement. We know the committee will give the statement due consideration in appraising the legislation pending before it.

THE COLORADO RIVER WATER CONSERVATION DISTRICT,
By PHILIP P. SMITH, *Secretary-Engineer.*
KENNETH BALCOMB, *Counsel.*

Senator ALLOTT. The last witness this morning, and may I express my deep appreciation to all of you gentlemen who have been here and so assiduously and conscientiously attended these meetings; I know that for each of you it is a sacrifice of your own time in your own profession, and your own businesses, whatever they may be; and not only in behalf of my own State, but in behalf of the committee, I want to thank you for your advice, your statements, and your counsel.

Those of you who are not too late, I hope will make your airplanes this time.

The last witness—I agreed to stay, the distinguished Senator from Arizona, Mr. Fannin, had to leave, and he couldn't avoid it—is Dr. Paul Martin, who is a representative of the Arizona Academy of Sciences.

I understand from Senator Fannin that his statement will be brief.

Dr. Martin, your statement will be inserted in the record. You may proceed to comment on it as you will.

STATEMENT OF DR. PAUL S. MARTIN, ASSOCIATE PROFESSOR OF GEOCHRONOLOGY, UNIVERSITY OF ARIZONA; AND CHAIRMAN, GRAND CANYON STUDY COMMITTEE, ARIZONA ACADEMY OF SCIENCES

Mr. MARTIN. Mr. Chairman and gentlemen of the committee, my name is Paul S. Martin. I am an associate professor of geochronology at the University of Arizona, for the past 10 years a resident of Tucson, Ariz., and chairman of the Grand Canyon Study Committee of the Arizona Academy of Science.

I am attending these hearings as a private, informed citizen, and as a representative of the Arizona Academy of Sciences. This group of over 600 members was organized in 1956 to stimulate education and research in science in the State. At its annual business meeting in Tucson on April 29, 1967, the membership received the following report of the Grand Canyon Study Committee and adopted the following resolution:

REPORT FROM THE GRAND CANYON STUDY COMMITTEE, ARIZONA ACADEMY OF SCIENCE

At its September 23, 1966, meeting in Tempe, the executive board of the Arizona Academy of Science authorized the appointment of a study committee to consider possible consequences of dams proposed for the Grand Canyon. The committee was aware of, but did not attempt to confront, controversial questions of economic necessity, water politics, engineering feasibility, and esthetics that have generated a major national debate centering in part on the question of dams in the Grand Canyon. The Grand Canyon Study Committee was formed to investigate a relatively less critical but seriously neglected matter.

We have attempted to appraise the archeological, biological, and geological resources of interest to scientists in the parts of the Grand Canyon threatened by possible impoundment.

THE QUESTIONNAIRE

To gain information on natural features in the Grand Canyon of interest to Arizona scientists and to sample the opinion of our members regarding their position on the proposed dams, we circulated a questionnaire to all members in early February. Two hundred and thirty-four replies were received and tallied by March 13; 90 contained statements in reply to question 3, on scientific features of the area.

Regarding opinion, a clear majority of members expressed opposition to the dams, 64 percent opposed Hualapai and Marble Canyon dams, 28 percent favored them, and 8 percent expressed no opinion. Some respondents stated they would regard the scientific assets of the area as an insufficient reason for opposing the dams, if they should prove essential to meeting the water needs of the State.

On the question of a proposed extension of Grand Canyon National Park, 61 percent were in favor, 27 percent opposed, and 12 percent expressed no opinion or no answer. Not all those opposed to the dams were in favor of an extension of the park. One senior Arizona scientist strongly urged that parts of the canyon lying outside the national park be set aside as a State park.

ARCHEOLOGICAL RESOURCES

Reconnaissance surveys by R. C. Euler, Prescott College, in the proposed Marble Canyon impoundment revealed seven archeological sites below the high water line, three immediately above that line, and 45 in the environs of possible construction camp sites. Those in the pool area are small—one to five-room—Pueblo structures or mesal pits, probably occupied around A.D. 1100.

Stanton's Cave, above Vasey's Paradise, contained split-twig figurines with a radiocarbon date on one of 4095 ± 100 years. We understand that the cave was vandalized by unauthorized parties in 1966. On the west rim immediately above the proposed damsite and in the area of possible construction camp or recreational site development, 45 small Pueblo and 77 agricultural check dams lie along $2\frac{1}{2}$ miles of shallow drainage.

Behind Hualapai Dam, Euler has made three reconnaissance trips, not including the many canyon tributaries that undoubtedly contain archeological remains. So far as is known, only four campsites lie directly within the proposed reservoir pool, two occupied circa A.D. 1100 and two of younger age.

Apparently, the proposed Marble Canyon and Hualapai Canyon reservoir areas contain no spectacular or extensive archeological remains. While prehistoric sites are less numerous than in the Glen Canyon Reservoir area, those discovered to date are sufficiently important from a scientific standpoint to warrant salvage excavation. With or without dams, archeological salvage is needed to prevent further loss from vandals.

Finally, beyond the narrow question of salvage archeology, we wish to speak in behalf of the welfare of ethnic groups living along the rim of the canyon. The Hualapai Tribe stands to benefit to a considerable degree if construction of a dam on their reservation is au-

thorized. But their economic plight deserves independent consideration, and their economic advancement should not be made contingent on the authorization of Hualapai Dam.

BIOLOGICAL RESOURCES

Northern Arizona in the vicinity of the San Francisco Peaks, and including the Grand Canyon, is the "type locality" for the North American life zones of Merriam—1890, North American Fauna No. 3. Extensive areas of northern Arizona remain in a relatively natural condition. Construction of a 310-foot high dam at Marble Canyon, with a 55-mile backup of the river and construction of a 736-foot high dam at Hualapai (Bridge) Canyon, with a 93-mile long reservoir, would flood no more than a minute part of the Grand Canyon and open a large part of it to easy access by boat. Unfortunately, in terms of canyon life zones, the impoundments would obliterate more than half of the highly productive streamside and terrace vegetation at the bottom of the Lower Sonoran (Desert) Zone.

Possible changes in aquatic fauna, especially those affecting species typical of torrential waters, seems even more serious. The Colorado River Basin has an extremely high percentage of endemism. Of 35 native species of fish, 27—74 percent—are found in no other river basin.

The crustacean and inert faunas are essentially unknown, but are likely to be equally rich in endemics, as suggested by studies in the Green River segment of the Colorado River drainage. Evidently, the fauna is ancient and specialized, not comparable to any other aquatic fauna in North America.

All of the native fish now known from Grand Canyon are Colorado River Basin endemics. The bizarre humpback chub—*Gila cypha*—was described from the mouth of Bright Angel Creek; it is known only in the Grand Canyon and in the Green River.

Other unusual fish recorded by R. R. Miller, University of Michigan, are the humpback sucker, *Xyrauchen texanus*, mountain sucker, *Panosteus delphinus*, and bonytail, *Gila robusta elegans*. The Colorado River squawfish, *Ptycholocheilus luctus*, and flannelmouth sucker, *Catostomus latipinnis*, are known both above and below the canyon and are almost surely present in it. At least one undescribed dace, of the genus *Rhinichthys*, has been collected—C. A. Lowe, Jr.

But, without detailed faunal surveys, no useful statement about possible future upset can be attempted. A fundamental difference exists between salvage biology of an area such as the Colorado River Basin and that of other streams in which salvage operations have been carried out in the past. In an area of high endemism, the populations that might be discovered and "salvaged" prior to impoundment may be the last of their line. We are not dealing with a case of reduction of range, but rather with the threat of extinction.

GEOLOGICAL FEATURES

The pool behind Marble Canyon Dam offers excellent exposures of the Upper Paleozoic strata in an area that is critical to regional studies and correlation. These strata may be expected to yield data of interest

to physical stratigraphy and paleontology. Parts of the sequence, especially the Redwall Limestone, Supai Formation, and Coconino Sandstone would be flooded. An unstudied Mississippian nautiloid locality in the Redwall would be covered.

Behind Hualapai Dam are remnants of lava dams, river terrace deposits, and some unstudied Precambrian rocks. The lava remnants are significant to the interpretation of the history and rate of canyon cutting. A potassium-argon date of 1.2 ± 0.2 million years has been obtained by P. Damon, University of Arizona, from the lowest lava flow at the base of the valley fill in Toroweap Canyon. This provides a means of determining rate of canyon cutting in the lowermost 50 feet of the canyon at that point. Precipitated calcite dams in Havasu Canyon would be flooded as well as travertine seeps, both active and fossil.

Because of the dry climate, we anticipate the discovery of dry, perishable plant and animal remains in rock shelters and in small caves. These may or may not be associated with archeological sites. The recent discovery of ancient "fossil" pack rat nests—Wells, Science, volume 143, page 1171—provides an unexpected source of information on past vegetation zoned during Pluvial times in arid regions.

A pack rat nest in Glen Canyon, part of an archeological site, was 24,600 years old by radiocarbon dating and contained pollen evidence of water birch growing considerably below its present position in southern Utah.

Rock shelters, crevices, and even very small caves along the Colorado River may contain clues to what happened to Merriam's vegetation zones during Pleistocene times, as well as direct evidence from driftwood of Pluvial age floods. This recent development in the study of paleocology would be adversely affected by the drowning of extensive parts of the Grand Canyon.

Although the loss of geologic features mentioned above would not be as serious as the elimination of endemic species of animals, the study of the exposures available behind proposed damsites would contribute much to the understanding of regional geology and the geologic history of Arizona. Most members of this committee would not wish to see these portions of the canyon flooded unless there are very compelling economic reasons for doing so. Whether or not the dams are built, there is need for support of extensive geologic investigations in the canyon.

CONCLUSIONS

The Grand Canyon extends roughly 280 miles from Glen Canyon Dam to the head of Lake Mead. Regulated flow from Lake Powell has already lowered the water temperature, reduced silt content, and changed the regimen of the Colorado River through the canyon. The effect of these changes on the native fauna is not known.

Proposed construction of two dams in the Grand Canyon would (1) obliterate a few small prehistoric archeological sites; (2) seriously disrupt and perhaps extinguish a small, poorly known, presumably highly endemic fast water aquatic fauna; (3) drown extensive parts of the natural river terrace and riparian vegetation, the smallest and most vulnerable of the canyon vegetation zones; (4) inundate significant Precambrian outcrops, lava dam remnants, travertine springs,

dry caves, and rock shelters likely to contain mummified plant and animal remains of interest to the Pleistocene studies of both the river and the present vegetation zones.

There is no adequate, up-to-date biological or geological survey of this region. For this reason, it is not possible to anticipate the ecological and geological consequences of impoundment, much less to know just how serious would be the damage to the Grand Canyon as a natural laboratory. Pending results of a careful survey, essential to any scientific evaluation of the effect of impoundment, we recommend a moratorium on dam construction.

Grand Canyon Study Committee: Robert C. Euler, anthropology, Prescott College; Roy M. Emrich, physics, University of Arizona; Charles A. Lowe, Jr., biology, University of Arizona; William L. Minckley, zoology, Arizona State University; Stanley S. Beus, geology and geography, Northern Arizona University; Hugh Cutler, Missouri Botanical Garden; and Paul S. Martin, geochronology, University of Arizona (chairman).

I thank you for this opportunity to insert into the record the testimony that I bring, that is, a report from this Grand Canyon Study Committee of our organization, a result of a questionnaire which we submitted to our membership of over 600 several months ago, and a resolution bearing on the problem of scientific surveys in the area of the proposed impoundment behind both Hualapai and Marble Canyon Dams.

Senator ALLOTT. The resolution is attached to your statement and it will be included.

(The documents referred to follow :)

RESULTS OF QUESTIONNAIRE

1. 639 copies mailed in early February, 1967, to all members of the Arizona Academy of Science.

234 returns received through March 10.

2. "Have you conducted field work or scientific research at any time in the Grand Canyon (between Lees Ferry and Grand Wash Cliffs)? If so, please describe briefly, citing the source, if results are published.

Yes, 41; No, 193.

3. "Whatever your answer to question two, please describe briefly any scientific features of direct interest to you (biological, geological, prehistoric, other) which might be lost or altered if one or several dams are built in the Grand Canyon.

Quotable information on scientific features received from 90 members.

4. Do you (a) favor (b) oppose (c) have no opinion regarding construction of Hualapai (formerly Bridge) Canyon Dam?

66 (28%) favor; 149 (64%) oppose; 19 (8%) no opinion or no answer.

5. Do you (a) favor (b) oppose (c) have no opinion regarding construction of Marble Canyon Dam?

66 (28%) favor; 150 (64%) oppose; 18 (8%) no opinion or no answer.

6. Do you (a) favor (b) oppose (c) have no opinion regarding an expansion of Grand Canyon National Park, to include the full length of the Colorado River through the Canyon (Lees Ferry to Lake Mead?)

142 (61%) favor; 64 (27%) oppose; 28 (12%) no opinion or no answer.

Report submitted for the committee by the chairman, Paul S. Martin, on April 19, 1967.

RESOLUTION OF THE ARIZONA ACADEMY OF SCIENCE, ADOPTED APRIL 29, 1967

Whereas the Grand Canyon Study Committee of the Arizona Academy of Science was requested to review the effects of dam construction in the Colorado River upon the scientific resources of the Canyon; and

Whereas all scientists in the State of Arizona, as well as throughout the world, have a definite interest in the historic value of the Grand Canyon, because of the archaeological, biological, ecological, and geological data available in that region; and

Whereas it is believed that existing salvage laws relative to construction are inadequate: Now, therefore, be it

Resolved—

(1) That existing salvage laws be modified to specifically include biological, ecological, and geological studies in addition to archaeological and paleontological studies already regulated under law;

(2) That prior to any possible major construction in the Grand Canyon of the Colorado River, scientific surveys of archaeological, biological, ecological, and geological features be made and publicized.

(3) That local, state or national scientific organizations or agencies be commissioned for such studies and funded, with sufficient lead time for adequate surveys preceding possible construction; and that funds be provided for publication of such studies; and be it further

Resolved That due to the unique importance of the region to many fields of science, we approve in principle the extension of Grand Canyon National Park along the Colorado River from Lee's Ferry to the present Park boundary and if possible to the western end of Grand Canyon National Monument.

Mr. MARTIN. May I have a few moments to summarize the thrust of this problem?

Senator ALLOTT. Yes.

Mr. MARTIN. What we are concerned with is the question of what really is at the bottom of the Grand Canyon, behind the areas that would be flooded if the dams were to be built. At the same time, we cannot ignore, although perhaps for the moment we can set aside, the broader, much more difficult question of economic development, resource development, in the Southwest.

As scientists, we felt obliged to direct, first, our attention to the special area that involves our own particular narrow fields of study, whether they are biology or geology or archeology, and we have attempted in this report to give to you our impression of the status of knowledge of information in that part of the canyon which is quite remote and has never really been thoroughly investigated by a biological survey team or a recently mounted field party of geologists interested in basic science problems.

It does appear, on the basis of our study, that we have relatively more knowledge about the archeology of this area, and that the number of archeological facts is reasonably small; that flooding behind the proposed impoundment would, of course, destroy archeological features, but that a salvage program of the sort that is now generally a part of dam construction in the United States, salvage archeology, could perhaps recover what one would need to know about that branch of science.

On the other hand, the problem in terms of biological resources is much more serious, we believe. That is, we are dealing with an area of endomorphism. California River fauna contain many peculiar species, certainly, of fish. We know very little about the other kinds of aquatic animals.

We are concerned that two additional dams, and 280 miles of already altered river between Lee Ferry and Grand Wash Pittsville would have a detrimental effect on the aquatic fauna, perhaps resulting in the extinction of some species.

We are also quite concerned with the potential destruction of vegetation zones, at least the effect on the lower Sonora zone in this area,

which is the classic type locality for myriad analysis of life zones in Western North America, dating back to 1890.

The problem of exactly how far to go in the defense of fauna in this area, of course, is one that we can't settle, but we are very much concerned about the fact that so little is known about this part of the Colorado River system. We would hope that the Congress would find a way, or the private individuals would find a way, or some combination of granting agencies could be found to support before, prior to a final decision on dam construction in this area, a careful biological investigation, geological investigation, of the natural resources that are present.

Senator ALLOTT. Thank you very much, Dr. Martin. I understand you came here at your own expense. You are a professor at the University of Arizona, but you are here on behalf of yourself and on behalf of your committee.

Mr. MARTIN. That is correct.

Senator ALLOTT. Thank you very much, sir. I am now going to make the appointment I was supposed to be at a long time ago. The hearing will be recessed until 2 o'clock this afternoon, in this room, at which time the chairman of the subcommittee will resume the chairmanship.

(Whereupon, at 1:15 p.m., the committee recessed, to reconvene at 2 p.m. this same day.)

AFTERNOON SESSION

Senator KUCHEL. The hearing will reconvene.

The next witness is Mr. Soucie, representing the Sierra Club.

STATEMENT OF GARY A. SOUCIE, ASSISTANT TO THE EXECUTIVE DIRECTOR, SIERRA CLUB, NEW YORK CITY

Mr. SOUCIE. Mr. Chairman, my name is Gary A. Soucie and I am assistant to the executive director of the Sierra Club in New York City. I am here today to present what, in this committee at least, is a minority point of view: that of the urban East.

But the eastern viewpoint is, in fact, the majority viewpoint. Some 129 million people live in the 26 States that lie wholly east of the Mississippi River—nearly two-thirds of our Nation's population.

In New York City I share offices with the Sierra Club's Atlantic chapter, which is the third largest and the fastest growing of the club's 20 chapters. It is no accident that a club founded and headquartered on the west coast is growing fastest in the East, particularly within and around the coastal megalopolis. The reason is simple enough: in our day-to-day lives we are reaping the melancholy harvest of a past in which the conservation ethic played too minor a role. Our air is unfit to breathe, our waters unfit to drink, and our elbow room limited to the proximity of our neighbor's ribcage. Perhaps because we have so little left, we are beginning to understand the value of each little open spot of green amid the asphalt and steel.

Consequently, it is not surprising the Sierra Club's ads in the New York Times and Washington Post would lead people to respond. And the ads that have captured the most attention are those about the pro-

posed Grand Canyon dams. The typical eastern reaction to learning that the Grand Canyon might be dammed, ostensibly to finance an Arizona water project, is a mixture of disbelief, outrage, and anger—disbelief that anyone could seriously make such a proposal, outrage over the preposterousness of the idea, and finally, outright anger that one or two, or even seven, States think they have a special right to spoil one of the greatest natural and scenic resources in the country and, indeed, in the world.

Sierra Club members are fighting the good fight on many fronts here in the East. In New York, we are striving to keep the forest preserve "forever wild" and we are in combat with Con-Edison to keep a pumped-storage plant out of the Hudson Gorge. In New Jersey, we are helping to preserve the Great Swamp as wilderness. In North Carolina, we are working to prevent Great Smoky Mountains National Park from being bisected by another road. Here in the Washington area the Hunting Creek Dam project keeps us hopping. Down in Florida it's the Everglades water problem.

But above all of these is the "Big One": the threat to the Grand Canyon. You don't have to add "of the Colorado River" for a Maine Yankee or a Georgia Cracker to know what you're talking about. In the minds of Americans everywhere there is only one real Grand Canyon. And they don't want that one dammed, for water or for power or for revenue or for anything else. "After all, it's our Grand Canyon, too."

Most easterners, I among them, have never seen the Grand Canyon, neither from the South Rim nor from the mouth of Havasu Creek. But we know it and value it in the same way we cherish so many other things we haven't seen: the Mona Lisa, the Matterhorn, the North Cascades, the redwoods of California, or the Sistine Chapel.

While we easterners appreciate the water problems of Arizona and California and the rest of the arid Southwest, we don't think things have come to a point where the Grand Canyon must be sacrificed. Especially when the impounded water would be used, not to slake the thirst of Arizona's hoped-for millions, but to satisfy an outmoded formula for financing reclamation prospects.

And we megalopolitans understand water shortage, for we have one. Our recent water-rationing campaign is still pretty fresh in our minds. And I might interject here that in the New York newspapers the other day was a news item that this has been the driest spring in New York State in something like 10 years, so the prospect for the future doesn't look too good.

And we understand the resource problems of population pressure, too. It is no secret that we have the most densely populated States; Rhode Island and New Jersey have over 800 persons per square mile of land area, as compared with 11.5 for Arizona and 100.4 for California. Here in the District of Columbia, there are 12,525 persons per square mile.

And the fastest-growing State during the decade between the last two census years was not Arizona, nor even the frontier State of Alaska; it was Florida, all the way back here on the Atlantic coast.

Between 1950 and 1960, Florida's population increased by 2,180,255 persons, or 78.7 percent. We have our fair share of population and

resource problems in the East. But if ever we New Yorkers were to start talking about diverting Niagara Falls to irrigate the streets of Manhattan, I am sure the westerners would rise in protest.

We hope they will likewise understand how easterners feel about anyone who would do anything to the Grand Canyon but leave it as it is.

Thank you, Mr. Chairman, for this opportunity to present an eastern viewpoint.

Senator KUCHEL. Thank you very much, Mr. Soucie, for a very interesting statement. Any questions?

Thank you, sir.

Mr. SOUCIE. Thank you, sir.

Senator KUCHEL. The committee has a statement from Mr. Thomas L. Kimball on behalf of the National Wildlife Federation, which will be inserted in the record at this point.

(The statement referred to follows:)

STATEMENT OF THOMAS L. KIMBALL ON BEHALF OF THE NATIONAL WILDLIFE
FEDERATION

Mr. Chairman, I am Thomas L. Kimball, Executive Director of the National Wildlife Federation, which has headquarters here in Washington, D.C. Ours is a nonprofit organization which seeks to attain conservation goals through educational means. The Federation has affiliates in forty-nine States. These affiliates, in turn, are made up of local groups and individuals who, when combined with associate members and other supporters of the National Wildlife Federation, number an estimated 2,000,000 persons.

I appreciate and welcome the invitation to appear here today.

Before proceeding, I should point out that I am a native of Arizona who was fortunate enough to administer State wildlife agencies in both Arizona and Colorado before assuming my present position. Therefore, I am acquainted with most of the Colorado River and can identify personally with problems of the people who reside in its watershed.

Attached is a copy of a resolution adopted in March of this year by our organization. While this resolution is self-explanatory, I should like to enlarge briefly upon it. Obviously, however, we will not comment on all aspects of all bills under consideration here today.

First, we fully recognize the necessity to bring water into the interior of Arizona. Without it, the growth of this State will be severely handicapped.

Second, we hope that power for the Central Arizona Project can be provided through thermal generation, thereby obviating the need for any hydro-electric dams in the Grand Canyon area. We were pleased when the Interior Department recommended the purchase of power from a utility. We also believe that the Federal Government, or the State of Arizona or its political subdivisions can follow the precedent already established in the Tennessee Valley to utilize steam generation for providing pumping power for the Central Arizona Project.

Ideally, this steam generation would utilize nuclear energy. Of course, a plant or plants also could utilize fossil fuels to achieve the same objective. In the event such a plan is authorized, we recommend that the principles of conservation be required; (1) that cooling towers or other methods be used to avoid creating thermal pollution and (2) that any coal used for the project be mined under regulations applying the maximum protection for and rehabilitation of the land resources involved.

Third, if the Congress does not adopt the thermal generation concept, we believe that a high dam at the Hualapai (Bridge Canyon) site should be authorized if measures are taken to protect units of the National Park System from the dangerous precedent of an invasion by dams and reservoirs.

This bears on proposals which have been introduced in the House but, to the best of our knowledge, not in the Senate. Mr. Wayne N. Aspinall (Colo.), Chairman of the House Committee on Interior and Insular Affairs, has introduced H.R. 6132, which would extend the present boundaries of Grand Canyon National Park upstream 60 miles to the foot of the Glen Canyon National Recreation Area and extend the Park westward to Vermillion Cliffs. This proposal

differs considerably from H.R. 1305, introduced by Mr. John P. Saylor (Pa.), ranking minority member of the House Interior Committee, which would prevent construction of dams at both the Hualapai and Marble Canyon sites.

We hope that a narrow strip of land around the Hualapai reservoir, and the waters, will be designated as a national recreation area. We believe the remaining lands in the Grand Canyon National Monument should be combined with Grand Canyon National Park, with its boundaries extended upstream to the Glen Canyon National Recreation Area, generally as proposed by the Chairman and ranking Minority Member of the House Committee. Of course, one major benefit of such an extension would be to preempt the construction of a dam at the Marble Canyon site.

We agree on inclusion in the Park of a limited area to the rim of the Vermillion Cliffs one-half mile on each side of the River through House Rock Valley in the Park. In order to create the least possible disruption to Grand Canyon Game Preserve, the Kaibab National Forest, and other areas, we recommend that the extended boundaries of Grand Canyon National Park be set as a half-mile on either side of the center line of the Colorado River rather than following contour lines. Also attached to this statement is another resolution relating to this park extension.

Because of language recognizing the possibility of a dam in the area in the basic Acts establishing both Grand Canyon National Monument and Grand Canyon National Park, we do not regard such a revision of boundaries as compromising the integrity of these units of the National Park System. However, we prefer the alternate means of no dams.

Fourth, I should express another hope of our organization. We hope that the Committee, in legislation already under consideration or by new introductions, will reserve for itself all decisions on granting a license for any dam between Glen Canyon Dam and Hoover Dam. Such a procedure, of course, would call for a moratorium on licensing by the Federal Power Commission even if the Congress does not take definitive action to enact legislation for the Colorado River Basin or the Central Arizona Project.

Fifth, and finally, Mr. Chairman, we recommend that another downstream site be selected if the Committee sees fit to authorize the construction of Hooker Dam and Reservoir as part of the Central Arizona Project. As presently proposed, Hooker Dam would back water into the Gila Wilderness Area and the Gila Primitive Area, thereby compromising a region which was the first to be so recognized by the Forest Service. An alternate downstream site not only would prevent invasion of these areas, but make the reservoir more readily accessible for general types of water-related recreational uses.

Again, I thank you for the opportunity of appearing here today.

COLORADO RIVER BASIN PROJECT ACT

Whereas the program of the National Wildlife Federation is firmly based on principles of conservation which recognize a reasonable balance between the preservation and prudent use and development of natural resources for several beneficial purposes, including fish and wildlife management and outdoor recreation; and

Whereas this Federation exerts a leadership role in the development and protection of sound conservation practices, bringing matters in this vital area of American life to the attention of the public; and

Whereas various proposals would authorize a high dam at the Hualapai (Bridge Canyon) site for the purpose of providing revenues to help finance the Central Arizona Project, whereby badly needed supplies of water would be brought into the interior of Arizona; and

Whereas construction of Hualapai Dam would create new fish and wildlife and outdoor recreational opportunities in the lower Colorado River Basin and enhance properties owned by the Hualapai and Havasupai Indian tribes; and

Whereas water salvage programs in some proposals recognize "a reasonable degree of undisturbed habitat for fish and wildlife;" and

Whereas specific provisions are made in some proposals for conservation of scenic, historical, natural, wildlife and archeological features, as well as for the public use and enjoyment of included lands, facilities, and water areas; and

Whereas any Lower Colorado River development should consider this Federation's policy of protecting the integrity of national parks and monuments: Now, therefore, be it

Resolved, That the National Wildlife Federation, in annual convention assembled March 11, 1967, in San Francisco, California, hereby supports these principles: (1) that power for pumping for the Central Arizona Project should be provided through thermal generation; (2) that, if the Congress will not adopt the thermal generation concept, then a dam at the Hualapai site should be favorably considered with Grand Canyon National Monument being incorporated into Grand Canyon National Park and its boundaries adjusted to: create a narrow Park corridor northward along the west boundary of the Colorado River, including the least amount of wildlife habitat, from the Park's present eastern boundary to the southern boundary of the Glen Canyon National Recreation area, thereby pre-empting construction of Marble Canyon Dam by any agency; and, (3) create a national recreation area adjacent to the proposed Hualapai reservoir in such a manner that the Reservoir will not invade either Grand Canyon National Monument or Grand Canyon National Park.

GRAND CANYON NATIONAL GAME PRESERVE

Whereas, by Act of Congress and proclamation of the President of the United States, the Grand Canyon National Game Preserve was set aside for the protection and production of the Kaibab mule deer and other native wildlife; and Whereas the area known as Kaibab North has attained national recognition because of its ability to provide outstanding hunting and to produce outstanding trophy mule deer; and

Whereas the Kaibab North area provides an outstanding example of multiple use resources management; and

Whereas inclusion of this area in the Grand Canyon National Park would preclude hunting under present policies of the National Park Service; and

Whereas hunting is necessary for proper management of the deer herd, keeping it in balance with the sustaining capability of the environment; and

Whereas elimination of hunting from this area would result in a recurrence of tragic deer die-offs prevalent in the past; and

Whereas sportsmen have contributed in excess of \$350,000 to enhance wildlife values of the Preserve: Now, therefore, be it

Resolved, That the National Wildlife Federation, in annual convention assembled March 11, 1967, in San Francisco, California, hereby asserts its belief that the present status and integrity of the Grand Canyon Game Preserve must be maintained except, possibly, for a narrow strip of land bordering the Colorado River which might be included in an extension of boundaries of Grand Canyon National Park.

Senator KUCHEL. Mr. Carl Chafin, chairman of the Grand Canyon Subcommittee, Sierra Club, Tucson, Ariz.

STATEMENT OF CARL CHAFIN, CHAIRMAN, GRAND CANYON SUBCOMMITTEE, SIERRA CLUB, TUCSON, ARIZ.

Mr. CHAFIN. Thank you very much, Mr. Chairman. I have a very brief statement here, and I would like to read the entire page.

My name is Carl Chafin. I live in Pima County, Ariz., just outside of Tucson. In addition to appearing here today, it was also my privilege to testify on March 17 at the House subcommittee hearings on H.R. 3300. At that time, I summarized the present usage of water in Arizona and pointed out that over half of our 6.5 million acre-foot annual consumption is now used to grow low-value feed grains and forages. A copy of that statement has already been submitted to you for reference and your files, if you so desire.

In this reference, I would like to add at this point that Mr. Picora, Director of the U.S. Geological Survey, submitted a very interesting letter which appears on pages 575 and 576 in the hearings of H.R. 3300. I would like to draw this to the attention of the Chair, and indicate that I think this is some very useful information on the water supply of Arizona.

I am only supplying that because Mr. Picora did not see fit to include this information earlier in the 85-page booklet on Arizona water that the Geological Survey published earlier, because it does bring out some additional new information which modifies my position somewhat. It shows the availability and the quality of the ground water in Arizona is somewhat more restricted than I had originally assumed, and I think it tends to make the need for the central Arizona project a little bit more urgent.

To continue, it is not my purpose, however, in appearing here today to oppose the central Arizona project. There is no doubt in my mind that Arizona can really use her fair share of the Colorado River. How that water is actually allocated within the State is perhaps an internal decision and will undoubtedly be resolved by economic and political forces too complex to analyze at this time.

I would like to make merely one minor exception to the central Arizona project as it is currently written, and I would like to insert this at this point. That is to the Charleston Dam, which is on the San Pedro River in southern Arizona. This San Pedro River, I think, in the East you would refer to as a creek. It is a rather ephemeral stream. It originates in Mexico, which is only 30 or 40 miles to the south of the proposed Charleston Dam site.

If the people in Mexico decided to use additional water in this basin, it might conceivably reduce the flow of the San Pedro River. It would upset the water rights in the San Pedro Valley. The same water would be impounded further north or downstream in Buttes Dam. This impoundment would only account for 12,000 acre-feet, which is only about 10 percent of the water contemplated for Tucson.

There is another aqueduct coming in from the north, which will bring in 100,000 acre-feet, which is considerably more important. I don't think everyone in Arizona wants to go motorboating on Sunday afternoon, so I would like to just call attention to these reservations to the Charleston Dam, which is a very minor portion of the central Arizona project.

I speak today for the Grand Canyon chapter of the Sierra Club, in which I hold positions of responsibility on the conservation committee and the executive committee. Our members, to the best of my knowledge, have never opposed the importation of water under the central Arizona project. In spite of my own previously stated reservations about how the water is to be actually allocated and used within the State of Arizona, I come here today in the spirit of compromise, prepared to support the bill offered by the Secretary of Interior at the House subcommittee hearings on March 14, and more recently, earlier this week. Not only does it contain the essential features of S. 1004 for the construction of the central Arizona project, but it also contains provision for the expansion of the Grand Canyon National Park to include Marble Gorge and the region eastward to Lee Ferry. We wholeheartedly endorse this farsighted and enlightened proposal by Secretary Stewart Lee Udall.

While the Secretary's plan recommends deferment of any action on the Hualapai or former Bridge Canyon Dam pending the outcome of a study by a national water commission, the Grand Canyon chapter of the Sierra Club, whose 300 members incidentally raised the funds to send me here today, would like to go on record as favoring

the expansion of the Grand Canyon National Park to also include the entire region westward to Lake Mead.

We make this recommendation on the basis that the highest and best use of this land is to leave it in its natural state. We are aware of the Goss plan, which by virtue of its pumped storage feature and special turbines, would triple the amount of power that was initially proposed for Hualapai Dam at the Bridge Canyon site. The true significance of the Goss plan, however, is in the use of its technology to triple the power output of existing Hoover and Glen Canyon Dams, thereby making it unnecessary to even construct Hualapai Dam in the first place. Surely, existing structures can be modified or converted more cheaply than a new dam can be constructed.

I believe Mr. Moss will have further to say about that later this afternoon. At this point, I would like to interject one additional comment into my testimony. I would like to refer to Mr. Ely's very able and brilliant testimony on behalf of California earlier this week, on which I think he made a very significant point, which ranks in water statesmanship in the West, and that was to offer to Arizona the hand of friendship, in the form of the 4.4 guarantee, in exchange for a shortage sharing.

I think this proposal should be seriously considered. In the past, Arizona has always held out for all or nothing, and ended up with nothing. I think it is time we took a realistic look at the water available in the river, at what California is actually using now.

We are not guaranteeing her something which she is not using or which the Supreme Court is not granting her, and accept this offer in exchange for sharing a shortage in the river in future years. While I live in Arizona, I have lived in California and Oregon in the past, and I think we have got to take a look at this, not from the view of whether we are in Arizona—whether we are an Arizonan or an Oregonian or Californian—but whether we are an American.

We have somehow got to solve this problem on the Colorado River Basin.

The people in Arizona who know the Grand Canyon have a special obligation to raise their voices in its defense and to inform the people in the rest of the country of all aspects of its grandeur and uniqueness. I have been down into the Grand Canyon seven times, including a raft trip down the Colorado River from Lee Ferry to Havasu Canyon, at which point I hiked out 75 miles in a 5-day period, carrying most of my water with me. I know the value of water in arid environments.

The uniqueness of the Grand Canyon is such that, while dams would not flood out the entire area, access would be made difficult to some of the most beautiful spots, such as Elves' Chasm and Deer Creek Falls. Also, the side canyons, where much of the hiking now takes place, would be flooded for many miles back from the Colorado River. One striking example comes to mind.

The mouth of lovely Havasu Creek would eventually be under 80 feet of water if Hualapai Dam were built 80 miles downstream.

I might point out in connection with this, some question has arisen as to how many people hike in this region. I consulted with Mr. Reed Water, the tourist manager of the Havasu Tribe, last year, and was

informed over 3,000 people came into that one canyon alone. They keep records. They charged \$1 apiece to cross the reservation, so there are possibly many, many more than that, counting the side canyons.

Those of us who have hiked in this region or floated down the Colorado River on a raft have had an experience which no words can adequately describe. We make no apologies for the fact that we love this part of America as it is and we invite others to come and see it for themselves. Then, they, too, will raise their voices in favor of including the entire region from Lee Ferry to Lake Mead in an enlarged Grand Canyon National Park for the use and enjoyment of millions of Americans in generations to come.

Thank you.

Senator KUCHEL. Thank you very much, Mr. Chafin.

Any questions, Senator?

Senator FANNIN. May I see the statement? I wasn't here.

Senator KUCHEL. I gather he is for your bill, Senator.

Mr. CHAFIN. That is right.

Senator FANNIN. From something I have been told, I gather he is not.

Mr. CHAFIN. I think in the spirit of compromise, you yourself have offered a bill which the conservationists in Arizona can support, because the present bill, as I understand it, eliminates any dams in the Grand Canyon.

Senator FANNIN. That is not the point of my inquiry. I understand, Mr. Chafin, that you are an expert on the so-called rights of California to a 4.4 priority. I am very interested in why you would take such a position.

Mr. CHAFIN. I think that it has been pointed out earlier this week, Senator, that California needs far more than this, and the court opinion of 1963 and the decree of 1964 granted this much. The water flows into this by gravity, and I think that it would be wise to recognize what has already happened.

Senator FINNAN. Where do you live, Mr. Chafin?

Mr. CHAFIN. I live in Pima County, just outside of Tucson.

Senator FANNIN. Do you realize that the city of Tucson is the largest city in the United States that is dependent upon underground water?

Mr. CHAFIN. I am aware of this. As a matter of fact, this is probably a more dependable supply than having the water evaporate in a lake on the surface.

Senator FANNIN. In other words, in preference to California, you are willing to sacrifice your city of Tucson and the area of Pima County, because that is exactly what you would be doing, if you take that position.

Mr. CHAFIN. I think that Tucson uses 55,000 acre-feet a year, and Phoenix about 125,000. We are talking about 200,000 acre-feet of water, Senator, and even if we only got 600,000 or 700,000 acre-feet in the central Arizona project, I think the cities would have a supply against a rainy day, or perhaps I should say the lack of a rainy day, which is what we should reserve our ground water for.

Senator FANNIN. I would suggest that you read your newspaper records as to what is happening in your city of Tucson today. They

are striving to hold their water supply, and having a very difficult time in doing so.

You realize that they are pumping water from the Indian reservation, and this is being challenged. So I would suggest you get more information before you come back and testify as an expert in this regard.

Mr. CHAFIN. I don't claim to be an expert hydrologist. As a matter of fact, the University of Arizona is doing a study on the water supply of Tucson, which will be released this fall, at which time, as a layman, I will attempt to digest that report.

Senator FANNIN. I can furnish you information in that regard, and will be very pleased to do so, which I am sure, would, if you are a loyal Arizonan and a loyal Tucsonian, certainly change your mind with regard to the precarious position in which your city finds itself.

Mr. CHAFIN. I would be delighted to see that, Senator.

Senator FANNIN. I certainly do not think that you are a loyal Tucsonian or Arizonan to come back and make this statement as you have in support of a 4.4 priority to California.

Mr. CHAFIN. That is entirely your opinion, sir.

Senator JACKSON. Thank you, Senator Fannin.

Thank you very much for your statement. We appreciate having the benefit of your views.

Mr. CHAFIN. Thank you, sir.

Senator JACKSON. The next witness is Mr. Paul Hamilton, field secretary, Columbia Basin Commission of the State of Washington, who is here representing the Governor of the State of Washington.

Mr. Hamilton, we are delighted to welcome you to the committee. I understand you have a prepared statement from the Governor, which you will read at this time.

You may proceed.

**STATEMENT OF HON. DANIEL J. EVANS, GOVERNOR OF THE
STATE OF WASHINGTON; PRESENTED BY PAUL HAMILTON,
FIELD SECRETARY, COLUMBIA BASIN COMMISSION OF THE
STATE OF WASHINGTON**

Mr. HAMILTON. Mr. Chairman, the State of Washington is one of the 17 States that has historically been included among the western reclamation States.

A major portion of Washington State lies east of the crest of the Cascada Range, and is arid in nature. This area possesses several million acres of highly fertile soil and a long growing season.

The pioneers who settled this region during the middle and latter 1800's realized that their existence, the future of their families and of the State lay in the utilization of the Columbia River and its tributaries to fully develop the capability of these rich, but then idle, soils.

Much of the progress that has been made through reclamation in our State and in the West has been due in large part to the sincere interest and diligent efforts of this committee. With the expanding population in the Western States, water and related land-use problems continue—in many areas, at a vastly accelerated rate. The bills currently before this committee for consideration certainly reflect this

factor. I am sure that they will receive the full attention of the committee and, in this regard, wish to express my sincere appreciation for the opportunity to submit the following statement for the record:

Of the five major Senate bills currently under consideration and involving the use of Colorado River water, three contain provisions which are of importance and deep concern to the citizens and governmental agencies of the State of Washington. These are S. 861, S. 1242 and S. 1409. Generally, the sections to which we take exception are common in all three measures, being set forth under the headings of title I and II, respectively.

The State of Washington has consistently taken a position affirming the desirability and need of a national water commission. However, we have been opposed to any proposition which would condition the creation of, or the scope of study by that body to any specific project.

In essence, title I of the three measures cited above sets forth this premise. We believe the merits of the Commission and intent of Congress as set forth in S. 20 speak for themselves, and that subjecting the Commission to the provisions of title I is not in the national interest.

It is our contention that the provisions of section 3 of the National Water Commission legislation, previously passed by the Senate and now being considered by the House of Representatives, provides the means to supply the answers to many questions and to give much needed direction and impetus to the solution of a wide variety of problems involving water, on a scope that is more broad in nature and less susceptible of agency influence than might otherwise be the case under title I provisions.

Likewise, we find title II of the three respective bills objectionable at this time to the interests of the State of Washington, inasmuch as we are a downstream State within a basin whose waters have been consistently looked upon and prejudged as a source of import supply.

The State of Washington and its sister States in the Pacific Northwest have individually begun inventories and analyses of their existing water supplies, uses, and the projected needs through the year 2020 and beyond. In addition to this, the Congress has authorized a type I study involving an expenditure in excess of \$5 million in the Columbia-North Pacific comprehensive study program.

While this program was initiated under the direction of the Columbia Basin Interagency Committee, the new Pacific-Northwest Basins Commission has now been officially established by Presidential proclamation and will direct completion of this effort. We believe that the Basins Commission should be given the opportunity and the time to analyze the water resources and needs within the Columbia-North Pacific area and to formulate river basin plans for submission to the States involved, the Water Resources Council, the President, and the Congress.

It seems to us, therefore, highly premature to direct the Secretary of the Interior to investigate and prepare estimates of long-range water supply from areas adjacent to the Colorado system for importation purposes.

Again, I would stress the importance of passage of separate National Water Commission legislation. The independent judgment of

the members of that Commission, chosen on the basis of diverse backgrounds and broad professional experience, seems to us to be essential to an unbiased evaluation of the entire range of our Nation's water problems and policies.

We emphasize the importance of early passage of this legislation which would, in effect, make unnecessary the inclusion of titles I and II of the bills subject to this discussion.

Thank you very much.

Senator JACKSON. Thank you, Mr. Hamilton. Please express to the Governor the Chair's appreciation for a very fine statement that you have read for him this afternoon.

Senator FANNIN?

Senator FANNIN. No questions.

Senator JACKSON. Thank you very much. We appreciate having that.

The next witness is Mr. Laurence I. Moss. Mr. Moss, before you proceed, could you state, briefly, your background?

STATEMENT OF LAURENCE I. MOSS, NUCLEAR ENGINEER

Senator JACKSON. This is more or less of a semitechnical approach, and therefore I would like your qualifications.

Mr. Moss. Mr. Chairman and members of the committee, my name is Laurence Moss. I am a nuclear engineer employed by Atomics International, as an assistant project manager. I am testifying today, however, as a private citizen.

Senator JACKSON. Atomics International is affiliated with whom?

Mr. Moss. It is a division of North American Aviation.

Senator JACKSON. North American Aviation. And you are here speaking in your own personal capacity.

Mr. Moss. That is correct.

Senator JACKSON. All right, sir, you may proceed.

Mr. Moss. I appreciate the opportunity to appear before this committee to present testimony on the economics of the proposed Hualapai Dam, or perhaps I should say dams. I would like to ask that my statement be included in the record in full, and that I then be permitted to summarize it.

Senator JACKSON. Without objection your entire statement will appear in full. You may proceed to highlight your statement.

Mr. Moss. Thank you. The statement was made this morning, and it has been made many times in the past, that the energy in falling water should not be wasted, and therefore we should build Hualapai Dam to use a national resource. I submit that this is not how development decisions are made in the year 1967.

As the members of this committee know, the accepted way of determining if a project is economically justified is to examine alternative means of producing the same result. If the comparison is made with a reasonable consistent set of ground rules, and it is found that the project costs less than the lowest cost alternative, it is economically justified. If the project costs more, then it is not economically justified. It is assumed, of course, that there is a use for the product.

If a project that is not economically justified is built, then the result is a misallocation of real resources (capital, land, and labor). The

national income will be lower than if the project was not built (and the lowest-cost alternative built instead).

The comparison between the project and the alternative is usually done by performing a "benefit-cost study." The costs of producing the same result with the alternative are defined as the "benefits" of the project. This number is divided by the costs of the project to give the benefit-cost ratio. If the ratio is greater than 1 to 1 then the project is said to be economically justified.

This is a simplified, but essentially correct, description of how the analysis is performed. It must be emphasized, however, that if the benefit-cost ratio is to have any meaning, the lowest cost alternative must be selected for the comparison, and the ground rules must be reasonable and consistent.

The Bureau of Reclamation reported a benefit-cost ratio of 2 to 1 for their Hualapai Dam project. Unfortunately, in their analysis they violated each of the above essential conditions. When the conditions are met it is found that the Bureau's project is not economically justified.

A benefit-cost analysis has not yet been performed for the Hualapai Dam proposal of the Los Angeles Department of Water and Power (referred to herein as the Goss proposal), because of a lack of information on the details of the important features of the project. The LADWP has not yet presented any comparison between their project and low-cost alternatives. It will be shown that obvious alternatives exist which appear to be lower in cost than the Goss proposal. If further study shows this to be true, or if another lower cost alternative is found, then the Goss proposal is not economically justified.

Before covering these points more fully, a background discussion will be presented of why it was proposed that dams be built in the Grand Canyon, along with some general technical and economic discussion of alternatives to the dams. Reference will be made to H.R. 4671 by way of illustration of the main points. The statements regarding various provisions of H.R. 4671 are valid for the bills before this committee—such as S. 861, S. 1242, and S. 1409—to the extent that they have similar provisions.

IN SEARCH OF A SUBSIDY MACHINE: OR, WHY THE GRAND CANYON MUST BE DAMMED

In the American West of 1849 the preoccupation of the day was the search for gold. In the West of today, the search is for a very special kind of water. Although it looks the same, tastes the same, and feels the same as ordinary water, this water is different. It is subsidized water, the full cost of which need not be paid by the user of the water. And last year the search for subsidized water led a small group of men, the "water leaders" of the seven Colorado Basin States—with the help of the Bureau of Reclamation of the U.S. Department of the Interior—to the conclusion that the Grand Canyon must be dammed.

These architects of water policy and planning fashioned a document that became known, in the form in which it was submitted for the approval of Congress, as H.R. 4671. The various provisions of H.R. 4671 give a classic example of the lengths—some might say depths—to which the people who now formulate water policy are willing to go in their pursuit of subsidized water.

Why can't the people who use water pay the full cost of delivering it to them? More than 99 percent of the people can—and usually do. These are the users of water for municipal and industrial purposes. The users of water for agriculture, however, say that they cannot afford to pay the full cost, and in the Colorado Basin States they use more than 90 percent of all the water. If it is granted that subsidizing irrigation agriculture is of social value, it still remains necessary to scrutinize the efficiency of the methods.

HOW TO SUBSIDIZE WATER

The ways of subsidizing water are many. Four favorite methods are as follows:

(1) Charge municipal and industrial water users more than the cost of delivering water to them, and use the difference to help subsidize agricultural water users. In H.R. 4671 it was proposed that municipal and industrial water be sold for \$50 per acre-foot and agricultural water for \$10 per acre-foot.

(2) Get the Federal Government to pay for a portion of the project with funds that need not be repaid. In H.R. 4671, \$83 million of the costs were assigned to "recreation, fish, and wildlife" and were, therefore, nonreimbursable. Beyond that, H.R. 4671 set the stage for a multibillion dollar grant of nonreimbursable funds for a massive importation of water from—presumably—the Columbia River. This was done by having the Federal Government assume the obligation—previously an obligation of the Colorado Basin States—to deliver 1.5 million acre-feet of Colorado River water per year to Mexico. This would become a national obligation as soon as water began to be imported into the basin. H.R. 4671 also sought to establish the precedent that a State seeking to expand the capacity of an aqueduct need pay only the incremental costs of the expansion. The scenario is thus quite clear, though a bit expensive for the average U.S. taxpayer. At some future date it will be proposed that the Federal Government build an aqueduct to transport 2.5 million acre-feet of water per year from the Columbia River to the Colorado River to satisfy the national obligation—1.5 million acre-feet for Mexico plus 1 million acre-feet for losses from evaporation and seepage along the way gives 2.5 million acre-feet. This project would qualify for nonreimbursable funds. Representatives of the Colorado Basin States would then offer to pay the incremental costs (not the proportional costs) of an expansion of the facilities to handle another 6 million acre-feet per year of Columbia River water.

The net result is that the Colorado Basin States would get 80 percent of the delivered water and the Federal Government would pay most of the costs. These costs have been estimated to be about \$10 billion.

(3) Borrow what the Federal Government won't give you outright, at interest rates subsidized by the Federal Government. Money for the costs of facilities to supply irrigation water can be borrowed from the U.S. Treasury interest free. Money for the costs of other facilities—such as hydropower dams—can be borrowed at interest rates—3.2 percent—that are, at least at the present time, much less than the Treasury's cost of borrowing money—over 5 percent. This is because

the formula used to determine the interest rate does not average the costs to the Treasury of all money; it considers only long-term obligations. When interest rates are high the Treasury finances its operations with short-term obligations, and the costs of these borrowings never appear in the formula.

Finally we come to the method that has caused more controversy with respect to proposed legislation than any other feature.

(4) Build what I call a "subsidy machine." A subsidy machine is a physical object, that, to the casual observer, is capable of making money. Its actual role is to divert money from the U.S. Treasury to another bank account while giving the appearance that the money is being earned. Two subsidy machines were proposed in H.R. 4671. These were the two hydropower dams to be built in the Grand Canyon: Bridge Canyon Dam—now called Hualapai Dam—and Marble Canyon Dam. These dams would not provide anyone with water. They are intended to provide the basin account with money.

NUCLEAR POWER COSTS LESS THAN HYDRO POWER

Item (4) deserves further comment.

In the past, power from dams could be generated and delivered at lower cost than with steamplant alternatives. In most areas of the United States this no longer is the case. A historic reversal of the relative costs of hydro versus steamplant power has occurred. The prior commitment of many of the most desirable hydropower sites, the gradual increase in the costs of heavy construction, and the imminent large-scale introduction of low-cost nuclear power have accomplished this reversal.

In 1965 about 30 percent of all of the steamplant generating capacity ordered by utilities was for nuclear plants. In 1966 more than 50 percent was nuclear. And the pace is continuing: Orders placed in the first quarter of 1967 were about three times the capacity ordered in the same quarter of 1966.

The total generating capacity of the nuclear plants ordered in just the 2 years 1965–66 is about 15 times the combined capacity of both Hualapai and Marble Dams. The at-plant costs of power from most of these nuclear plants will range from about 3.5 to 4 mills per kilowatt-hour under conditions of financing by investor-owned utilities—which, primarily because they must pay taxes, have typical capital charge rates of 12 percent—to less than 2.4 mills per kilowatt-hour with financing by public agencies such as TVA—with typical capital charge rates of 6 percent. These costs are based on complete amortization of the plant in a 30- to 35-year period. Since the costs of nuclear plants are relatively independent of location, they can be better situated with respect to load centers, and transmission costs will be very much less than for hydropower dams.

PEAKING POWER

This committee has heard much testimony about peaking power and how peaking power is different.

As you know, "peaking power" is power generated during those hours of the week when the demand for electricity is high. It can be

supplied by either hydro or steamplants operated only during these high-demand hours.

Hydropower installations designed for peaking power operation cannot operate continuously over a long period of time, at least not at full capacity. The reason is that the water turbines are sized to use all the river's average annual flow when operating only about 20 to 45 percent of the time. Beyond that, there is no additional water to run through the turbines to generate power.

Because nuclear plants have no such limitation, they can provide savings not only during peak-demand hours but also during off-peak hours by displacing higher production cost coal-, oil-, and gas-fired steamplants. That is, since today's nuclear plants are being added to utility systems in which the predominant source of generating capacity consists of more expensive fossil-fuel units, it is preferable to operate the new nuclear plants continuously and relegate some of the older fossil-fuel plants to operation only during peaking power hours. The end result, in terms of system generation, is the same as if the new plants (either nuclear or hydro) were operated for peaking power alone and the operation of the fossil-fuel units was not changed, but the overall system production costs are very much less.

IS HYDROPOWER ESSENTIAL?

Proponents of hydropower projects, when their projects have been shown not to be economically justified, have a propensity to wax eloquent over the supposed unaccustomed virtues of hydropower as compared with the supposed sins of thermal generation. Their acceptance of hydropower, regardless of cost, has a quality bordering on that of mystical revelation.

These proponents are welcome to their illusions. The facts, however, are as expressed by Philip Sporn, chairman of the System Development Committee, American Electric Power Co., in remarks presented to the New York Society of Security Analysts on April 20, 1966. In commenting on the cause and remedy for the Northeast power blackout, Mr. Sporn said:

The first statement was made by a major utility executive. He said: "What it boils down to is this: Thermal units cannot respond quickly enough to sudden load demands, such as occurred on November 9th, to avoid a power failure. Nor can they be restarted as quickly as hydroelectric plants, should they shut down the power. This—as we found out the hard way on November 9th—is by no means satisfactory."

Now my answer to this, and its not an off-the-cuff answer, is that this is just not so. It is a complete misstatement of the facts. A well-designed thermal system, operated so that the spinning reserve is properly distributed in the generating units at all times, and that is adequately interconnected with its neighboring systems can—and by experience has proven so—be wholly reliable and capable of withstanding all manner of disturbances. It is not necessary to create uneconomic sources of hydro power in order to achieve a high degree of reliability.

This doesn't mean that hydro capacity cannot or should not be used, if it's economically sound. The two largest cities of the United States—everybody knows which they are—have for a period of 83 years in one case, and close to that in the other (I don't know when the other city really started its electric service, but it cannot have been more than a year or two after 1882) managed to give a high quality of service without any other generation in their system except thermal.

To condemn thermal generation after that sort of a record is to me unthinkable.

REVENUE FROM THE GRAND CANYON DAMS

In the specific case of the proposed \$750 million Grand Canyon dams, the delivered cost of power, according to figures presented by the Bureau of Reclamation, would be 5.5 mills per kilowatt-hour. The Bureau's cost estimates are several years old and do not include items of additional cost stated by the Bureau to be either necessary or desirable, such as cash payments to the Hualapai Indians (\$16 million), an after-bay dam below Marble Dam to even out the flows in the river through Grand Canyon National Park (\$34 million), and a second road to the Hualapai Reservoir site. The Bureau's calculations, based on a total initial cost of \$750 million, should therefore be regarded as optimistic.

The same must be said of the Bureau's revenue projections, since they are based on the sale of power for the first 100 years of operation at a price of 6.0 mills per kilowatt-hour. Accepting these figures for the moment, and calculating the net revenue from the difference between selling price and cost, gives a total of only \$3.5 million per year from both dams during the initial 50-year payout period. Parenthetically it should be noted that the initial cost of the interest subsidy for the dams, provided by the U.S. Treasury, would be five times as great—about \$17 million per year at current money-market rates. There is yet another hidden subsidy: The Bureau assigns zero value to water lost by evaporation (100,000 acre-feet per year) from the reservoirs behind the dams. If a value equal to the marginal cost (at least \$70 per acre-foot) of importing this amount of water into the Colorado River Basin is assigned, the subsidy amounts to an additional \$7 million per year.

The proponents of the projects say the proposed dams are necessary to provide a large accumulation of funds in a "basin account." This would be used to finance the long-distance importation of water into the Colorado River Basin. How is it possible to accumulate massive sums of money in the basin account (the Bureau calculates \$900 million at the end of the initial 50-year period) if the Grand Canyon dams can contribute only \$3.5 million per year, even on a subsidized basis? When you multiply \$3.5 million by 50 and you don't get \$900 million.

The trick is that surplus revenue from the existing Hoover, Parker, and Davis Dams (all located on the lower Colorado) are put into the basin account, starting at the ends of the payout periods for each of those dams. These funds are then used to rapidly reduce the interest-bearing investment in the new dams. The result is to greatly exaggerate the importance of the new dams and to disguise the vital role of the existing dams. Actually, the amount of the basin account at the end of the 50-year period without the new dams would not be appreciably different from the amount with the new dams.

There was testimony presented by Secretary Holum and Mr. Dorniny, at the hearings held in March of this year before the Reclamation Subcommittee of the House Interior Committee, which shows the truth of these remarks. They said that if the construction of Hualapai Dam was deferred for 10 years, then the basin account would have more money in it than if Hualapai Dam was built right away. In the year 2025, it would be \$34 million more; in the year 2047, \$190 million more. For a dam which has been billed as the best thing for making money since the invention of the printing press, that is a rather remarkable admission. It just shows that it is not Hualapai Dam which is really providing the muscle for the accumulation of funds.

As previously stated, all of these calculations are based on a market value for the power of 6.0 mills per kilowatt-hour. At anything less than 5.5 mills per kilowatt-hour the revenue from the dams could not even cover the costs (even with the massive interest subsidies). Over most of the lifetime of the dams, their power will be sold in a market dominated by low-cost nuclear power. Already, even before the large-scale transition to nuclear power has taken place, the Bureau has not been able to sell the power generated at the new Glen Canyon Dam (just upstream from Grand Canyon) for 6.0 mills per kilowatt-hour. What will happen in the future is always a matter of some speculation, but it seems fair to say that no prudent investor would make a long-term commitment the success of which depended on obtaining a price of 6.0 mills per kilowatt-hour for the next 100 years.

The more sophisticated among the proponents of the dams probably realize that they are not economically justified. But they know that if the dams are authorized and built it will always be possible to make sure that the basin account accumulates money. This would be done by passing legislation to assign a larger proportion of the investment in the dams to purposes which qualify for nonreimbursable and zero-interest funds. Elaborate rationalizations will no doubt be developed to justify the action. Most legislators, and certainly most members of the general public, will have little idea of the implications of the legislation. When it is passed, the finances of the dams, from the very beginning of the project, will be recalculated on the new basis. The effect will be to credit the basin account with an additional (and continuing) subsidy from the U.S. Treasury. Those who doubt the use of such mechanisms and the willingness of legislators to approve of them are encouraged to examine the legislative history of other Federal dam projects. And in some of the legislation that is now before this committee, we see an example of this: The upper basin is trying to get out of the financial difficulties they are in with Glen Canyon Dam, by passing a bill which will reimburse the upper basin for the payments that it has made in the past and those that it will be required to make in the future to compensate the lower basin for Hoover power dam production deficiencies.

Senator ANDERSON. Did you say something about the dam, the upper Colorado dam—

Mr. Moss. Excuse me, Senator?

Senator ANDERSON. Did you say something about a dam being in trouble financially?

Mr. Moss. Well, my understanding with respect to the upper basin is that—

Senator ANDERSON. Glen Canyon Dam?

Mr. Moss. Yes; \$700 million has been authorized for the upper basin projects. The estimated cost is now \$1.2 billion for all of these projects. In the specific case of Glen Canyon Dam, the power production has been much less than forecast at the time of authorization, and the amount of payments to the lower basin account to compensate for the deficiency in the production of power at Hoover Dam has been greater than originally estimated. I think that in some of the legislation now before the committee, we see an example of how there is an attempt made to go back and make up for the mistakes that have been made in the past.

PURPOSE OF GRAND CANYON DAMS

The true purpose of the Grand Canyon dams is to provide a respectable front for the siphoning of hundreds of millions—even billions—of dollars from the U.S. Treasury to the basin account. Because the dams are not economically justified the cost to the U.S. Treasury will be far greater than if direct subsidies were made. Moreover, the national income will be lower than it would be if the dams were not built (and lower cost alternatives built instead, as would happen in the normal course of events). But all of this counts for little to the proponents of the dams, who believe that it is easier to raid the Treasury for more money, if the raid is disguised, than it is to obtain a direct, openly stated subsidy of the same net amount to the basin account. And they, of course, need not pay the bill. That will be the role of the U.S. taxpayer, who will have no understanding of the choice that has been made for him.

INDICATIONS OF SHIFTS IN ATTITUDES

Recently, there have been some encouraging indications that shifts in attitudes are taking place. In a speech given in July 1966, John A. Carver, then Under Secretary of the Interior, as much as admitted that the traditional approach to the planning of water resource development was faulty. He stated that Congress and the public should be informed of the alternatives to hydropower as a means of financing water projects. He continued—

Present procedures do not provide an adequate comparison of such alternatives * * *. Classically, legislation, whether it be for a project or a government policy, has been presented by the executive branch to the legislative branch as an act of advocacy, the best possible case for a particular course of action or a single project. The process of identifying alternatives—indeed of discovering if any exist—is left to the arena of counter vailing powers in the political process.

In February 1967, Secretary of the Interior Stewart Udall announced that the administration was no longer supporting the proposed Grand Canyon dams, though he did leave the door open for later reconsideration of one of them (Hualapai Dam). The Secretary was asked by a reporter if this was a victory for the Sierra Club, the group that led the fight against the dams. Quite aptly he replied: "This isn't a victory for anyone. It is a victory for commonsense."

The victory has not yet been won. Powerful men still want one or both of the dams to be built, and they have not given up. Bills have been introduced in both the Senate and the House to authorize one or both dams.

THE NATIONAL WATER COMMISSION

Not without reason, the most fervent of the prodam people are the same ones who are forming the major opposition to another piece of proposed legislation. That is the authorization of a National Water Commission, free of domination by agencies with vested interests in particular kinds of development. The Commission, composed of eminent experts outside of Government, would conduct a 5-year study of national water problems and would propose solutions. Congressman Wayne Aspinall of Colorado gave his opinion of this on November 18, 1966, in a speech at the 35th Annual Convention of the National Reclamation Association in Albuquerque, N. Mex.:

I have been concerned with respect to some of the recent statements and reports originating with federal groups which are attempting to apply the scientific or theoretical approach to our national water problems. For instance, the Scientific Adviser to the President, Dr. Hornig, told the Senate committee that the proposed National Water Commission would provide an overview of our national effort in water by some of the best thinkers and most experienced experts in the field, and provide for an independent evaluation of pressing problems beyond any commitment to state, local, or regional interests. How can an independent evaluation, free of state, regional, or local interests resolve complicated water issues involving water rights, interstate compacts, long-standing agreements, et cetera? The recent report of the Committee on Water of the National Academy of Science, after discussing the changing objectives in the water field and the need for new policy, and after suggesting that perhaps the Reclamation program is outdated, concludes that a review of the Federal reclamation policy, in the light of present and future competing needs for water and agricultural products, is a critical requirement. You can imagine what might happen to water development in the West if the decisions were left to a group such as this.

THE BUREAU'S HUALAPAI DAM

As pointed out by Carlin,¹ the Bureau used the following unjustified benefit-cost practices in evaluating Hualapai Dam:

- (1) Choice of "most likely" rather than least cost alternatives.
- (2) Use of higher interest rates and taxes in evaluating alternatives.
- (3) Insistence on same transmission costs for alternatives at load centers.
- (4) Use of unrealistically low interest rate for dams.

When Carlin and Hoehn recalculated the benefit-cost ratio after eliminating the faulty evaluation procedures of items (1), (2), and (3), but still retaining the unrealistically low $3\frac{1}{8}$ -percent interest rate, they found the value to be 0.61 to 1. At the more realistic 5-percent interest rate the value of the ratio is 0.52 to 1.²

Clearly the Bureau's Hualapai Dam is not economically justified.

Senator ANDERSON. Where do you get these interest rates?

Mr. Moss. The $3\frac{1}{8}$ -percent interest rate is the interest rate used by the Bureau.

Senator ANDERSON. What does the Government pay for that?

Mr. Moss. Right now the Government is paying around 5 percent or slightly more than 5 percent for the money the Treasury borrows. The reason why such a low interest rate is used in the Bureau calculations is that the formula that the Treasury employs considers only bonds of 15 years or longer duration. When the interest rates exceed $4\frac{1}{4}$ percent, the Government is prohibited by law from issuing bonds of longer than 5 years' duration, so the higher interest rate obligations never get in the formula. That is why the $3\frac{1}{8}$ -percent rate is unrealistically low.

Senator ANDERSON. The cost of money is not 5 percent now. Long-term bonds are lower. Don't you have very short-term notes and long-term bonds and don't the longer term bonds reduce the interest cost?

Mr. Moss. There are bonds of all durations as you say, but in 1966 to my knowledge the Treasury did not issue any of the long-term

¹ Alan Carlin, in Hearings, Colorado River Basin project. Subcommittee on Irrigation and Reclamation, Committee on Interior and Insular Affairs, House, 90th Cong., Serial No. 90-5 (hereafter referred to as hearings), p. 609.

² Alan Carlin and William Hoehn, "The Grand Canyon Controversy—1967: Further Economic Comparisons of Nuclear Alternatives," hearings, p. 625 (also in this hearing record).

bonds because they couldn't have sold them in the money market for less than $4\frac{1}{4}$ percent. It would have been much higher than that, and by law they were prohibited from paying more interest on long-term bonds. The answer to your question, I think, is that even for long-term bonds the interest rates are much higher than the rate used by the Bureau.

Senator ANDERSON. I thought they used the interest rate because of the formula that the Congress of the United States wrote into it.

Mr. Moss. I think you are referring to U.S. Senate Document 97, which lays down the ground rules to be used for benefit-cost ratio studies.

Senator ANDERSON. There was an Oklahoma bill that came in here and the actual calculation of interest rate was fixed in that law and it has been used ever since, I think.

Senator ALLOTT. Mr. Chairman, I think that with no exception since the consideration of that Oklahoma bill, we have used the formula that was set up in that bill which is the average interest long-term rate for every reclamation project this committee has considered. I can recall no exception to it.

Senator ANDERSON. I think that is absolutely right.

Mr. Moss. I accept the Senator's statement, but I wish to reiterate that this does not represent the true cost of all borrowings of the Treasury, that is, the cost of money to the U.S. Government.

Senator ALLOTT. Let me call your attention to this fact. The interest rate on short-term borrowings is always higher, and the facts are that what we are considering here is the use of long-term money, and therefore the average cost of that money on long-term borrowings to the Federal Government is the standard that Congress has set up almost uniformly, at least as far as the Interior Committees of the House and Senate are concerned, and so we are talking about not what the interest cost may be on a particular type of borrowing but on a type of borrowing the standard for which Congress has set up, and which is the kind of borrowing which will be used in this bill. We are talking about 50-year money here.

Senator ANDERSON. In the first place there has been a recent drop in short-term bonds, below the rates we had not long ago. Senator Burdick introduced a bill offering the same formula again of $3\frac{1}{4}$ percent. The tax rate on U.S. Savings bonds is $4\frac{1}{4}$ but the Federal Government borrowing is as high as 5 percent or as low as 2 percent. There is no reason in the world why if the Hoover Dam was feasible we get 2 percent. When you get to $3\frac{1}{4}$ —

Senator JACKSON. On short-term notes I believe last year, when it reached an alltime high last October, my recollection is on short-term notes it was in excess of 5 percent.

Mr. Moss. Yes.

Senator ANDERSON. The Burdick bill is $3\frac{1}{4}$ percent. That is the average rate of interest. Do you have figures to dispute that?

Mr. Moss. What I am saying, Senator, is that when the average is computed in such a way that necessary borrowings made by the Treasury which must be short-term because of law, and represent a real cost to the Treasury higher than the cost of long-term bonds, when these costs are incurred but not included in determining the average, then

there is a substantial difficulty involved. If the U.S. Treasury pays \$750 million to the basin account—or whatever it is called at that time—to build these dams, it has \$750 million less to work with in its accounts, and if at the time it has to borrow money to make up for that disbursement it has to incur some short-term obligations, because of the current money market conditions, then that is a real cost which must be included.

May I go on to Mr. Goss' proposal for Hualapai Dam?

Senator ANDERSON. Yes, only I say to you that when you say that bonds are up against $4\frac{1}{4}$ percent, the average rate figured out the last time we borrowed was $3\frac{1}{8}$ percent. The Water Supply Act provides that. It isn't an arbitrary formula. It is a carefully planned and delineated cost for these bonds.

I am sure it is $3\frac{1}{8}$ percent.

Senator JACKSON. Isn't the real question here, which I think one needs to get the answer to, is that, in determining the average, do we include the short-term obligations, the notes, so to speak? It is in this area, as Senator Allott pointed out, those notes go for a higher rate of interest, because they are tied to the cyclical money market as it exists at that time.

Now is that included? You say that it is not being included.

Mr. Moss. Yes.

Senator JACKSON. Isn't that your contention?

Mr. Moss. Yes, I say it is not being included.

Senator JACKSON. In determining the averages.

Mr. Moss. Yes, and I say that this unfairly biases the average.

Senator JACKSON. I don't know what the answer is.

Senator ALLOTT. Mr. Chairman, I think the answer is very simple. We are not talking about short-term notes or even short-term bonds. We are talking about long-term obligations, and this is what the Government proposes. Therefore, the Congress has applied the formula as the chairman suggested to these bills, and I don't know of anyone who has objected that it is unfair to the borrower.

Mr. Moss. If I might state this another way, Senator: If \$750 million is taken out of the general fund of the Treasury to finance these dams, it will be taken out of the Treasury, because the Treasury doesn't float special bonds for special projects. It doesn't say that we need a 50-year bond for this dam project, it just issues the money from the general fund. That money has got to come into the Treasury in some way, through tax collections, through notes, or through bonds.

Now if as in 1966 the only way to get that money coming into the Treasury—above the amount of tax collections—is to issue short-term notes at high interest rates, and if you have got to sell \$750 million more of those notes because of the projects that you have authorized, then that represents a true interest cost which should be assessed to that project and should be included in the average.

Senator ALLOTT. We are not talking about 1966. We did have a very precarious state of affairs there for a little while. As a matter of fact, on participation certificates the interest went up to 5.92, to be exact.

Mr. Moss. Yes.

Senator ALLOTT. But we are talking about long-term borrowings. The Government isn't going to borrow the money that they have to take out of the Treasury on this, and raise it by 90-day notes.

Mr. Moss. They will get it in whatever way they can. If they are prohibited by law from issuing bonds of higher than—

Senator ALLOTT. I would like to hear the testimony of somebody who is interested and skilled. I don't want to denigrate your own ability but I would like to hear the testimony of somebody who is skilled in economics and finance testify about this rather than here. I think the formula we have set up is a very fair one and I don't think it is contrary to the interests of the Government.

Senator JACKSON. Mr. Chairman, I suggest that at this point in the record we get a statement from the Treasury, indicating whether or not short-term obligations, notes as they are referred to, and participation certificates, are included in determining the overall interest average. I think that can be obtained. Either they are included or they are not. They are borrowings. It is interest that is paid by the Government, and therefore I think we ought to find out whether it is really in the formula. That is the question. Now what is your understanding as to the maximum interest rate permitted on long-term government obligations?

Mr. Moss. It is $4\frac{1}{4}$ percent for obligations of 5 years or greater duration.

Senator JACKSON. Yes; that is my understanding.

Senator FANNIN. Mr. Chairman.

Senator JACKSON. That is why they have to go in on these short-term borrowings, and did in the peak of the money market, and that is what drove it up, because you had these obligations coming due and you couldn't market them at $4\frac{1}{4}$ percent on long-term obligations, so they went in and borrowed over that time after time after time by utilizing the principle of short-term notes.

Mr. Moss. That is correct.

Senator JACKSON. That is my impression. I may be wrong, but I would almost stand on that one.

Senator ANDERSON. I think that may be right. I only want to point out that in the past the Government borrowed billions of dollars at less than 1 percent interest on short-term notes. They were very short-term notes. We are in a different cycle and for awhile the bonds were at 5 percent. The Secretary of the Treasury boasted about his—

Senator FANNIN. Mr. Chairman, this is what I wanted to bring out. This money would not be borrowed at one time. It wouldn't be \$750 million involved at one time. It would be over a period of years and some of it may not be borrowed for 8 or 10 years.

Mr. Moss. Yes, I realize that, Senator, and I want to clarify what I have said. I didn't mean to imply that we ought to use the interest rate that existed in 1966 just because it happened to be high. I am saying we ought to use a long-term average but with the cost of short-term financing included whenever the Treasury is forced to use this method to finance projects that would normally be financed with long-term bonds.

Senator ANDERSON. The Colorado River project was at a $3\frac{1}{8}$ -percent bond and there are a good many others at that figure. The rate changes, of course, for the same bonds for irrigation projects or bonds for automobile companies and telephone companies. They had to pay a higher rate of interest for short periods of time when money was very, very scarce.

I think we had a very careful study of this act, and it was written into the law round after round after round.

Mr. Moss. I think the question of whether the costs of all money to the Treasury should be included in the formula is worthy of the attention of the committee.

Senator ANDERSON. At one time we were borrowing because the rate was so low, less than 1 percent. For years and years we kept trying to calculate that and the Treasury said no, no, that is short term. It has to be higher than 3 percent. The REA, that still borrows money at 2 percent, the rate was very satisfactory in raising money on a short-term loan. Sometimes it was lower than that: 3.22 is the average right now on these long-term and short-term bonds.

Senator JACKSON. We have been informed that they do not include the short-term notes in computing the average, so that is the answer.

Mr. Moss. Yes.

Senator JACKSON. Your point is they should.

Mr. Moss. Yes; that is my point. They should, because the Treasury gets part of their funds that way, and you can't separate the funds in the Treasury one from the other in calculating the average cost of money.

If I might go on now.

THE GOSS PROPOSAL

The Los Angeles Department of Water and Power has proposed that the maximum generating capacity of Hualapai Dam be increased from 1,500 megawatts to about 5,000 megawatts by adding a pumped storage capability to the installation.

Pumped storage is a way of converting off-peak energy generated at steamplants to more valuable peaking energy. During off-peak hours, water is pumped from a lower reservoir to an upper reservoir. It is thus available, during on-peak hours, to flow back through the turbines to generate more energy.

In May 1966, I testified before the Reclamation Subcommittee of the House Interior Committee to the effect that pumped storage facilities could be used to satisfy the same peaking power requirements for which the Grand Canyon dams were designed, and that the cost of conversion of off-peak energy to peaking energy in such facilities would set an upper limit to the difference in value between the two kinds of energy.

The contribution of the LADWP to this discussion is to imply, by advocating immediate authorization of the Goss proposal, that of all possible locations for a pumped storage facility, Hualapai Dam is the lowest in cost. They have presented no cost comparison to document this conclusion.

COSTS OF THE GOSS PROPOSAL

The LADWP estimates that the cost of the Goss proposal will be \$728 million, excluding transmission. The Bureau of Reclamation has made their own estimate of the plan; they regard \$793 million as a somewhat better estimate.³

³ Letter, Stewart L. Udall, Secretary of the Interior, to the Honorable Wayne N. Aspinall, chairman, House Interior Committee, Apr. 29, 1967—in this hearing record.

Goss discusses the possibility of utilities sharing in the cost of the project by means of prepayment arrangements; this consideration is important in deciding how much money must be appropriated by the Federal Government but it has no bearing on a benefit-cost analysis. All project costs must be included regardless of who pays the bill.

Goss calculates that if the streamflow energy can be sold at the price estimated by the Bureau of Reclamation, then the cost of capacity at the bus bar—that is, at the dam—will be \$3.60 per kilowatt-year.⁴

As Mr. Goss testified, the Bureau of Reclamation estimated that the costs of transmission from the bus bar to the load centers would be about \$6 per kilowatt-year.⁵

Adding this amount to the above \$3.60 per kilowatt-year gives a total of \$9.60 per kilowatt-year for the cost of capacity at the load centers. For all practical purposes this is identical to the cost estimated for the Bureau's Hualapai Dam.

The only apparent cost difference between the Bureau's proposal and the Goss proposal is that the LADWP seems to believe that municipal- and investor-owned utilities can build and operate transmission lines at a far lower cost than can the Federal Government.

For the special case of the LADWP, this contention may have some merit, but only for a limited increase in transmission capacity. This is because a relatively low-cost modification to the existing transmission lines between the Mead substation (near Hoover Dam) and Los Angeles, will result in a tripling of their capacity.⁶

Mr. Goss has not yet presented evidence, however, that it is proper to assign this low marginal cost to his proposed project, by the time the project has been constructed (1967), this transmission capacity may have been committed to serve other generating units.

Mr. Goss also contends that increasing the capacity of transmission lines now being designed will greatly reduce costs. This is problematical, since for the voltages being proposed—50 kilovolts—it is not practical to string multiple circuits on a single set of towers. No doubt some economies can be made, but Mr. Goss has yet to present evidence that they are large.

OTHER PROBLEMS WITH THE GOSS PROPOSAL

In common with the Bureau plan, the Goss proposal would result in the evaporation of 85,000 acre-feet per year of water from Hualapai Reservoir. Additional water would be evaporated from the afterbay reservoir. If this water is valued at the marginal cost of importing an equivalent amount, it adds at least \$6 million per year or \$1.2 per kilowatt-year to the stated costs.

The rise and fall in water level in the afterbay of 140 feet will have, among other problems, a significant effect on the power generation capacity of the facility. At the end of a generation cycle the difference in height between the surfaces of the reservoirs will be only 566 feet, 20 percent less than the maximum of 706 feet. The capacity will be reduced, at this time, by about 1,000 megawatts. In effect, this adds to the

⁴ Floyd L. Goss, "General Description—Proposed Hualapai Power Project," hearings, op. cit., p. 599.

⁵ Hearings, op. cit., p. 587.

⁶ Goss, hearings, op. cit., p. 578.

cost of the project because turbines are often operating well below maximum rated capacity. It is not clear whether this has been properly considered in the Goss proposal.

There are also political problems with the Goss proposal. Investor-owned utilities in the Southwest know that if the role of the Federal Government in the area is limited to the construction and operation of conventional hydro installations, it will be a physical impossibility for the Federal Government to maintain their share of generating capacity in a rapidly expanding system.

There is, at present, an uneasy peace: Investor-owned utilities do not oppose Federal hydro projects, and the Department of the Interior provides needed cooling water, transmission line rights-of-way, and access to coal deposits on Indian lands. A Federal move into pumped storage, which is not physically limited by riverflow, might cause considerable controversy. It would appear to be significant that not a single investor-owned utility has yet joined the LADWP in advocating the Goss proposal.

POSSIBLE LOWER COST ALTERNATIVES TO THE GOSS PROPOSAL

One alternative to the Goss proposal would be several smaller pumped storage facilities located near the major load centers, to save on transmission cost. Such a plan would also offer significant advantages because in system stability because of the more even distribution of generation and loads.

The pumped storage facilities recently completed and now being built in many locations across the country range in cost from a bit less than \$80 per kilowatt to as much as \$125 per kilowatt installed capacity, exclusive of transmission. Using the same capital charge rate as for Hualapai Dam and applying it to a typical cost of \$100 per kilowatt results in an annual capacity charge—at the bus bar—of \$4 per kilowatt-year. Transmission costs should add no more than the delivered cost of the Goss proposal.

There is a second alternative that bears investigation: Add pumped storage capability to Hoover Dam. All of the advantages claimed for the Goss proposal would apply equally as well to Hoover, and many of the disadvantages would be absent. The cost of Hualapai Dam and Reservoir, and Hualapai afterbay, a total of \$254 million, would be saved. The investment in transmission facilities from Hualapai Dam to Mead substation would be saved.

The existing Lake Mohave, properly regulated, could probably serve as the afterbay for Hoover Dam. The initial modification might consist simply of adding penstocks, underground powerhouses containing reversible pump turbines, and tailrace facilities to the two existing diversion tunnels now used only for possible spills. Later expansions could add more diversion tunnels as well.

No additional evaporation of water will take place, because no new reservoir need be built. The fluctuations in reservoir levels should be minor, since Lake Mohave, and particularly Lake Mead, have large surface areas.

Contrary to testimony presented by Mr. Goss,⁷ there would be no need to throw away the present investment in Hoover generating

⁷ Hearings, *op. cit.*, p. 582.

machinery. Not all of the generating units at a combination conventional plus pumped storage installation need consist of reversible pump turbines. Note, for example, that in at least one version of the Goss proposal,⁸ fully half of the generating units are not reversible.

There is every indication that a modification of Hoover Dam would provide a lower cost alternative as compared with the Goss proposal.

CONCLUSIONS

The Bureau of Reclamation's Hualapai Dam has a benefit-cost ratio of substantially less than 1 to 1; it is not economically justified.

The Goss proposal's Hualapai Dam makes additional capacity available at about the same cost as the Bureau's dam. The LADWP has not presented sufficient data for a careful study of the project and possible alternatives to be made. Nevertheless, there appear to be at least two alternatives—smaller pumped storage installations near the load centers, and a modification to Hoover Dam to provide pumped storage—lower in cost. There is every indication that the Goss proposal is not economically justified.

Mr. Chairman, the choice to be made is not between the continued growth of the Southwest and an unspoiled Grand Canyon. The real choice is: Shall we continue a reclamation program which has become outmoded by advancements in technology, or shall we replace it with rational planning as a way of solving our national water problems?

Thank you.

Senator ANDERSON. You have made quite a study on this. What is your employment?

Mr. Moss. I am employed by Atomics International, Mr. Chairman.

Senator ANDERSON. Fred de Hoffman's company?

Mr. Moss. No; that is General Atomic.

Senator ANDERSON. Chauncey Starr's?

Mr. Moss. Yes; though just recently Dr. Starr left to take the position of dean of engineering at UCLA.

Senator ANDERSON. Are they building some nuclear plants now?

Mr. Moss. We are not now building any central station nuclear plants, although we have hopes for the future.

Senator ANDERSON. Didn't they start some plant? What is the Nebraska plant?

Mr. Moss. The Nebraska plant was a sodium-graphite nuclear reactor powerplant. It had problems, as you know, involving leakage of sodium into the graphite, which resulted in a decision to shut down the plant.

Senator ANDERSON. What I am trying to say is, Don't the nuclear people have trouble once in awhile, too?

Mr. Moss. Oh, yes, there is no question that everyone engaged in advancing technology, bringing in a new technology, has problems, I remember the statement made by one eminent scientist and engineer back just after World War II when he was trying to get the new Atomic Energy Commission to fund the development of nuclear powerplants. He said that what this country needed more than anything else was to build a nuclear plant which didn't work, so we could learn why it didn't work.

⁸ *Ibid.*, p. 594.

Senator ANDERSON. We have a few of those haven't we?

Mr. Moss. We have had a few of those. We hope we have learned from those experiences. We also have the experience of the highly successful operation of other nuclear plants. Certainly, the recent ability of the nuclear industry to sell many plants to utilities within the last 2 or 3 years, considering that utilities are demanding customers when it comes to reliability, indicates that some successes have been achieved.

Senator ANDERSON. Has Atomics International sent you here to testify?

Mr. Moss. No. I am testifying as a private citizen, as I indicated at the beginning of my statement.

Senator ANDERSON. Senator Kuchel.

Senator KUCHEL. Mr. Moss, in your capacity as a private citizen, can you tell the members of this committee whether any of the bills now pending before it dealing with the general subject of the Colorado River development, do you favor any of the bills?

Mr. Moss. I have no objections to the administration bill, which would obtain power for pumping from the prepayment plan described by the Secretary.

Senator KUCHEL. As an interested citizen, do you favor the construction of the central Arizona project?

Mr. Moss. I have not objection to the construction of the central Arizona project.

Senator KUCHEL. But do you favor it?

Mr. Moss. I have not personally made a detailed enough study to come to that decision. I know that work has been done at the University of Arizona, which would indicate that even for Arizonans, there is a question of whether the central Arizona project is the best thing to do at this time, but I have not come to any conclusion myself.

Senator KUCHEL. You make no recommendations to this committee pro or con on that point.

Mr. Moss. Except that I have no objections to construction of the central Arizona project.

Senator KUCHEL. Mr. Moss, this is presumably the last day of this hearing. Have you been here in the committee room earlier this week and have you listened to any of the testimony?

Mr. Moss. Yes; I have listened to a good share of it.

Senator KUCHEL. You have heard many of the witnesses discuss what apparently is a controversial item, the contention by representatives of your State that "first in size, first in rank" should be respected and a minimum amount of \$4,400,000 acre-feet of Colorado River water should be protected so far as California is concerned.

Mr. Moss. Yes.

Senator KUCHEL. Do you have an opinion on that to give the committee, up or down?

Mr. Moss. No; I have no opinion on the legal and moral obligations involved in that controversy. The main point that I attempt to make here is that the way to augment the supply of water in the Colorado River, if that is the decision, is not to build dams in the Grand Canyon, since they are not economically justified. They would require subsidies of their own. More money would be required from the U.S. Treasury with the dams than without the dams.

Senator KUCHEL. Do you have any opinion to offer this committee on whether or not the waters in the Colorado River should be augmented by any other source?

Mr. Moss. I have no opinion on that.

Senator KUCHEL. If it were the conclusion of the committee that the waters of the Colorado River need to be augmented, would you have any recommendation to the committee as to what the best way of augmentation might be?

Mr. Moss. No, Senator. I have not studied that problem carefully enough to know. I do advocate the establishment of a National Water Commission, which I think being composed of eminent experts outside of Government would be in a position to make the kind of study that could come to rational answers to your question.

Senator KUCHEL. Your objection here, which you urge the committee to consider, is to any consideration for the construction of a dam at Hualapai.

Mr. Moss. Yes. It is not economically justified.

Senator KUCHEL. And the grounds for your objection are those of economic feasibility or lack of it?

Mr. Moss. Lack of economic justifiability.

Senator KUCHEL. Lack of economic justifiability. The problem of preservation of the beauty of the Grand Canyon as expressed by our able friends here from the Sierra Club do not play a role in your conclusions.

Mr. Moss. Senator, I don't go around testifying before congressional or senatorial committees on every Government project that I might think is not economically justified. There are limits to any individual's time, although I am sure that most Government projects are economically justified.

I have a particular interest in this controversy because I do have convictions regarding the need to preserve the Grand Canyon in its natural state, but I have attempted to make these studies without allowing those convictions to influence the technical conclusions reached.

Senator KUCHEL. I am going to ask the chairman of the committee, I am going to ask consent that the chairman of the committee make Mr. Moss' testimony available to the Bureau of Reclamation, and to Mr. Goss of the Los Angeles Water and Power, and give each an opportunity to rebut or attempt to rebut any of the positions which Mr. Moss has taken here today. I think that is both in the interest of fairness and in the interest of making this record complete.

Senator ANDERSON. That will be done. We will hold the record open until they do comment on it.

(The information requested appears on page 656.)

Mr. Moss. May I ask that I be allowed to receive copies of their comments and then be allowed to insert my comments into the record?

Senator KUCHEL. That is sure rebuttal.

Mr. Moss. Yes.

Senator KUCHEL. Well, I don't know. Anyway, I ask consent that the staff send you, Mr. Moss, the copies of the comments, and that the committee receive such sure rebuttal, is that the way it goes, or rejoinder.

Mr. Moss. The reason I make the request is that that is the way it was done in the House committee and I, at least, was pleased with the result.

Senator JACKSON. You would like a similar result here.

Mr. Moss. Yes.

Senator JACKSON. That is a reasonable request.

Senator KUCHEL. Mr. Moss, with what firm in California are you connected?

Mr. Moss. Atomics International.

Senator KUCHEL. Atomics International. What is their business?

Mr. Moss. Their business is the design and development of nuclear reactors, mainly for generating electricity.

Senator KUCHEL. Thank you. No further questions.

Senator ANDERSON. Let me just ask you one question here again. When you make these comments and show how the short-term bonds at high cost were included, the 1960 short-term bonds were 4.01, and the long term 2.87. Why did the 2.87 hurt the situation?

Mr. Moss. Sometimes, Senator, they will be less, sometimes they will be more.

Senator ANDERSON. You picked out the year 1966, which was completely abnormal.

Mr. Moss. No; I am not saying we ought to use the year 1966. I am saying we ought to go into the records of the Treasury and see what is the average cost of money to the Treasury including both kinds of borrowings.

Senator ANDERSON. The Members of the U.S. Senate and the House went carefully into that and adopted this into law. In 1963 the long terms were 4 and the short terms were 3.16. It is a very rare occasion when these short-term bonds have been more expensive, and the complete reversal of this is usually true.

The Treasury helped to keep the short-term bonds out of the area because they were so cheap that it upset the market, upset the averages. I do think you will have a hard time establishing your case that the short-term bonds are at a high price in averaging the cost.

Senator JACKSON.

Senator JACKSON. A very good statement. I enjoyed your comments.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. I would like to ask you a couple of questions. I think you described yourself as a nuclear scientist.

Mr. Moss. A nuclear engineer.

Senator ALLOTT. A nuclear what?

Mr. Moss. A nuclear engineer.

Senator ALLOTT. Nuclear engineer?

Mr. Moss. Yes.

Senator ALLOTT. Would you state your professional background?

Mr. Moss. I studied at Massachusetts Institute of Technology, received a bachelor—

Senator ALLOTT. Did you know Mr. Ingram there? I think he said he went there, too.

Mr. Moss. I did not know Mr. Ingram while we were at MIT. Mr. Ingram studied mathematics. As an undergraduate I studied chemical engineering and then as a graduate student nuclear engineering. I received bachelor's and master's degrees from that institution.

I have been employed at Atomics International since 1959 in various positions involving the design and development of nuclear power reactors, and presently I am an assistant project manager.

Senator ALLOTT. On page 8 of Mr. Goss' statement he said:

Statements have been made that steam peaking units and even nuclear heating units are even economically more attractive than peaking power from Hualapai.

Then here is the part:

So far as we know, no manufacturer has offered to either design or to build nuclear peaking units.

Have you made any such offer to the city of Los Angeles, to their water and power department?

Mr. Moss. As I went into in my testimony, Senator, if nuclear plants are added to——

Senator ALLOTT. Wait a minute, you can answer that question yes or no. Have you or have you not?

Mr. Moss. No. I would like to explain why, though.

Senator ALLOTT. That is all right, just answer the question though. You may explain.

Mr. Moss. The answer is "No," because the new nuclear plants being sold today have lower production costs than the existing fossil-fuel plants on the system of the typical utility, thus it is in the utility's interest to baseload the nuclear plant, and during the off-peak hours of the day shut down the higher cost coal or oil-burning plants. That way they get the same system peaking power, but at a lower overall cost of generation.

Senator ALLOTT. You are not trying to tell this committee that you can bring thermal plants on and off the line for peaking power on an economical basis, are you?

Mr. Moss. In the history of the utility industry of this country, peaking power has been supplied in the great majority of cases by just the process I have described here.

Senator ALLOTT. That is correct, but you are not trying to tell us that it is an economical basis of doing it; are you?

Mr. Moss. Yes; I saying the utilities have chosen this means because they have decided it is more economical for them to do it that way. You bring in the efficient new plants and operate them all the time and shut down your older plants during the off-peak hours of the day. They have preferred this to making investments in equipment which would be designed specifically to supply the peaking-power need and nothing else. So you have got to compare the two ways of doing it to come to a conclusion.

Senator ALLOTT. This is entirely true, but you couldn't claim that this is an economical method of doing it.

Mr. Moss. Yes; I make that claim.

Senator ALLOTT. I don't think you could bring a man into this room from any electrical industry in the country who would tell you that it is an economical way of doing it. It is because it was the only choice that most of them had in doing it.

Mr. Moss. If I may give an example of another choice they have had: On the market now there are stripped-down, coal-burning units of rather low efficiency designed specifically for peaking power, and they sell at about \$60 or \$65 per installed kilowatt. They are really very

cheap. Gas turbines designed specifically for peaking power sell for about \$80 per installed kilowatt.

Yet the bulk of the peaking-power capacity of the utilities in areas which must rely upon thermal power is not achieved by buying these units, even though they are so cheap, because they have found it more economical to do it the other way with their old units.

Senator ALLOTT. They use their advanced and larger units to produce their power, and use their older units for peaking power.

Mr. Moss. Yes.

Senator ALLOTT. This is correct?

Mr. Moss. Yes.

Senator ALLOTT. But it is not an economical way and I don't think you can get anybody to tell you that any man in the electrical industry, and I have talked with hundreds of engineers in my lifetime, to tell you this is an economic way of doing it.

It may be the most economic way that an individual unit can do it, but on an overall basis I don't think you will get anybody to tell you this is an economical way of doing it.

Mr. Moss. I believe that economics is motivating their decision.

Senator ALLOTT. The economics of the particular situation, yes. If they had their "druthers" they wouldn't take it.

I am reminded here, and it is apropos to this, the Public Service Co. of Colorado, which is an investor-owned utility, to cover exactly this situation has just built—I am not sure whether it is actually in operation at the moment yet or not—the so-called Cabin Creek Pump Back Storage System. This would indicate at least that one company didn't think that the use of thermal generation for peaking purposes is the most feasible or the most economical.

Mr. Moss. Senator, I didn't mean to imply that the use of thermal generation was always the best way to do it. But in order to come to a decision it is necessary to compare the project with the various alternatives. In my testimony I did describe two alternatives to Hualapai Dam; they would be designed specifically for producing peaking power.

One of those alternatives is quite comparable to the installation you have just described, the Cabin Creek installation 85 miles from Denver, which is being put in at a cost of about \$80 per installed kilowatt. With that kind of cost for an alternative pump storage installation, a proposal of the kind that Mr. Goss describes, costing \$146 per installed kilowatt, located about 350 miles from the major load center of the Southwest, and which would incur high transmission costs, probably is not economically justified.

Senator ALLOTT. Let me ask you this. You said you were a chemical engineer, had your master's degree in chemical engineering.

Mr. Moss. My bachelor's degree is in chemical engineering, my master's degree is in nuclear engineering.

Senator ALLOTT. Have you ever in the course of your studies studied hydrology, meteorology, civil engineering?

Mr. Moss. I have not made such studies in any formal manner as part of an educational curriculum.

Senator ALLOTT. You say that you appear here upon your own.

Mr. Moss. Yes.

Senator ALLOTT. And this of course then raises the presumption that you do not represent your company here.

Mr. Moss. That is right. I am on vacation this week.

Senator ALLOTT. Paid vacation.

Mr. Moss. Yes; paid vacation. I get 2 weeks of vacation a year.

Senator ALLOTT. And were you on vacation when you testified before the House committee?

Mr. Moss. No. I was on a leave of absence for that week.

Senator ALLOTT. Paid leave.

Mr. Moss. That was paid leave; yes.

Senator ALLOTT. Did you talk with anybody about your statement prior to the time of coming here?

Mr. Moss. I neither tried to receive nor did I receive any clearance from executives in my company with reference to my statement, if that is what you are asking, Senator, because I believe that when one indicates clearly that he is speaking in his capacity as a private citizen, that this should be quite divorced from his formal business responsibilities.

Senator ALLOTT. We are perfectly willing to divorce your company from you for the purposes of this hearing, but I think we also have a right to inquire into the background of your testimony here. Did you discuss this with any members of the Sierra Club?

Mr. Moss. I showed copies of my testimony to members of the Sierra Club earlier this morning for the first time.

Senator ALLOTT. Did you discuss it with any members of the Sierra Club before you decided or made up a tentative decision to appear here?

Mr. Moss. Yes.

Senator ALLOTT. Thank you.

Senator JACKSON. I must say that personally I don't know what relevance that has.

Senator ALLOTT. It has a lot of relevance and I am sure that the chairman recognizes it as well as anybody else.

Senator JACKSON. I think this is a free country. He has testified he is here on his own.

Senator ALLOTT. That is absolutely right. He has a right to testify.

Senator JACKSON. But I haven't gone around and asked whether some of these people have talked to utility executives or others.

Senator ALLOTT. I am just trying to ascertain what impelled him to come here and I think we have the answer now.

Senator JACKSON. Mr. Moss, you belong to the Sierra Club don't you?

Mr. Moss. Yes, I am a member of the Sierra Club and make no secret of it.

Senator JACKSON. You are personally concerned about this.

Mr. Moss. Yes.

Senator JACKSON. No one is subsidizing you in this effort?

Mr. Moss. I receive no income for this effort.

Senator JACKSON. You are not being paid?

Mr. Moss. No.

Senator ALLOTT. You are paying your own way here?

Mr. Moss. I used my credit card, my personal credit card. I know that if I ask the Sierra Club to pay for my travel expenses, they would pay it. I have not yet decided whether to ask.

Senator ALLOTT. Thank you.

Senator ANDERSON. Senator Fannin.

Senator FANNIN. May I ask you if you were repaid when you testified in the House.

Mr. Moss. If my expenses were paid?

Senator FANNIN. Yes.

Mr. Moss. My travel expenses were paid in 1967. In 1966 I obtained my own airline ticket, but then I found out later that one had been obtained for me, so I accepted the ticket obtained by the Sierra Club and gave them a \$300 donation to help cover that cost.

Senator FANNIN. Thank you for clarifying that.

Senator JACKSON. Mr. Chairman, I ask that each and every witness who has testified here be requested to state who paid their expenses. We have never gone into these things before. I make that request. I think it is a reasonable one, that they be called upon to state who paid their way to and from. I think that is a reasonable request.

Senator ALLOTT. Mr. Chairman, I have no objections to this, but I want to make the record clear. This young man has come here, and I don't question his belief in what he has said. He is very obviously unqualified to make such broad sweeping conclusions about matters which affect such a great area of the country, just in terms of his experience, his education, as he has made.

I felt from his very examination here and his testimony that he was not impelled just by the statement that he made and that he had other reasons. I inquired about these things. I think they are wholly pertinent.

I hope one of these days we will have an opportunity to inquire about the Sierra Club and its lobbying activities which have become so great in this country.

Senator JACKSON. I think his qualifications are a matter for each member of the committee to decide.

Senator ALLOTT. That is right, and I am simply stating my opinion.

Senator JACKSON. I suggest that each witness who has testified here now be asked to submit to the committee who paid his transportation and costs. I think that is a reasonable request—each and every one of them. I think we ought to be fair. I don't think any one person ought to be singled out.

Senator ANDERSON. We will.

Do you have more questions, Senator Fannin?

Senator FANNIN. Yes, I do, Mr. Chairman. I will just ask Mr. Moss, who speaks for your company, Atomics International? Do you speak for them?

Mr. Moss. I don't speak for them today.

Senator FANNIN. Does your president speak for them? In other words, who would speak for your company, Atomics International, not the individual but the person in what capacity? Who would be the top persons speaking for them? Who would be the one that if you wanted a decision made would be the person of greatest authority?

Mr. Moss. The president or the chairman of the board I suppose. But decisions in large corporations are made at many levels, and depending upon the magnitude of the decision, by any number of people.

Senator FANNIN. But if you made a statement, would it be the responsibility of Atomics International?

Mr. Moss. Not any statement made on this subject before this committee; no.

Senator FANNIN. Do you write articles for magazines or for periodicals?

Mr. Moss. Some of my writings have appeared in periodicals; yes.

Senator FANNIN. Is *Atomics International* responsible for those or do they stand behind those articles?

Mr. Moss. They stand behind the technical articles that I write, which are specifically related to my job and the purposes of the company, but they don't get involved at all in articles which are on different subjects which are not related to those purposes.

Senator FANNIN. Do you recall a statement that you made regarding an article that you said, a study as you referred to it, that illustrated that the central Arizona project was not needed? You referred to that in your testimony.

Mr. Moss. Yes; I referred to work being done on research projects at the University of Arizona by some of the faculty there.

Senator FANNIN. Individually. I have letters that have been entered into the record showing the president of the university and the people in top authority are very much in favor of the central Arizona project and realize a great need for the project. Aren't they the ones who should speak for the university?

Mr. Moss. They may be speaking for the university, Senator, but that fact in itself doesn't establish anything of terrible significance about what is said.

Senator FANNIN. The thing about it is you are not speaking for *Atomics International*.

Mr. Moss. That is correct.

Senator FANNIN. So why should you refer to them and then say that a study has been made and then give the conclusions that you have prophesied?

Mr. Moss. If I implied that the study was endorsed and approved by the University of Arizona, then I am sorry. I didn't mean to imply that. I just meant to indicate that at the University of Arizona there were some people doing studies.

Senator FANNIN. Individuals.

Mr. Moss. Yes.

Senator FANNIN. Just the same as at *Atomics International* there are some people like you who are doing other work that is not connected with *Atomics International*; is that right?

Mr. Moss. I don't know whether the parallel is an exact one, because the individuals at the University of Arizona are doing this work as part of their research, which is one of their functions in being on the faculty of the university.

Senator FANNIN. That isn't necessarily true. That isn't always true, you know that, because you could be doing some of this work that could be connected with your company. In this case you say you are not. But then you could be. So I wouldn't say that that conclusion is proper.

Mr. Moss. The people at the University of Arizona are working on a \$200,000 study, and I haven't received even \$1 from my company for my work.

Senator FANNIN. But you have not seen that study.

Mr. Moss. I have seen some of their publications.

Senator FANNIN. You have not seen that study, nor have you seen any conclusions from that study, because it has not been finished.

Mr. Moss. I have not seen the final report; that is correct. I have seen some interim reports.

Senator FANNIN. So you are not qualified to speak as far as any studies are concerned.

Mr. Moss. That is right. As a matter of fact——

Senator FANNIN. That is all I wanted to know.

Mr. Moss. I indicated——

Senator FANNIN. You answered my question.

Mr. Moss. May I comment?

Senator ANDERSON. I think you can complete your statement.

Mr. Moss. I indicated that I had no opinion on the central Arizona project in part because I had not studied it in enough detail, and I just wanted to clarify the record at this point.

Senator FANNIN. I think you said you have not studied it, not in detail. You said you had not studied it; is that right?

Mr. Moss. I will accept that, yes. I have not made a careful study of it.

Senator ANDERSON. Thank you very much.

(The rebuttal of the Bureau of Reclamation, above referred to, follows:)

DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION

COMMENTS ON THE STATEMENT OF LAURENCE L. MOSS

Mr. Moss' testimony is, in essence, an attempt to demonstrate that the Hualapai Dam proposal is economically and financially infeasible. While the Administration is opposed to the authorization of Hualapai Dam at this time, as Secretary Udall has testified, it is for entirely different reasons than those which were advanced by Mr. Moss and which we consider highly erroneous. Therefore, these comments question only the validity of Mr. Moss' several arguments and do not concern themselves with the question of authorization of Hualapai Dam.

Mr. Moss' statement consists of a sequence of contentions, including minor statements and major theses, and it includes unsupportable statements and errors in both inductive and deductive reasoning throughout. Because of the loose organization of the statement, it is not possible to offer a concise rebuttal. Instead, we have selected the most glaring inconsistencies for comment. Lack of comment on every phase of his testimony does not indicate concurrence in those not covered.

Mr. Moss does not present a valid statement of the logic of a benefit-cost analysis; therefore, his attack on his own definition is irrelevant. His major points are (1) that the methods of analysis used must be consistent and (2) that the evaluation of benefits should be based upon the "lowest cost alternative."

We submit (1) that the methods used were those used throughout Federal water resource development planning, and are as consistent as possible under existing techniques, being those prescribed by Senate Document 97, 87th Congress. In respect to point (2), the benefit-cost analysis is intended to provide a comparison of realistic future conditions with and without the project. Therefore, the alternative which is logically used is the *most likely* alternative, which may or may not be the lowest cost alternative. In the specific case under consideration, Mr. Moss appears to argue that a large, federally financed nuclear power plant would be the proper alternative to consider. Although a comparability test made during plan formulation would be considered, it would not provide a valid measure of benefits. In the absence of the construction of the dam, the required power is not likely to be provided from such a source but "most likely" would be provided by privately financed steam plants of the type now being planned in the region and at the economic cost associated with such plants.

Mr. Moss next discusses at length the question of the appropriateness of providing repayment assistance to irrigators from power sales or other sources of revenue. If the argument is stripped of emotion, it resolves to Mr. Moss' personal disagreement with conventional reclamation repayment policies as established by the Congress in reclamation law. A portion of this argument is considered with Mr. Moss' contention that the interest rate formula established by the Water Supply Act of 1958 (Public Law 85-500) is inappropriate and constitutes a subsidy. Mr. Moss' argument here is not specifically against the Colorado River Basin Project but against congressionally established policy applicable to all Federal water resource development programs.

Next, Mr. Moss asserts his opinion that hydroelectric peaking power is no longer competitive with thermal alternatives. This contention was presented in testimony before the House of Representatives Committee on Interior and Insular Affairs by Mr. Moss and others. It is discussed on pages 40 through 42 of the Committee Report on H.R. 4671 (House Report No. 1849, 89th Congress). Two quotes are especially applicable.

"The opponents of these two dams, through technical witnesses, sought to convince the committee that the dams are economically infeasible. They questioned the marketability of the energy and they claimed that nuclear powerplants would provide a cheaper alternative. Because this testimony came from technical witnesses, the committee studies these matters in some detail."

The committee's conclusions include the following:

"3. The power and energy which will be produced by the dams is marketable on a long-term basis at competitive rates, and will help to satisfy the needs of the Pacific Southwest region for 'peaking power.'"

Mr. Moss also advanced a particularly irrational new argument. Recognizing that continuous, baseload operation is necessary if large new thermal plants are to achieve their potential efficiency, Mr. Moss now agrees that they will be operated in this manner and not as peaking plants. They will thus displace the older, *less efficient* steam plants to intermittent peaking operation with concomitant waste of fuel in repetitive starting and nonproductive "spinning reserve," making them even *less efficient*.

It is true that this is the way in which peaking power is produced in many power systems. It is done this way because there is no efficient means available to the system to produce peaking power. As a result, the emphasis is placed upon maximizing the efficiency of baseload generation with new units, and inefficient peaking is accepted as unavoidable. This is one reason why potential hydroelectric peaking units are desired by utilities such as the Los Angeles Department of Water and Power.

Mr. Moss, however, simply claims that peaking with old plants must be economic because it is being done. In effect, he is now saying that the old, obsolete steam units, operated in a most inefficient manner, would be more economical than the Hualapai peaking power. This is a totally unsupportable contention which even Mr. Moss did not presume to put forth in his earlier statements to the House Committee.

In contesting the value of the operational characteristics of hydroelectric power plants—quick response to load changes and ability to operate under more variable loads—Mr. Moss quotes at length from a statement of Mr. Philip Sporn of the American Electric Power Company. The quotes, however, make no reference to economy. The point made in them is that the characteristics of hydroelectric power can be duplicated to a satisfactory degree by the provision of "spinning reserve" steam capacity. Spinning reserve is provided by keeping steam plants in thermal operation without generating energy. In other words, the fuel costs go on without any usable production. The costs of the nonproductive fuel consumption must be assigned to the energy actually supplied. At low plant factors, such excess operating costs quickly nullify any inherent efficiency the plant may have. By contrast, a hydroelectric plant may be maintained in a similar state of readiness to produce power with practically no operating cost.

Mr. Moss is incorrect in his statement that the current cost estimates of Marble Canyon and Hualapai Dams which have been provided to the Congress omit significant features. The costs shown on page 43 of the House Report include the proposed Hualapai Indian settlement and the access roads provided for in H.R. 4671. No afterbay dam at Marble Canyon was contemplated. The costs are, however, based on 1963 price levels.

Mr. Moss states that the amount contributed to a development fund at the completion of a 50-year payout period would not be greatly increased by Hualapai or Marble Canyon Dams. As a matter of fact, Hualapai would contribute about \$370 million to such a fund (depending, of course, upon the other project features and provisions included in the plan. This figure is consistent with the provisions of S. 1242 and S. 1409). An important observation is that the dam becomes a more valuable contributor *after* it repays its own costs. This is precisely the reason for the importance of Hoover and Parker-Davis revenues which are often cited as an argument against the need for further such investments.

The testimony of Secretary Holum before the House Committee has been incorrectly paraphrased. Mr. Holum stated *not* that the Basin Account would be increased if construction of Hualapai Dam were delayed ten years, but that if the Central Arizona Project were built without assistance from the Basin Account (as the Administration proposes) and the dam were later constructed as an independent project, the development fund would be greater at a future date as a result of building *both* Hualapai Dam and the Administration plan. This is, of course, entirely reasonable since the Central Arizona Project would not be assisted from the fund and would even be a source of revenues for the development fund after it pays itself out.

Mr. Moss has commented that \$700 million has been authorized for the Upper Colorado River Storage Project and Participating Projects. The initial authorization under Public Law 84-485 was \$760 million. Subsequent authorizations of additional participating projects has brought this total to about \$1,028 million. This figure does not include indexing to current price levels which is permitted in some of the authorizing Acts. Also, it is a ceiling on appropriations and not a ceiling on the cost of works authorized. We do not feel that this bears any logical relation to the proposed legislation, but it is an example either of Mr. Moss' lack of understanding or misrepresentation of the facts relating to his arguments.

Senator ANDERSON. The next witness is Mr. Davis.

STATEMENT OF JOHN D. DAVIS, MEMBER, STATE WATER RESOURCES BOARD OF OREGON; APPEARING ON BEHALF OF HON. TOM MCCALL, GOVERNOR OF THE STATE OF OREGON

Mr. DAVIS. Mr. Chairman and members of the committee, my name is John D. Davis of Stayton, Oreg. I am a member of the State Water Resources Board of Oregon, and appear before you on behalf of Hon. Tom McCall, Governor of Oregon, and that board. We sincerely appreciate the opportunity to present our views of this important legislation. I might mention in passing that I am also here in connection with public works appropriations in both the Senate and the House in behalf of the State of Oregon.

My expenses here are paid by me, and they probably will be reimbursable by the State of Oregon if I submit a voucher, which I sometimes do.

We do not intend to comment on the physical features recommended for authorization in these bills, but do wish to inform the committee that the State of Oregon has consistently supported sound reclamation development. In keeping with these concepts we shall direct our testimony primarily to S. 861, but also, as far as it is applicable, to S. 1242 and S. 1409.

We believe the proposal to authorize feasibility reports to augment the waters of the Colorado River from sources outside the Colorado Basin is premature if the source of such water is the Columbia River or its tributaries. S. 861 directs the Secretary of the Interior to investigate and prepare estimates of the long-range water supply in States and areas from which water may be imported into the Colorado River

system together with estimates of the probable ultimate requirements for water within those States and areas of origin for all purposes.

Such studies are currently underway by the States of the Columbia Basin and by Federal departments. The State of Oregon is expending \$332,000 during the current biennium to develop estimates of its future water requirements. The 1967 session of the Oregon Legislature has appropriated an additional \$506,000 to complete these studies and prepare a report scheduled for publication in June of 1969. The purposes are: (a) determination of waters, Pacific Northwest, that are surplus to future needs, State of Oregon; (b) determination of benefits and detriments to the State of Oregon resulting from proposals to divert water from the Pacific Northwest to the Pacific Southwest; and (c) provide information to enable the State of Oregon to evaluate and develop methods of meeting long-range water requirements for all beneficial uses for the entire State.

The legislatures of our neighboring States of Idaho, Washington, and Montana have appropriated funds for these States to determine their long-range water requirements. I might mention in passing that the studies are already underway in Idaho and in Washington.

Federal agencies are currently undertaking a type I comprehensive investigation, at an estimated Federal cost of \$5 million, to determine water requirements for all authorized purposes to the year 2020 in the Columbia River and Pacific Northwest. This Federal study is scheduled for completion in 1970, a matter of slightly under 3 years. A technical staff has been employed composed of representatives of the Departments of the Army, Agriculture, Interior, and Health, Education, and Welfare.

Activities to date have been coordinated under the auspices of the Columbia Basin Inter-Agency Committee and will be coordinated in the future under the newly formed Pacific Northwest River Basins Commission. The river basin commission will provide the vehicle to develop and coordinate a comprehensive plan through the joint efforts of private, local, State and Federal interests. This commission must, of course, have time to get this highly important assignment completed before consideration is given to exportation of water from the Columbia system to other regions.

We believe there are substantial opportunities in the Western States to develop much more efficiency in water use. We commend the Secretary of the Interior and water users in the Southwest for their efforts to date to achieve reductions in losses from evaporation, phreatophytes and inefficient transmission. We hope Congress will look favorably on proposals to expand research and accelerate programs to further reduce water losses.

We strongly recommend that before authorization is approved to import water into the Colorado River Basin from sources outside that basin, a full evaluation of the possibility of achieving more efficient use of the water presently within the basin be undertaken.

The type of water planning envisioned in S. 861 is substantially different from project or river basin planning undertaken heretofore by Federal agencies. The possibility of serious economic and social loss to the States which are the source of water to be diverted is real and should not be discounted.

The Senate has approved S. 20, to establish a National Water Commission. The duties of the Commission include a review of present and anticipated national water resource problems, making projections of water requirements, and identifying alternative ways of meeting the requirements. The Commission is also required to consider the economic and social consequence of water resource development including the impact of water resource development on regional economic growth, on institutional arrangement and on esthetic values affecting the quality of life of the American people. S. 861, as we interpret it, would direct the National Water Commission to give high-priority in the preparation of a plan and program for the relief of shortages in the Colorado River Basin.

We would suggest that water problems are national in scope and, therefore, should be first reviewed from the standpoint of national interests and responsibilities. We would, therefore, recommend that the National Water Commission be given an opportunity to undertake the assignments and investigations contained in the bill approved by this committee and the Senate, before it is directed to develop plans to solve a particular water problem in a particular area. It is our belief that timing of activities is important in seeking resolution to national problems. For this reason we request that authorization of studies directed toward importation of water into the Colorado system be deferred until the National Water Commission has had an opportunity to render its report concerning alternative methods of meeting water requirements and developing means and methods of evaluating the economic and social consequences of water resource development.

While the Commission is undertaking its assignment, we believe there is a concurrent responsibility on the part of the States and the Federal Government to complete at the earliest opportunity studies directed toward the determination of long-range future water requirements.

In addition to the studies underway by the States and the Federal agencies in the Columbia Basin, we would call the committee's attention to the proposed expenditure of over \$12 million by Federal agencies in the Pacific Southwest to identify needs for water that will develop within the next 50 years. Incidentally, a large part of this expenditure will be spent in the Colorado River Basin study. These type I framework studies are being coordinated under the auspices of the Pacific Southwest Inter-Agency Committee. These studies, like those in the Columbia Basin, should be completed before consideration is given to authorization of studies for importation or exportation of water.

We have difficulty rationalizing the language of section 305 of S. 861 which refers to decisions that are to be made after the waters are imported into the Colorado Basin, with the supposed objectivity of the studies to be undertaken in section 201 and the decision with respect to preparation of a feasibility report in section 203. If Congress is going to request the Secretary to undertake reconnaissance and feasibility studies of importation of waters into the Colorado system, we would strongly recommend that the Congress delete any reference to decisions to be made after the water, that is supposedly being studied, has been imported.

We have the highest regard for the objectivity of the present Secretary of the Interior but suggest some future Secretary of the Interior might interpret the language contained in S. 861 as a directive from Congress to find feasibility for importation of waters into the Colorado system. This, we are sure, is completely contrary to the intent of this committee.

That completes my testimony, gentlemen. Thank you very much for the opportunity to appear here.

Senator ANDERSON. Mr. Davis, we know that you have done some very fine work. We are happy to have you here today. I commend you for the brevity with which you made the statement and appreciate it a whole lot.

Mr. DAVIS. Thank you, sir.

Senator ANDERSON. Senator JACKSON.

Senator JACKSON. I want to compliment Mr. Davis, Mr. Chairman, for a very fine statement. He has very properly limited and directed his comments to the work that is being done by the State of Oregon in trying to get its own house in order regarding water needs.

Second, you have expressed your concern about the question of water importation, and you have given I think some very cogent reasons why you feel the sections in this bill and in the other bills should not be included. I want to compliment you on a fine statement. That is all.

Mr. DAVIS. Thank you, sir.

Senator ANDERSON. Senator KUCHEL.

Senator KUCHEL. Mr. Davis, I want to just say for the record that the U.S. Senate and this committee are both honored to have your former very able Governor made a member of our committee. There isn't anyone in the U.S. Senate for whom I have any higher respect than Mark Hatfield, and I have no doubt that he well and ably represents the views of your people on this committee.

Just a couple of questions. First, does the Governor of Oregon take a position pro or con on the construction of the central Arizona project.

Mr. DAVIS. No, sir; he does not.

Senator KUCHEL. It seems to me that one of their best forward steps that Congress took was in considering and in acting upon the so-called intertie proposals. Here was where there was some surplus power in the Northwest, which could be utilized beneficially in the Southwest.

You had problems regarding preference. You had the question of whether or not it would be possible if an intertie agreement were entered into, to recapture some of the power subsequently if the Northwest grew.

And finally we got an agreement where all parties, the States involved, the public agencies, the privately owned utilities put together a legislative package that presumably will be of a good deal of benefit to the entire Pacific coast region.

I say that because in good faith, if I can try to speak out as a Californian, and just as a citizen of Western America, that if it were possible sometime for any other system to be used in an area of deficiency I think it would be in the interests of the Nation. I rather imagine you might agree with me and give an affirmative to that generalization, or would you?

Mr. DAVIS. Senator Kuchel, I think the two situations are not comparable. I shouldn't attempt to lecture you on this sort of a situation.

Senator KUCHEL. You would disagree.

Mr. DAVIS. I would disagree, sir. The electric situation is one and the water situation is another. In respect of the interchanges of power between the regions, it runs both ways. The benefits occur for both areas. The power runs both ways.

True, the large supply of power will come from the Northwest to reduce the utilization of high cost steam operations in California substantially, shut down high cost steamplants. But those steamplants are in standby. There is as much power availability in California as there is power coming in over the line.

The power which is being sent south from the Northwest can be knocked off the line, can be switched off at any time, and the steam-power can be brought on the line in California to pick up the load, so that the problem of cutting off California in this situation, when the power is needed in the Northwest, is not anticipated to be a serious one.

But the same is not true of a water supply. If we are feeding water from the Columbia River to a lot of dry farmers in California and Arizona and to the cities of Los Angeles and Tucson, et cetera, that water can't be cut off. Once it starts feeding into this area, Senator, it can never be cut off.

I don't think you can ever establish rights in the States of origin which would ever permit that. This would be contrary to any good national policy to treat people in this fashion. So again I repeat what I said earlier: the thing to do is to determine what the problem is in the Southwest, determine what your future quantities of diversion are going to be, what you are going to need in the long term, complete our studies in the Northwest, and then see where we stand, Senator.

We feel that what is contained here in titles I and II, I believe it is, of your bill, Senator, is a prejudgment of the situation. That is the only thing we quarrel about here.

Senator KUCHEL. I think that is a very frank statement, but it does seem to me that your approach would lead inevitably to an agreement with the broad generalization that I stated a few moments ago, that where there is in America any basic surplus resource that could be beneficially used in another part of our country which is deficient, that that resource should be used rather than wasted. I don't think we disagree on that.

Mr. DAVIS. Senator, California and Arizona are as much a part of my country as they are yours. This is very true.

Senator KUCHEL. That is an indication that there is a chance that you would agree.

Mr. DAVIS. Senator, we just disagree on whether the facts are as they are anticipated or inferred by your bill, and we ask for time to do the job.

Senator KUCHEL. When I made that statement a moment ago, truthfully, I didn't want it directed to my bill. I wanted to direct it to a policy agreement that perhaps you and I might enter into.

Mr. DAVIS. Speaking personally, I think it is entirely possible that these studies may find that in the very long term we have waters in the Columbia River which might be utilized elsewhere.

Senator KUCHEL. Thank you very much.

Senator ANDERSON. Senator Allott.

Senator ALLOTT. Mr. Davis, I am very happy you appeared here. I think your State water resources board is charged with the same responsibilities our water conservation board in Colorado is charged with; is it not?

Mr. DAVIS. I have never read the legislation creating the board, Senator.

Senator ALLOTT. In the broad area of conservation and use and development of water.

Mr. DAVIS. Well, this isn't our mission in life essentially. Our responsibility in Oregon is to review the availability of water, to determine its program, its use for the future, and control it.

We have a developmental responsibility which is as yet pretty well undefined by the legislature, but we have lent our efforts toward effective assurance, assurance of effective utilization of water.

Senator ALLOTT. Strangely enough I agree with a lot of what you say here. You won't believe this, but I think it is fine that Oregon has taken the three steps that you have defined on page 2 to evaluate its own water resources. I think every State in the West has to do this. We have been involved in this in my State for many, many years, as you know.

I would like to inquire about one thing. What department is charged with the responsibility for this Federal study; do you know?

Mr. DAVIS. For the Federal study?

Senator ALLOTT. Yes. You have said that Army, Agriculture, Interior, and HEW are participating, but I would like to know where the appropriations came from. I don't remember its authorization.

Mr. DAVIS. The appropriations are made, as I understand them, to the various Federal agencies participating in the study. You will find them in each agency.

Senator ALLOTT. And no one agency is charged with the responsibility.

Mr. DAVIS. No one agency is charged with all of them.

Senator ALLOTT. With the responsibility of them.

Mr. DAVIS. I think that is true. The Pacific Northwest River Basins Commission will inherit the job or has inherited the job of coordination of the studies.

Senator ALLOTT. I want to say to you that I believe absolutely in what you say at the bottom of page 3:

The possibility of serious economic and social loss to states which are the source of water to be diverted is real and should not be discounted.

I would be the last one on this committee to ever try to advocate or engineer in any way a steal on water, and there is no other way to describe it because that is what it would be—a steal on water that belongs to other States and which is needed for their development.

But it seems to me, Mr. Davis, that what you have said here, and it is a very valid point to discuss, is this: That by eliminating the provisions in Senator Kuchel's bill—and I suppose the same remarks would go to the bill submitted by me, would they not?

Mr. DAVIS. Yes, sir.

Senator ALLOTT. That what we are being kept from doing is not from diverting water but simply from finding out whether such a plan is ever going to be feasible. I don't know, and I don't think anybody else knows at the moment but what waters might be diverted from northern California to help alleviate this serious shortage, and we are here simply because we feel that Arizona does need this.

We also need to be protected, but Arizona does need the central Arizona project. It seems to me the question is not whether we are going to engage in a commitment to divert waters from Oregon or northern California or the Columbia River, but if we take the position that you have taken, we are not even going to be permitted to look at it and study it for the purpose of finding out 2 or 3 or 5 years down the line whether or not it is feasible.

I don't know it, and I don't think there is a man in the United States today that can answer the question of whether or not these diversions are feasible. But in view of the serious situation not only in Arizona and California but in Colorado, Wyoming, Utah, and New Mexico, it seems to me that no one can support the position of saying, well, you just don't even have a right to take a look at it, and that is all we are asking for.

My bill calls for a feasibility study. I think Senator Kuchel's bill asks for a reconnaissance study, and this is all we ask. This is all we want. We want to inquire. We want to find out. And it might be that after we have gone down this road a ways, we would find out that considering the future needs of Oregon, the future needs of Washington—although I don't know what they are going to do with 160 million acre-feet flowing into the ocean—but we might find out the probable needs of your State, the State of northern California and the diversions that would be made from northern California to southern California, that none of these are feasible. But for God's sake, we ought to have a right to look at it.

Mr. DAVIS. Senator, may I comment.

Senator ALLOTT. I wish you would, sir.

Mr. DAVIS. Between the Federal Government and the States, we are spending something on the order, the Congress is spending and the States are spending, of \$14 to \$16 million to make these studies now. When these studies are done, I think the facts will be substantially available, Senator.

We would recommend that the National Water Commission have the responsibility on a broad-gage basis to look at the whole sociological and policy theory of such major resource diversions, and this is taking gold from one region and moving it to another. It is taking a major asset from one region to another, and it ought to be looked at in these terms, in its long-term sociological implications.

And then the National Water Commission ought to pull together the figures and the information which will become available within a matter of something less than 5 years, and give the Congress a determination, a decision, at least the information, on which you can proceed.

But we do object to handing the contractor, the builder, the Bureau of Reclamation, the job of making the feasibility study, making the reconnaissance report, and in effect prejudging the case by detailing

how the imported water is going to be used before they build the canals.

This is the way we feel in the Northwest, Senator. We think we are doing the job of getting the basic information.

Senator ALLOTT. For which I applaud you.

Mr. DAVIS. It is underway, sir.

Senator ALLOTT. I say I applaud this. I think it should be done.

But certainly—let me ask you this question: With relation to the National Water Commission which is not law, there is no such commission—

Mr. DAVIS. Yes, sir.

Senator ALLOTT. We don't know whether there will be such a commission this year or next year or the year after that or the year after that. As a member of this committee, I offered an amendment to that which would set up criteria for certain professional members of that Commission. That amendment was defeated. I offered a further amendment on the same bill to provide that the studies of the Colorado River Basin seem to be the most acute. They are far more acute than yours, you will agree with that.

Mr. DAVIS. Yes, the shortages, the potential.

Senator ALLOTT. Should become the first order of business with the commission. That was defeated.

Now, even if you finish your study and complete it, we will not know or have any idea at the end of 5 years whether, engineeringwise, there is any feasibility whatever to the importation of water, even if you find that you have got it running out of your ears at the end of 5 years. We will not know any more than we do now, and this is all we are asking.

We are asking for an opportunity to take a look at it, and I certainly don't think this is an unreasonable attitude.

Mr. DAVIS. Senator, if you are simply referring to the physical aspects of importation, I can't comment on them. I am not an engineer. But I have talked to engineers who tell me that these determinations are not difficult to make.

The surveys can be made rather easily and rather rapidly. The facts about pumping and the costs of pumping to particular heights and in particular quantities are well known. The cost of building a canal is well known. Estimates of reservoir costs based on predetermined capacity, in varying capacity, is known, and these are things that can be pulled together rather fast.

But the things which are difficult to do are the basic studies of what alternatives you have, Senator, in the Colorado River Basin, what our long-range use and requirements are going to be in the Columbia River Basin.

These things take time, but it is the long-range things, the time-consuming things that we are investigating. We are hard at them.

Senator ALLOTT. Are these any real reasons, Mr. Davis, why the engineering facts which would ultimately determine feasibility could not be worked on at the same time? It is true the cost of pumping against a certain head is well known. It is true that we have a pretty good idea in the West of what it costs to construct canals and reservoirs and drops and all the other things that go with this, but this would be a mammoth undertaking, and is there any reason why this should not

go along with the study that you have performed to determine the availability?

Mr. DAVIS. To us there is a very good reason, Senator. It is putting the cart before the horse, and we think looking at it up there, perhaps we are parochial, but we think it is an advance commitment toward something which may never occur. We don't know whether it is justified, and the justification must, we think, be found before we start building, before we talk of building.

Senator ALLOTT. I don't believe we can blame you at all for being parochial in the sense in which you use it. We are all parochial in that sense. We have to be. But I can't quite agree, I am sorry, with your conclusion that it is putting the cart before the horse. It seems to me like it is putting two front wheels on an automobile instead of trying to go down the road with one.

Mr. DAVIS. Well, there we must differ I guess, Senator, and I am sorry, sir.

Senator ALLOTT. Thank you, Mr. Davis.

Mr. DAVIS. Thank you.

Senator ANDERSON. Senator Fannin?

Senator FANNIN. No questions.

Senator ANDERSON. Thank you very much.

Senator JACKSON. A very fine statement.

Senator ANDERSON. Mr. Raushenbush.

STATEMENT OF STEPHEN RAUSHENBUSH, CONSULTING ECONOMIST TO THE NATIONAL PARKS ASSOCIATION. WASHINGTON, D.C.

Mr. RAUSHENBUSH. Mr. Chairman and members of the committee, my name is Stephen Raushenbush, a consulting economist at the National Parks Association. I appreciate this opportunity to appear before you to present a statement by the president of the association, submitted on invitation.

I have been a consultant to the association in a number of technical studies it has made during the last several years on Colorado River resources management problems.

I am acquainted with the economic parts of this statement and would be happy to comment on specific problems with which it deals, or to answer questions which you may have on them.

I am also submitting a brief résumé of my own professional background.

Mr. Smith's statement is as follows:

The National Parks Association is a private, nonprofit, educational and scientific association concerned primarily with the protection and restoration of the natural environment generally. It publishes the monthly National Parks magazine, received by all members, about 35,000 persons.

It is a privilege and a pleasure, he says, to respond to your welcomed invitation to submit testimony on the program of the administration to get water into central Arizona promptly, without dams in the Grand Canyon or the Colorado, and to enlarge Grand Canyon National Park.

The administration proposal, as we understand it, is a simple, economical, commonsense plan; namely, that the Bureau of Reclamation be authorized to construct the aqueducts and pumping plants necessary to transport water from the reservoirs behind Parker and Davis Dams on the Colorado River into central Arizona, and to purchase the power from the new combination of privately and publicly owned utilities known as West, participating in the financing of a new thermal powerplant which would be constructed for that purpose; the plan contemplates further the enlargement of Grand Canyon National Park, essentially to include the reach of the river between the park and Glen Canyon Dam and the withdrawal of the authority of the Federal Power Commission to license power projects on the Colorado between Mead Reservoir and Glen Canyon Dam.

The bills which you have under consideration today, S. 1013 on the central Arizona project, including the restrictions on the Federal Power Commission, and S. 1300 to enlarge the park, would in combination implement the administration proposal.

I shall have a few specific comments and some minor reservations in regard to particular provisions of these bills, but taken together they would carry out an overall program to get water into Arizona and protect the Grand Canyon which is very definitely in the national interest.

It is our understanding that the plans embodied in these measures are the program of the President of the United States; it is in general an excellent program.

I made a similar proposal, Mr. Smith goes on, to the subcommittee on Irrigation and Reclamation of the House of Representatives on August 31, 1965. It is gratifying to find that these recommendations have received such a firm stamp of approval by the President. I submit the testimony given at that time for the record in the present hearings with considerable satisfaction.

I reviewed these earlier recommendations recently and reiterated our position by editorial in the March 1967 issue of National Parks magazine, which I would also like to submit for the record.

This editorial reviews many proposals which we made for solving the water problems not only of Arizona but of the entire Pacific Southwest, during the period when the issues have been under discussion.

We showed, for example, that the proposed Bridge Canyon Dam was and is unnecessary as a money earner for any basin account because the water which would be sold in central Arizona would earn much more money than the Bureau of Reclamation originally said it would earn.

We showed that the proposed Marble Canyon Dam was uneconomic for the production of firm power for pumping purposes because this power would cost 4.2 mills or more while power produced by coal-fired thermal plants would cost from 3 to 4 mills or less, according to Commissioner Dominy of the Bureau of Reclamation.

We showed, furthermore, that peaking power produced at Marble or Bridge Canyon and carried long distances to loan center at Los Angeles would be doubtful profitability in competition with atomic power, coupled with pumped storage, at load center. Expert testimony by Dr. Carlin and Mr. Moss before the House committee has demon-

strated this quite fully. Certainly, the repayment schedules and the representations made in behalf of these hydroelectric power projects with respect to the accumulation of funds for reinvestment were dubious in the extreme.

We submitted testimony in the recent hearings in the House on these matters that if it should be thought desirable to build up a large basinwide fund for reinvestment in additional water supply facilities, the most economical way to do it is to provide for a deferrable construction loan to a basin agency at $3\frac{1}{4}$ percent which would be reinvested at 5 percent in savings banks or AAA or AA bonds.

If \$100 million were invested and reinvested in this manner, the fund would have more money in the year 2047 than it could get from the investment of \$670 million in Bridge and Marble Canyon Dams together; it would be about \$1.75 billion, instead of \$1.33 billion.

Mr. Stephen Raushenbush, consulting economist to the association, submitted a table before the House committee which I am including in this statement at this point.

But, basically, what we have been saying is that the important thing is to get water into central Arizona promptly, and that the way to do this is to build the necessary aqueducts and pumping plants, buy the power, and start pumping.

We have said that such a clearcut commonsense central Arizona project should be coupled with the equally sensible Grand Canyon protection program; for this purpose, the entire reach of the Colorado River between Mead Reservoir and Glen Canyon Dam, with due consideration for the interests of the Indians along the river, should be incorporated either into a Grand Canyon National Monument or an enlarged Grand Canyon National Park.

The current park enlargement bill, S. 1300, which is intended to implement the President's program, accomplishes this protective purposes admirably for the portion of the river between Grand Canyon Park and Glen Canyon Dam; the central Arizona project bill, S. 1013, accomplishes the protective purposes adequately for the present by suspending the authority of the Federal Power Commission to license power and storage projects on the river between Mead Reservoir and Glen Canyon Dam.

This is a vital portion of the combined proposal. Without it, the embittered controversy over the Grand Canyon would undoubtedly, as a matter of simple fact, explode into flames once again and endanger the central Arizona project itself.

I do not have to explain to this committee, which is well acquainted with this subject, that Bridge Canyon Dam, misnamed Hualapai Dam for propaganda purposes, was not proposed as a reclamation project; nor would it conserve water, but on the contrary, evaporate it; nor explain that its function was to generate and sell hydroelectric power and accumulate money, although it was doubtful whether it would pay, for the eventual construction of additional water transportation facilities.

Surely, it has been demonstrated sufficiently by now, by the National Parks Association studies mentioned above, and others, that Bridge Canyon Dam cannot be justified for the purposes for which it was intended. Many of us are satisfied that once the problem of water for

Arizona has been settled in the manner presently proposed, Congress will never see fit to authorize a dam of any kind at Bridge Canyon.

In consequence, the suspension of the authority of the Federal Power Commission to license projects between Mead Reservoir and Glen Canyon Dam quite probably settles this issue permanently; this step, as a bare minimum should certainly be taken at once.

On the other hand, within this long-term perspective, it would seem quite sensible to enlarge the boundaries of Grand Canyon Park at once, to comprise the reach of the river between Mead Reservoir and the park, as well as the reach between the park and Glen Canyon Dam. There is no sound reason why this additional protective step should not be taken at this time, and we would recommend it.

I have, indeed, only one other reservation about the program as offered; namely, the undesirability of the authorization of Hooker Dam and reservoir in such fashion as to intrude on the Gila wilderness. Congress has only recently enacted the Wilderness Act, whereby this area, among others, was given supposedly permanent protection in natural condition, free from the works of man.

Approval of the proposed reservoir in the Gila wilderness would contradict this action taken but recently by Congress itself. Grave doubt would be cast for the future on the security of other wilderness areas protected by congressional action.

This particular project appears to be in fundamental conflict with the beneficial protective purposes of the administration plan, and in our judgment should be omitted.

In the background of the discussions on Colorado River development for several years we have had the proposal for a National Water Commission. The proposal has been embodied in S. 20, introduced by the chairman of this committee, and a lengthy list of eminent cosponsors.

I have long been an advocate of the establishment of such a Commission; we need to bring together the best policy minds in the country on water management questions and give them a chance to make policy recommendations through the President to Congress; this cannot be done by the operating agencies, whose recommendations are of necessity always influenced by narrow administrative and economic pressures; moreover, the need is not for the contribution of specialists, important though these always are, but for the contributions of policy minds, concerned with long-range goals, and the general national interest.

With these thoughts in mind, the proposal for a National Water Commission should stand on its own feet; it should not be incorporated into legislation related mainly to one river basin, as has been done with the current Lower Colorado Basin legislation in the House of Representatives.

A completely independent National Water Commission, concerned with policy and not with operations, representing the Nation and not the agencies and other special constituencies, is the primary current necessity in the national water management field. The National Water Commission proposal is highly meritorious and should have separate consideration by this committee on its own merits.

It would seem to many of us that sound national water policy applied to the Colorado River Basin, the Pacific Southwest, and the

Pacific coast, would dictate programs rather different from the grandiose schemes which have been presented in recent years.

First of all, good policy calls for the simple commonsense central Arizona project we now have under consideration, coupled with a comprehensive canyon protection policy, comprising the entire reach of the Colorado River between Mead Reservoir and Glen Canyon Dam.

Secondly, however the question arises whether southern California will continue to wish for the further concentration of population there; if so, the necessary supplemental water can be provided more economically, in all probability, looking into the future, by atomic desaltation plants, as contrasted with new aqueducts to bring water from northern California. The cost of such plants will be declining during the next decade or so, and the cost of the aqueducts and dams will be rising.

The absurdity of these enormous projected future waterworks becomes more apparent when we realize that they will eventually involve the further transportation of water from the Columbia River Basin and the Northwest generally into northern California. All this fore-shadows fantastic water diversion from Alaska at enormous costs; the social, ecological, and even meteorological dislocations would be so vast as to foreclose rational consideration.

It makes much more sense, in the judgment of many of us, to let the people go where the water is. The Pacific Northwest has abundant water; it has more water than a much larger population will require. Growth can take place here without inhuman overcrowding. Congestion has already passed the limits of human endurance in southern California.

Some of us think that if California were an independent nation, faced with the vast tides of immigration presently crossing its borders, it would resist the invasion by force of arms if necessary; it makes little sense to clamor for more water in southern California to facilitate the deleterious growth of malignant congestion.

In the same vein, one might suppose that the Pacific Northwest would properly resist by all legitimate methods any channeling of its abundant water supplies into other regions. I suspect that it would have the support of the Nation in such resistance.

Briefly, then, the elements of a good water and population program for the west coast and Southwest would seem to be: retention of Pacific Northwest water in the Northwest; retention of further northern California water in northern California; provision of additional water resources in southern California by atomic desaltation plants in case southern California thinks it wants more crowds; and the prompt solution of Arizona's water problems and the protection of the Grand Canyon, essentially by the program the President of the United States has proposed, subject to the minor reservations we have made, in the legislation pending before this committee.

In closing, let me say to the chairman and members of the committee, that I greatly appreciate the invitation to present this statement, this opportunity to offer my views, and the courtesies which have been extended to us.

(The table above referred to, together with the attachments to the statement, follow:)

CENTRAL ARIZONA DEFERRED CONSTRUCTION LOAN

This table shows how much more the Colorado Basin States can gain from a \$100 million deferred construction loan, repayable in 50 years at 3.25%, invested successfully in 5% interest-bearing industrial and state-guaranteed revenue bonds, than they could from \$670 million invested in Hualapai and Marble Gorge dams and powerplants.

- (1) That loan will produce \$604 million, 67% more than the dams by Year 2025.
- (2) It will produce \$1,747 million, 30% more than the dams by Year 2047.
- (3) It will provide the same \$184 million in irrigation aid for CAP by Year 2025.

Capital accumulation

Calendar year	Year of loan life	Interest component	Accumulated capital (millions)
1908	1	0.05 percent.....	\$105.0 1 -4.0 101.0
1977	10	0.551 percent (9 years).....	156.6 -4.0 152.6
1987	20	0.628 percent (10 years).....	248.4 -4.0 244.4
1997	30	do	397.9 -4.0 393.9
2007	40	do	641.2 -4.0 637.2
2017 (year of repayment with interest repayment).	50	do	1,037.4 -4.0 1,033.4 -500.0 533.4
2025 (key year); identical with Bureau's aid to CAP irrigation year 2025 (Bureau's dams \$361,300,000).	58	0.477 percent (8 years).....	787.8 -184.0 603.8
2027	60	Available	665.7 -4.0 661.7
2087	70	0.628 percent (10 years).....	1,077.2 -4.0 1,073.2
2047 (key year) (Bureau's dams \$1,335,500,000).	80	0.628 percent (10 years).....	1,073.2 Available

¹ A \$4,000,000 operations charge is deducted at the beginning of each 10-year period.

Raushenbush, Stephen, educator, author; labor relations manager, clothing industry, Rochester, N.Y., 1919-20; engaged in travel and oil industry, Venezuela and Mexico, 1920-22; staff member, Bureau Industrial Research, New York City, coal industry, 1923-25; sec. National Com. on Coal and Power, 1926-29; asst. prof. Dartmouth Coll., 1929-30; chief investigator Legislative Inquiry on Pub. Utilities, Pa., 1931; dir. Industrial Relations, Pa., 1931-34; chief investigator Legislative Inquiry on Sub-Standard Industries, Pa., 1934; chief investigator and sec. U.S. Senate Munitions Inquiry, 1934-36; lecturer Pendle Hill Post-Grad. Sch. 1938-39; with Bituminous Coal Div., U.S. Dept. Interior

1939-41, Chief, Bureau of Economics and Statistics, Power Div., U.S. Dept. of Interior. June 1941-Jan. 1947: on tech. staff, U.S. Naval Attache's Office, London, 1942; cons. on resources U.N., 1947-50, also Pub. Affairs Institute. Author: *The Power Fight*, 1932; *The Final Choice* (with wife), 1937; *The March of Fascism*, 1939; *Our Conservation Job*, 1949; also articles. Editor: *The Future of Our Natural Resources*, 1952; *Pensions in the Economy*, 1955; *Productivity and Employment*, 1956.

[From the National Parks Magazine]

BRIDGE AND MARBLE CANYON DAMS

My name is Anthony Wayne Smith. I am President and General Counsel of the National Parks Association, which is a private, non-profit, membership organization, educational and scientific in nature, with about 30,000 members throughout the United States and abroad. The Association publishes the monthly *National Parks Magazine* received by all members. I am an attorney admitted to practice in New York and the District of Columbia and a specialist in river basin planning and natural resources management. I appreciate the invitation to present this statement to the Sub-committee.

Analyses of the Central Arizona Project and the Pacific Southwest Water Plan by Mr. Stephen Raushenbush, former Chief of Research, Power Division, Department of the Interior, now economic consultant to the National Parks Association, were published in the *National Parks Magazine*, April and June, 1964. Supporting data for the conclusions reached by Mr. Raushenbush were tabulated at the request of the Assistant Secretary of the Interior, Mr. Kenneth Holum, later that year and submitted to him and Commissioner Dominy of the Bureau of Reclamation, together with a covering memorandum and letter of transmittal. I submit copies of all these documents for your convenience; much of what I have to say in my present testimony is based on the data previously made public in these documents. I submit also copies of the current September 1965 issue of *National Parks Magazine* which contains editorial comment on the problem before you. If the Subcommittee, the Committee, or the Committee staff desire further information on any points which I may deal with or which are covered in the supporting material, we shall be happy to attempt to supply it.

In recommending recently that authorization of the proposed Bridge Canyon dam on the Colorado River below Grand Canyon National Park and Monument be deferred for more careful study and later consideration, the Bureau of the Budget rendered a significant public service.

Bridge Canyon dam, if constructed to the elevation presently proposed by the Department of the Interior, would flood reservoir water into Grand Canyon National Monument throughout the entire length of the river through the monument and into Grand Canyon National Park some 13 miles. Such inundation would be in violation of the established national policy against reservoirs in national parks and monuments; it would not fall within the proviso of the Grand Canyon Park Act which has been relied upon to justify it, and which I shall discuss in a moment.

The scenic resources of the Grand Canyon of the Colorado, whether in the monument or the park, are irreplaceable. These resources have world-wide significance, and their wanton destruction for questionable utilitarian purposes would have serious repercussions on the American image abroad. The cultural, scenic, and ecological values at stake in this situation are, of course, intangible; they cannot be measured in dollars and cents as monetary economic advantages can; but in our judgment, which we think is likely to be the ultimate judgment of the American people as a whole, they far outweigh the very doubtful dollar values on which these projects purport to be justified.

While the Secretary of the Interior has recommended the authorization of Bridge Canyon dam, and the project has been a favorite of the Bureau of Reclamation for many years, other agencies of the Department of the Interior seemingly dissent. The National Park Service has stated that the reservoir would inevitably result in the loss of park values of national significance. The Bureau of Outdoor Recreation has stated that no new recreation benefits can be claimed, and pointed to the unusual existing recreation values of the area and the adverse effects the reservoir would have on them; it has elaborated its position at some length along such lines. Unfortunately, we have the impression that these

agencies do not feel entirely free to state their honest opinions in this situation, in view of the position of the Department; if this Subcommittee has not already done so, I would suggest that the Directors of the National Park Service and the Bureau of Outdoor Recreation be called to this stand and asked to state their views as they would state them if they were not component parts of the Department of the Interior. You might also wish to call two former Directors of the National Park Service, Conrad L. Wirth and Newton B. Drury, again with the reassurance that their uninhibited opinions are being sought.

This Subcommittee and the full Committee will, in our opinion, wish to give careful consideration to the implications of the last sentence in Section 302 of the proposed legislation, which says that "the Congress hereby declares that the construction of the Bridge Canyon dam herein authorized is consistent with the Act of February 26, 1919 (40 Stat. 1175)," the Act which created Grand Canyon National Park.

The Grand Canyon Park Act contains the following Section 7:

"That, whenever consistent with the primary purposes of said park, the Secretary of the Interior is authorized to permit the utilization of areas therein which may be necessary for the development and maintenance of a Government reclamation project." (U.S.C., title 16, sec. 227.)

Obviously, the questions are whether the utilization of areas of Grand Canyon National Park for the Bridge Canyon reservoir is *consistent* with the primary purposes of the park and *necessary* for the development and maintenance of a reclamation project.

The entire tradition of the protection of national parks in this country is eloquent testimony against the proposition that flooding a reservoir into Grand Canyon Park is *consistent* with the primary purposes of the park; we suggest that by far the dominant sentiment of the American people runs counter to the declaration of consistency contained in the measure under consideration.

Moreover, it is quite clear that this use of the land is not *necessary* to any Government reclamation project. Bridge Canyon dam could be eliminated completely from the Central Arizona Project, as far as pumping is concerned, and such elimination would not have the slightest effect on this project; the pumping power could be supplied entirely from Marble Canyon. Bridge Canyon has been represented as being entirely a peaking power project, and this has nothing whatsoever to do with any Government reclamation project; it has been represented as a money-earner for the construction of reclamation projects elsewhere; but such money can just as well be provided out of the general treasury, and Bridge Canyon is not necessary to such financing. If it be true, as now suggested, that Bridge Canyon may be used to provide a small measure of pumping power, it is not necessary that it should be so used. There is no way in which the language of the Grand Canyon Park Act can be tortured into consistency with the provisions of the measure under consideration. Needless to say, Congress is privileged, if it wishes to modify basic national policy in regard to park protection, to do so; but in that event, it would be preferable, in all candor, to state frankly that such a course had been chosen. A declaration of consistency where no consistency exists would, in our judgment, be unbecoming to the Congress of the United States.

I need hardly say to this Subcommittee, which is already well informed about these projects, that neither Bridge Canyon nor Marble Canyon dam will store any water whatsoever for irrigation purposes; in fact, both of them will cause severe losses of the irreplaceable water resources of the Pacific Southwest through evaporation.

Nor will Bridge Canyon be used in any significant measure for pumping water into central Arizona or elsewhere. In the original proposal for the Central Arizona Project and the Pacific Southwest Water Plan, advanced by the Department of the Interior, Bridge Canyon would not have been used at all for pumping; its functions would have been to supply peaking power, mainly for sale in California; it would earn money for the Basin Account which could be used for subsequent projects, mainly in California. We have been told recently that some of the Bridge Canyon power would be used for pumping, but a relatively small amount; apparently the purpose of this adjustment is to bring the project within the exception of the Grand Canyon Park Act as a reclamation project; but the power is not needed for this purpose.

As originally presented, Bridge Canyon was to produce and sell peaking power at about 6 mills; after the retirement of the investment, it would earn money for a Basin Account for new construction, mainly in California. This inducement

was thought to ensure support by California for the project as a whole. However, there seems to be no good reason why any further projects, if desirable, should not be financed directly from the general treasury of the United States; such direct financing might give Congress greater control over the basic decisions; moreover, the projects could be authorized later, if, as, and when the need for them became more apparent.

But the truth is that Bridge Canyon dam is not needed as a money-earner. A much larger percentage of the water which will be pumped into central Arizona from the lower Colorado River near the Mexican border pursuant to any Central Arizona Project will be sold at high municipal and industrial prices, as contrasted with low irrigation prices, than the Department of the Interior originally represented. At least 100,000 acre feet more municipal and industrial water will be sold at \$45 an acre foot than originally stated; this is in contrast with irrigation water at \$10 an acre foot; if realistic estimates of urban population growth and water consumption are made, the shift may be much higher.

The result is to make the Central Arizona Project more of a money-earner, considered merely as a water-pumping project, than was represented to the public; Bridge Canyon becomes a fifth wheel, even if we really want to earn money in this way in a public enterprise. There may be some people who would question the desirability of the Government getting into purely money-making operations of this kind: I suggest that the Committee give careful consideration to this question.

We had originally supposed that the changeover from irrigation to industrial and municipal water in Arizona would be even higher than the amount I have mentioned. Certain it is that M&I use will grow much more rapidly than that in the Phoenix-Tucson area. However, it seems that some of this M&I use will be satisfied from water in the old Salt River Project; this is a situation where the land owners acquired a vested interest in reclamation water at low prices and can retain that interest even though the water is put to a much more profitable use by municipalities and industries. The old laws provided no safeguards against such speculative profits. The land owners and water users can therefore split the difference, and Salt River water will be more attractive than Central Arizona Project water. We suggest that the Subcommittee look into this situation very carefully; you might wish to call Commissioner Dominy to the stand on that point.

There is another question which deserves attention by this Subcommittee. There will be a considerable amount of effluent from the municipal and industrial projects using both Salt River and Central Arizona Project water. It is not at all clear who will get the advantage of this water; who will own it, buy it, reap the profits inherent in it. Much of it may have great value for both irrigation and fertilizing purposes. This Subcommittee might consider safeguards against unreasonable speculative advantages going to persons who do not deserve them; Commissioner Dominy might be able to shed some light on this question.

There will also be some exchanges of water among these various projects in Arizona: Salt River, municipal effluents, and the CAP, which become rather complex; in view of the amount of land speculation likely to be involved, you might wish to question the Commissioner on these points.

Bridge Canyon dam and reservoir would be highly destructive in terms of the scenic, recreational, ecological, and cultural values of the Grand Canyon in both the monument and the park. It is not needed, and it is of questionable desirability, as a money-making project. It will not store any water for irrigation anywhere, but will, on the contrary, evaporate water; it will do little, if any, pumping. Its only value, if any, would be for generating power, and I would now like to turn to this point.

About a year ago a spokesman for the Bureau of Reclamation stated that the cost of power generated at coal-fired thermal plants in the Colorado Basin was being brought down to 5 mills a kilowatt hour or less. Just a month ago the Commissioner stated that it was coming down, in larger plants, to 3 or 4 mills or less. Bridge Canyon dam will produce peaking power at 6 mills; with firm power at 3 or 4 mills or less, it would behoove this Subcommittee to inquire very carefully into the profitability of peaking power at 6 mills. The Department of the Interior has not yet demonstrated, as far as we know, that Bridge Canyon dam would pay its way, principal and interest, over the 50-year repayment period, as a peaking power plant, as against such competition.

The Office of Science and Technology has indicated that nuclear power produced by the fission process, in conjunction with the desalination of saline water,

will probably be available within the next 10 or 15 years at a cost of 3 or 4 mills. There have been suggestions that such power will be well adapted to peak load purposes, and not merely to base load. If so, Bridge Canyon dam cannot be justified for peaking purposes; this last possible justification collapses. Presumably, this was one of the questions which the Bureau of the Budget thought should be very carefully examined before this project had serious consideration for authorization. It seems quite likely that in the 4- or 5-year period suggested by the Bureau for restudy, it will become abundantly apparent that better alternatives than Bridge Canyon for peaking power production exist.

Since the time when plans were crystallized for Bridge and Marble Canyon dams by the Department of the Interior, a serious doubt has been growing as to the probable quantities of water available in the Colorado River Basin. The very low flows of recent years may be more typical than otherwise. If so, the big reservoirs, including Glen Canyon, and most certainly Marble Canyon and Bridge Canyon, will not fill or refill on schedule. To the extent that their schedules are unmet, interest on the investment will rise, and power costs with it; Bridge Canyon power might be 6.5 mills instead of 6 mills, making it even more vulnerable to competition from coal-fired and nuclear-fission energy. By the time the waiting period of 4 or 5 years suggested by the Bureau of the Budget has passed, we shall have better information on weather cycles in the Basin; this is another excellent reason for denying authorization.

Just beyond the horizon is unclear fusion. This process, as you certainly know, will produce fresh water as well as abundant power. The Office of Science and Technology has suggested that the cost would be between 2 and 3 mills. It is widely supposed that this process will have been developed by the end of this century, before the end of the pay-out period for Marble and Bridge Canyon dams. Any such development could bankrupt both of these projects.

I am sure that the members of the Subcommittee have in mind that we are talking about the probable inability of Bridge Canyon dam to make payments on principal and interest throughout the pay-out period. Even if debt service proved possible at the beginning, it might fail in later years. It is not at all certain that competing power sources are not superior even now; it is almost certain that they will prove superior by the end of another decade or so, and that either the power consumers will be caught with long-term contracts at high prices or prices will have to be reduced and the project will prove to be uneconomic.

Turning to Marble Canyon dam, this project would be located above Grand Canyon Park, and the reservoir would not invade any unit of the national park system. However, Marble Canyon is also famous for its wild scenery and natural outdoor recreation opportunities, and most of the same cultural evaluations are applicable at Marble as at Bridge. Marble Canyon should not be destroyed for the sake of an unnecessary and unprofitable hydroelectric power project; certainly not where superior sources of power exist.

The comments made about Bridge Canyon are in the main applicable at Marble except that the purpose of the Marble was announced originally as that of pumping water from the Colorado River near the Mexican border into central Arizona for reclamation and municipal and industrial purposes. It was represented as producing firm power at 4.2 mills a kilowatt hour, and apparently no peaking power, and no uses other than those of the Central Arizona Project, were contemplated. We are now being told that it will also produce peaking power; this appears to be in line with the current thinking of the Department of the Interior that coal-fired plants will beat hydropower for base load purposes, and that hydro-power can be used only for peaking purposes. This Subcommittee will probably, therefore, receive the Marble Canyon proposal as a peaking power proposal, and the considerations involved will be more similar to those discussed in connection with Bridge Canyon.

But even the original proposal was unsound, if we accept the present analyses of the Department of the Interior. If it be true, as the Commissioner of the Bureau of Reclamation has said, that coal-fired plants may shortly be able to produce power at 3 or 4 mills or less, then they will obviously beat Marble Canyon at 4.2 mills. Moreover, the cost of hydro-power production, following construction costs generally, is constantly increasing, while the cost of coal-fire thermal power, due to advancing technology, is constantly declining.

It is difficult to understand how a project of this kind can be realistically appraised, whether by the Bureau of the Budget, or this Subcommittee, or public-service organizations like the National Parks Association, interested in present-

ing an objective analysis of the situation, if the purported justification of such projects changes from year to year in this chameleon fashion. I feel sure that this Subcommittee will take a great interest in finding out whether the Marble Canyon project is intended for pumping purposes, and hence for reclamation, with about 15% of the investment non-reimbursable, and about 50% interest-free, or whether it is a peak load project, not intended for irrigation, with principal and interest fully repayable.

If the Marble Canyon project is an irrigation project, intended for pumping, then we need to add the amount of interest lost and the non-reimbursable principal if we are to make a proper comparison with coal-fired costs at plants constructed by privately-owned, publicly-regulated electrical utilities. If this be done, the gap, if any, between hydro-power at 4.2 mills and coal power at 5 mills or less, as estimated by the Bureau last year, probably disappears. And of course, if coal costs are 3 or 4 mills or less, as apparently now admitted, the advantage is on the side of coal, even without consideration of the subsidy given to hydro-power.

You will bear in mind also, of course, that in the offing, first of all, is nuclear fission, with power costs at 3 or 4 mills; moreover, it is not at all clear that peaking power will not be produced by these methods at rates lower than hydro-power. This is a question of a 10- or 15-year development, and this competition will be in the picture long before any investment in the Marble Canyon dam, or Bridge Canyon, can be repaid. And in the longer perspective, but still within a generation's time, in all probability, there will be nuclear fusion, with power costs at 2 or 3 mills, according to the Office of Science and Technology.

We are not urging that nuclear fission plants be substituted for coal-fired steam plants, or for hydro-power plants, for that matter, because we are not satisfied as yet that the problem of disposing of radioactive wastes has been sufficiently solved. But it seems quite certain that atomic fission will be used for the desalination of sea-water and the generation of power in the Pacific Southwest in the readily foreseeable future; even if opposed on radioactive waste grounds, these developments are almost certain to take place. We mention the prospect merely as a fact, and without advocacy of any kind.

Atomic fusion, as we understand the situation, presents different questions. Radioactive wastes are not produced, and on the other hand, quantities of excellent water are developed. The difficulty appears to be the generation of enormous quantities of heat with adverse effects on waters and atmosphere, and unpredictable results in respect to weather, climate, and the environment generally. It seems probable that these considerations will have a limiting effect on nuclear fusion use, but will not preclude such use entirely. Admittedly, we are in the realm of rather broad speculation; yet the march of technology is so rapid that this prospect must be considered.

We have urged, and I would be inclined to emphasize at the risk of prolonging this testimony unduly, that more research and development work needs to be done in the field of solar energy. The development of solar energy in a sunny climate like that of the Pacific Southwest and particularly in the desert country of portions of the Colorado Basin holds great promise. Funds which might otherwise be expended on destructive hydro-power development might better be used in moving forward into the future in search of practical methods for harnessing solar energy.

This is a question of the kind of program a truly Great Society would adopt for the Colorado. It seems to many people that a high civilization will set great store by the scenic and recreational values of the canyons between Glen Canyon dam and Lake Mead; the Congress might well recommend to the President that he declare this stretch of the river a national monument, or might itself incorporate it all into Grand Canyon National Park, thus giving it full protection under the National Parks Act, the Federal Power Act, and otherwise. Coal-fired steam plants would then be relied on to provide the electrical energy needed for pumping, both for irrigation and for municipal and industrial purposes, as far as this portion of the river is concerned; such surplus coal capacity as might be required, or such nuclear capacity, would be provided for peaking purposes; if this were considered too costly, which seems doubtful, the hydro-power potentials of Glen Canyon, Hoover Dam, and other existing hydro-power structures in the Basin, could be devoted more completely to peaking purposes, and the base load could be picked up by thermal plants.

We would expect nuclear energy to produce additional prime power at costs at least as low as coal-fired thermal plants, and perhaps even to produce peaking

power more inexpensively; moreover, fission plants could pump desalted water from the Pacific and from the Gulf of California into both southern California and central Arizona. Quarrels about the division of water between the two states would thus be decreased. In due course, if the promise of nuclear fusion is fulfilled, and the problem of heat is not insurmountable, newly manufactured water will be available, and abundant power can be tapped.

The notion that more and more water should be brought south from northern California into southern California and even exported to Arizona becomes less and less attractive as those potentialities unfold. There has even been a threat to the Columbia River Basin with covetous eyes appraising the enormous water resources of the Pacific Northwest; such notions are also probably unrealistic in the long perspective.

In our judgment, the questions raised by the Bureau of the Budget with respect to Bridge Canyon are equally applicable to Marble Canyon dam. Both structures would contribute energy to the network, and it would be difficult to identify and earmark separate supplies. Neither project can be justified for base load purposes; it is highly questionable whether they are needed or can be justified for peaking power. This last question is the most important one for this Subcommittee, as for the Bureau of the Budget, and it needs much more thorough investigation than it has had thus far. The 4- to 5-year moratorium suggested by the Bureau for Bridge Canyon should be imposed on Marble Canyon as well, because the situations are similar. Bridge Canyon could not be built without Congressional authorization, in view of the strictures of the Federal Power Act prohibiting the Federal Power Commission from licensing projects constructed for reservoirs in national parks; this restriction applies to Grand Canyon National Monument. In the case of Marble Canyon, however, there is no such protection; Congress has properly imposed a moratorium on the issuance of licenses at these points by the Federal Power Commission pending a preliminary examination of the problem; this safeguard should be continued pending decision by Congress itself as to its course of action at both of these sites; that is, we suggest that you might wish to propose a moratorium on the issuance of any licenses at either Marble or Bridge Canyon for hydro-power construction until Congress itself has acted either to authorize construction, or, as appears to be the sounder policy, to give permanent protection to the entire Colorado in this area as a national monument, or, indeed, as a national park.

The Bureau of the Budget made one further excellent recommendation, that a Water Policy Commission be established composed of persons from outside the Government, to review our entire national policy with respect to water resources; the Bureau may have had reclamation problems very much in mind. Many people feel that a review of this nature, and a commission of this kind, are long overdue. Should we be subsidizing irrigation, as a nation, at a time when the Department of Agriculture is trying to retire many millions of acres of crop lands from production? Should we be shifting agricultural production in, let us say, cotton, from the Southeast to the Southwest, with the aid of reclamation subsidies? Should we be pressing for the development of every last kilowatt of hydroelectric power for peaking purposes or should we set higher store by the remaining scenic resources of our western canyons, and of our eastern river valleys, for that matter? Should the least-cost criterion retain its present high priority in the evaluation of specific projects, or should important ecological, social, and cultural values be given greater weight? The same question should be asked about the entire cost-benefit approach; should we not give much more consideration to both monetary and non-monetary intangibles? Should not the programming of water development projects be subordinated to either an interdepartmental commission or a White House level agency, or, better, to a commission composed of policy-minded persons, rather than operating agencies? These river basin planning problems are not primarily engineering problems, and therein lies the source of many of our mistakes; they are problems in economics, sociology, and indeed, in political philosophy, in the sense of the study of social values and objectives. These present hearings, and this Subcommittee and Committee, might well be an excellent time and excellent agencies to initiate an inquiry into a problem like the continued subsidy of reclamation. In addition, the Budget Bureau's proposal for a comprehensive commission to review other broad aspects of national water policy might well be given favorable consideration.

GOOD NEWS ON THE GRAND CANYON

[An editorial reprinted from the *National Parks* magazine for March 1967]

The great good news of the year thus far in conservation is the announcement by the Johnson Administration of a program to get water into Central Arizona without damming the Grand Canyon of the Colorado.

The new plan is to build the necessary aqueducts and pumping plants to carry water from the reservoirs behind the Parker and Davis dams, well below Hoover Dam, into Central Arizona, and to purchase the electric power needed for the pumping from the new combine of privately and publicly owned electric utilities in the Pacific Southwest known as WEST.

Interior Secretary Udall, in making the announcement for the Administration, stated that the new decision was "a victory for common sense."

More than a year and a half ago this Association advocated precisely the solution which has been adopted, in a statement given on invitation of the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, August 31, 1965, by the President and General Counsel of the Association as follows:

"Supplementing my statement of yesterday, in view of the question put to me at the end of the session, the immediate problem before all of us is to help Arizona get the water it needs right away.

"This is a question of aqueducts and pumps and the electric power to do the pumping. This electric power can be produced by coal-fired thermal plants at from 3 to 4 mills or less, according to Commissioner Dominy. Hydroelectric power for pumping purposes will be more expensive; 4.2 mills for Marble Canyon. One coal-fired thermal plant, capacity 600,000 kilowatts, the prime power capacity of Marble Canyon, will do the entire pumping job.

"Why should we choose the more expensive method when a cheaper one is available? In this case the cultural values also favor the cheaper method.

"Why should we embark on a course involving a multitude of bitter conflicts and protracted delays, when a better course is available which everyone would support?

"The interests of the people of Arizona dictate that there be no further delay in getting water into Arizona; the prompt way to get water into Arizona, the cheapest way, and the way which will have the least opposition, is to use coal.

"I would make this practical suggestion to the subcommittee: authorize the construction of the pumps and aqueducts at once; authorize the construction or licensing of a 600,000 kilowatt coal-fired thermal power plant to do the pumping at 3 to 4 mills delivered cost at once; put the money the water will earn into a development account for research and development in fission, fusion, and solar energy and in water production for southern California and Arizona, looking toward the use of the Gulf of California and the Pacific Ocean.

"There could be a very broad consensus on this approach. I do not know who would oppose this approach."

We reiterated our views on the aqueducts, pumping plants, power-purchase approach two months ago in the following language:

"True it is that Bridge and Marble Canyon dams on the Colorado have not been authorized. An outpouring of protests from conservationists and citizens generally helped to block the destruction of long reaches of the Grand Canyon.

"Technical analyses by this Association and others revealed superior ways to provide water for Central Arizona, electric power, and funds for the development of the Colorado Basin. Regional conflicts also had a part in the outcome: the promoters overplayed their hands.

"Whether a constructive program for the Colorado, based on modern technology, as contrasted with the idols of hydroelectric power, will now emerge, remains to be seen. We have expressed our view that the problem of water for Central Arizona might easily be solved by the prompt construction of the necessary aqueducts and pumping plants, and by the purchase of the pumping power from privately owned utilities generating current from coal; and that if funds are needed for future investment, they can come from water sales, the sale of power from existing dams, or earnings on savings accounts which could be established now."

Five years ago we devoted a special issue of *National Parks Magazine*, April 1962, to the impending attacks by the forces of so-called development on the Grand Canyon. We had intervened as early as the summer of 1961 in the

Federal Power Commission proceedings involving the proposed license for a dam at Marble Canyon, in opposition particularly to the proposed Kanab Creek diversion which would have taken most of the water out of the Grand Canyon through the Park. We had anticipated the possible reactivation of an application for a license at Bridge Canyon. We had noted that proposals might be advanced for the construction of dams by the Bureau of Reclamation at both Marble and Bridge Canyons and that the appropriate agencies of the conservation movement would undoubtedly, as a matter of fact, oppose such projects.

Thereafter, as grandiose projects for the manipulation of the water resources of the Pacific Southwest, and indeed the entire Pacific Coast, unfolded, we presented a long series of careful analyses and commentaries showing the superiority of an abundance of alternatives, including the approach which has now come to be adopted.

We published highly competent technical studies proving that Bridge Canyon Dam, below Grand Canyon Monument, which would flood into the Monument and Park, was not needed as a money earner for purposes of new investments in California, because enough money would be earned by the sale of water in Arizona.

We called attention to the fact, which was even then being admitted belatedly by the Bureau of Reclamation, that the pumping power for the Central Arizona Project could be produced more cheaply by coal-fired thermal plants than by firm power at Marble Canyon Dam, which had previously been proposed by the Bureau.

We showed also that when it came to peaking power for sale, with a view to building up an investment fund for southern California, atomic energy coupled with pumped storage would probably be more economical than hydroelectric power with long-line transmission from Bridge Canyon to Los Angeles.

We inquired very sharply into the profitability of the Marble and Bridge Canyon hydroelectric power projects as money earners, against the background of readily available low-cost coal resources in the Colorado River Basin and the impending advances of atomic energy; the hydro projects were looked upon as a bad risk for public investment.

More recently we advanced the novel proposal of a deferred construction account involving, instead of a high-risk public investment in hydro projects of doubtful profitability, a Federal loan to a basin agency at $3\frac{1}{4}\%$, capable of re-investment at $5\frac{1}{2}\%$, yielding a much larger fund over a 50-year period than the hydropower projects could possibly hope to yield.

Throughout the course of these successive technical analyses we maintained our position that the main purpose of a Central Arizona Project should be to get water into Central Arizona as quickly as possible by the simplest feasible method, and that the best method would consist of the construction of the aqueducts and pumping plants and the purchase of the necessary pumping power from existing utilities; the Johnson Administration has put its firm stamp of approval on this proposal, and the indications are that the Administration plan will be adopted.

A significant part of the proposal is that Grand Canyon National Park be expanded to include Marble Canyon. This Association has advocated, in testimony given on invitation, that the entire river between Powell and Mead reservoirs, including the sites of both Marble and Bridge Canyon dams, be protected against Federal Power Commission licenses by incorporation into a national park or monument. Protection as a national monument could be extended by Presidential Proclamation, thus setting these issues to rest the right way for good.

This success for conservation could never have been achieved without the well-nigh complete solidarity of almost the entire conservation movement.

The position of conservationists in the protection of the Grand Canyon of the Colorado has likewise had the solid support of the vast majority of the American people.

We would comment also that the outcome demonstrates the need for independent, scientific and educational institutions like the National Parks Association, which are able to bring the light of unbiased and objective inquiry to bear on the great public issues of our times.

Conservationists generally will be happy to congratulate President Johnson on this momentous decision by his Administration to protect the Grand Canyon of the Colorado for America and the world.—A.W.S.

Mr. RAUSHENBUSH. Senator, may I now, at this point, which gets into the economic thing on page 4, explain a little bit what that is all

about, because I think this is of major interest and may be of major help to the committee.

The economic part, which begins on page 4 and goes through that table that is added there, has a new approach, if you will, a most economical way of doing things, and one that I think meets the needs of the Upper and Lower Basin States, and at the same time practically protects or goes on the basis that the Northwest will not be injured by this development fund.

The criticism that is made basically of the Hualapai was originally presented by the Bureau of Reclamation and is that it is carrying too high a burden of improbability. They are asking too much of that plant, and it is going to be a big disappointment to the people of the whole Colorado River Basin. That is largely because that 6-mill rate that they assume will go on for 50 and 75 years is simply too vulnerable to the technological changes that have been taking place and have been lowering the power rates. We have evidence from the Federal Power Commission and from the Office of Science and Technology that their estimates of power rates going down over the years shows by 1980 possibly a drop of 40, in one case, and 45 in the other; and our contention simply there is a 6-mill rate is not going to hold.

It is going to be vulnerable to these other moves of other rates, and therefore, there is not, the probabilities are that there will be no surplus in Hualapai available for the people who want it so badly, the people of the Colorado River Basin.

The second part of this economic thing is that we think it is natural and desirable for all the Colorado River Basin States to be concerned with augmentation of water and to desire a more adequate development fund.

But, at the same time, we feel that this whole argument can be simplified by looking at the evidence of the present estimates that have been offered to us for the technologies of 1990 and 2000 on water distillation and alternatively on importing water from north California or above.

Even at the 1975 technology of desalination, as we make it out, there is already an advance of at least \$10 over importation from northern California, let alone anywhere else, and we think that scissors is crossing like that, and the cost of water desalting is going down, while a 2-percent increase in the cost of construction, canal building, and the like, is going up.

We don't think the Pacific Northwest has to be worried about this threat, and we are constantly taking the position that we offer the development fund and think that water must be augmented and it can be augmented, and that it will turn out when the National Water Commission is through with about a year's work, that this will be fairly clear.

Senator JACKSON. Do I understand you have come to the conclusion that we must get water out of the Columbia River?

Mr. RAUSHENBUSH. No, sir. The opposite—that we will not.

Senator JACKSON. I did not think so, but you said it must be augmented.

Mr. RAUSHENBUSH. By augmentation, I mean any means possible. We think it has to go on the basis of the scissors that have been developing lately so far; and that is by the desalination process.

Already, the techniques—and I call this report to your attention—this 1964 report, large nuclear power sea-water distillation plants, even using the 1975 technology which is still a primitive one as they outlined it, and using the Bureau of Reclamation's financing thing—they work it all out on a Bureau basis. Water can be produced at \$58 an acre-foot and delivered down at the Colorado Basin, and that \$58 is just about the same figure that the Department gave us some years ago when there were doing the whole Lower Basin of Colorado.

Well now, since that time the construction costs have inched up a little over 2 percent a year. We see no reason that they should stop going on up that way, and at the same time the 1980 costs of desalination are fantastically lower. These people have a drop in their expectation of water costs dropping between 1968 and 1980 of 32 percent in 12 years. In other words, we think the scissors is favorable to desalination, and that the problem of northern California water is not going to come up, or water from above, and that whole thing that has been standing in the way of getting the Colorado-central Arizona project on the way will simply disappear.

We can't ask Congress to go into all the technical problems involved here, but we do think that it will take a Presidential Commission, revising this up to date, revising all the costs that the previous witness said could be handled fairly simply, getting those up to date for importation from northern California, and check on whether this scissors as we see it is not correct.

In that case, the whole thing can move forward without any 15-year lawsuits or anything else.

Senator JACKSON. May I clarify one thing I should have asked in the beginning. I take it, you are a paid consultant.

Mr. RAUSHENBUSH. Yes; I am. I am paid by the National Parks Association; yes, sir.

Senator JACKSON. And your headquarters are here in Washington?

Mr. RAUSHENBUSH. Yes, sir.

Senator JACKSON. Fine. This question was raised before, and each and every witness will be asked.

Mr. RAUSHENBUSH. Yes, sir; I understand. Now, if you will please look at that table that follows page 4, you will see there a suggestion that a fund that really would be adequate could be raised by one simple measure—if you add to the central Arizona project a simple \$100 million deferred loan, that is all. And don't invest all the money, the \$670 million that the pure power part that both Bridge and Marble Canyons would take, but just that \$100 million, they will get you more money, 6 to 7 percent more, than the two dams would in the year 2025, and 30 percent more, about \$400 million more, by the year 2047.

Now the criticism that is to be made of the whole Bureau outline is that the money they have been talking about is, as I have said before—the rate they have been talking about—the presumption that it will hold for 50 and 75 years at the 6-mill rates seems too great a burden of improbability.

If it doesn't hold, there will be a deficit that the power users, the water users, of the area will have to pay. Therefore, it is necessary to turn to something else, and this process which is, after all, what the rural electrification cooperatives do when they get a loan of money

and can't use it right away, they put it in the bank and draw 5 percent or whatever they can get.

This puts this on a basis of simply adding \$100 million to the central Arizona project as a deferred loan project, and then coming out ahead not only much better than Hualapai, but also much better than Hualapai and Bridge put together, and coming out ahead at the end so that in the year 2047 you would have \$1,747 million, compared to the Bureau's \$1,335 million.

These are the figures without the benefit of Hoover, Parker, or Davis, the Bureau of Reclamation's figures on what their surplus would be without that.

Then, if you want to compare this with the \$254 million of the Goss plan of Federal money, roughly, you get a result like this: suppose you say we are willing to have a proposition that will do the most, we want a proposition that will do the most for all the people in the area, that will make money available for augmentation, and we think through the desalting plants, we want to get the most, we realize that the Bureau doesn't give you any money until long after the need, doesn't give you any money until 50 years, or 25.

The need is going to come in 1990 and the year 2000. You are going to need the money then. The Bureau doesn't give you that and they really don't get any amount to you until 75 years after the project is completed, perhaps 80 years from now.

And so, if you want to put before the rest of the Congress and the urban people, and the like, something they can understand, of getting the most results for the region, and the most hopeful augmenting water through this thing, you could take Mr. Goss' \$254 million of Federal funds that he suggests be invested, and using a simple multiplication factor here, come to about \$4.4 billion.

Now, with \$4.4 billion at the end of that period you would really have enough money to bring in something over 3 million to augment, or desalination, by about 3 million-plus acre-feet, and that would be a real contribution to the basin. So we think in suggesting this alternative to you, gentlemen, we feel that we are trying to help the basin, everybody in the basin, as well as central Arizona itself, which needs the project very badly, and should, in equity, get it.

Thank you very much.

Senator FANNIN. Thank you, Mr. Raushenbush.

Senator HAYDEN. The next witness is Robert D. Rawson.

**STATEMENT OF ROBERT D. RAWSON, M.D., ARIZONANS FOR
WATER WITHOUT WASTE, TUCSON, ARIZ.**

Mr. RAWSON. I would like to have my statement entered as if read and give, hopefully, a shorter verbal statement.

Senator FANNIN. The complete statement will be in the record.

Dr. RAWSON. I am Robert D. Rawson, representing Arizonans for Water Without Waste, and I reside in Tucson. Our organization was originally formed last fall as part of the nationwide concern about building more dams in Grand Canyon.

Our original concern was based on esthetics, but our subsequent studies have demonstrated many valid reasons why these dams should

not be built. They are based mainly on waste of water from reservoir evaporation and waste or tax money in constructing them.

These dams appear to be superfluous to the central Arizona project and it has been noted by many that they are necessary only to satisfy the complexities of the legislative process.

It is difficult to see the virtue in any plan which increases the evaporation of water from the Colorado River.

We are pleased this year to be able to support the administration's position and the bill entered by our Senators from Arizona, Hayden and Fannin. We will comment briefly on the original proposals as published by the Department of the Interior concerning the central Arizona project itself, and we will not belabor its necessity. It has been demonstrated that it is justified and needed.

However, we feel that it should be passed on its own merits and not be used as a vehicle to solve the long-range water problems of the entire Southwest. We support the plans for prepayment purchase of pumping power to be bought from the West Utility Group.

Someone mentioned this morning some comparison of strip mining. I am not an advocate of strip mining, but I hope that no one is seriously considering the run-of-the-mill desert as comparable to the Grand Canyon. We have no objection to the plan for financing CAP. It appears reasonable to expect that the persons receiving the benefits should contribute to the cost through a small tax or a small increase in water rates.

We most strongly believe that immediate action should be taken to enclose Marble Gorge in an enlarged Grand Canyon National Park and would like to see the same protection given to the lower Grand Canyon.

Regarding the guarantee of 4.4 million acre-feet to California, it appears reasonable to us that until a better method is determined, that any shortages should be distributed in proportion to compact allocations.

We favor formation of a national water commission and feel that this could be the most important legislation passed in recent history, and we hope that this commission will institute a new concept in planning.

And before we start diverting rivers, some wide-range studies and thoughtful examination of national goals should be undertaken. To maintain the quality of life as we know it, the Commission should consider more than acre-feet of water. If the current minor prices can threaten the price of water, imagine the threat to our scenic resources by the immense prices that will face future generations.

This crisis will bear down on our progeny, if we continue to assume that increase in numbers is possible and good.

Should integration to short areas continue to be encouraged by attempting to import these resources, quality as well as quantity of life must be considered. Good planning demands that future generations be left some maneuvering room and choice of alternatives regarding their environment. Their goals may be different than ours.

For this reason we hope the National Water Commission will be dominated neither by agencies responsible for construction of water works, nor by the direct beneficiaries of these works. Too often interest in national beauty decreases in direct proportion to one's eco-

conomic gain in altering. We can no longer trust our remaining heritage of natural or even urban beauty strictly to engineers, and this is not to degrade our general opinion of engineers. We feel they need help in evaluating many of the factors besides economic and engineering details of planning of this nature.

Our goals must be determined by considering more than economic and engineering factors. This will require a commission staffed with persons of great vision and wide interests, which hopefully would make it unnecessary for the private citizen to bear the entire burden of refuting the propaganda of Government bureaus and regional water interests.

Thank you.

Senator HAYDEN. Thank you, sir.

Senator FANNIN?

Senator FANNIN. Dr. Rawson, there are a few questions I would like to ask of you. In your statement on page 4 where you say, "The Department spent four years in studying this subject and it cannot be lightly dismissed," can you tell me what was the source of the funds for that amount of money?

Dr. RAWSON. I understand it was a Rockefeller grant.

Senator FANNIN. You understand. Do you know?

Dr. RAWSON. No; I do not have any definite information on it. I really feel that their conclusions are strictly a matter of internal Arizona affairs and have no relations perhaps to the justification of a central Arizona project, but I do feel they have some valuable questions as a matter of general principles of water management.

Senator FANNIN. You also state that there have been rebuttals to these statements.

Dr. RAWSON. Correct.

Senator FANNIN. More about your organization. How many members do you have?

Dr. RAWSON. We do not have any formal membership list. We are a young organization. We were formed last fall. We have meetings at individual persons' homes, at which up to 30 people may appear. We have had several public meetings, advertised by word of mouth, where up to 60 have appeared. We have a mailing list of people we feel are interested in our opinions, which is over a thousand at this time.

Senator FANNIN. But when you say you are speaking for this group, then you are not necessarily representing them as far as their voice is concerned, because they do not have a voice, do they?

Dr. RAWSON. I feel I represent a considerable body of informed Arizona opinion on this subject. I cannot give you a numerical figure; no, sir.

Senator FANNIN. In other words, you do not have meetings, you do not pass resolutions, you do not carry on business. It is just an ad hoc group.

Dr. RAWSON. I think this describes it. I make no apology for this, and I must emphasize that we come here to support your position in this matter.

Senator FANNIN. Thank you. No further questions.

Dr. RAWSON. Thank you.

(The prepared statement referred to follows:)

STATEMENT OF ROBERT D. RAWSON, M.D., ARIZONANS FOR WATER WITHOUT WASTE

Mr. Chairman: My name is Robert Rawson. I am a practicing surgeon in Tucson, Arizona, where I reside. I appear before you as a private citizen and as an officer of the Arizona-based organization known as Arizonans For Water Without Waste. The principle importance of my presence here today is that I am an Arizonan sent here by Arizonans. Our Chairman, Juel Rodack, testified at the House Subcommittee hearings last March. The expenses for both his trip and mine have been paid entirely through many small contributions from Arizonans who are firmly opposed to construction of dams in the Grand Canyon.

PREFACE

Last year a group of Arizonans, of which I was a member, watched the progress of HR 4671 in the subcommittee hearings. We were mainly conservationists concerned lest legislation be passed providing for the construction of dams in the Grand Canyon. Our studies convinced us that, in addition to esthetics, there were many other reasons why these wasteful dams should never be built. Last August 22, Arizonans For Water Without Waste was organized, a natural outgrowth of the hearings on HR 4671 in the 89th Congress.

The nature of our organization is specified in the name we have adopted. Though we receive support from many Americans outside of our state, we consist exclusively of Arizonans. Our existence demonstrates that Arizonans do not all want the dams. We are for water—we do not oppose CAP. We are against waste. In addition to waste of our national heritage, we oppose dams on the grounds that they would waste water through evaporation (not to be countenanced in our arid region regardless of the amount lost), and, if constructed, they will waste taxes, since it can be demonstrated that the dams are unnecessary except to satisfy the complexities of the political and legislative process or the greed of special interests. Further, since it is a precious commodity, water lost through evaporation and percolation should be charged to the project. For example, the Bureau of Reclamation now admits that some 3 million acre feet has already been lost through percolation from Lake Powell. This would represent between \$30,000,000 and \$150,000,000 at the rates proposed for CAP water sales. Charge this plus the loss through evaporation to any project and we see that it becomes increasingly uneconomic. As the lake level rises the loss will also rise, and contrary to previous claims, for all practical purposes this bank storage is permanently lost.

This year it is a matter of no small satisfaction to find the political climate changed considerably. The Administration has proposed construction of the Central Arizona Project without the dams. Secretary of the Interior Stewart Udall, an eminent and respected Arizonan, stated emphatically at the March House subcommittee hearings that neither dam is necessary at present for any purpose whatever. Arizona's Senators Carl Hayden and Paul Fannin both joined Senators Cannon and Jackson as co-sponsors of a bill similar to that proposed by the Administration. For years Arizonans have been led to believe that CAP was impossible without these dams. Now President Johnson, Secretary Udall and our distinguished Senators say that we can have CAP without having to commercialize the Grand Canyon. AWWW is making every effort to disseminate this truth.

We are here to offer our full support to the Administration proposal. We will not attempt at this point to convert anyone to esthetic persuasion. The damage dams would cause to the scenic beauty of the Canyon appears to us self-evident. On this question each individual must allow his own esthetic sense and conscience to make the decision. But we respectfully urge that the intelligent solution proposed by Secretary Udall be enacted swiftly into law.

The remainder of this statement is divided into two parts. Part 1 deals with Secretary Udall's proposals. We take into consideration each of the seven points contained in the Fact Sheet which accompanied the original Department of Interior press release announcing the proposals. Part 2 is an appendix concerning certain additional considerations on CAP.

Part 1

Central Arizona Project.—AWWW does not oppose CAP. We believe that CAP is practical and feasible without dams in the Grand Canyon. Certain reservations on this subject are dealt with in Part 2. We urge early passage of S 1004.

Pumping Power.—The plan for "prepayment purchase" of the estimated 400 megawatts of power from a steam plant to be built by the WEST utility group sounds highly reasonable. We support this without qualification.

Financing CAP.—There are ways to finance CAP other than by the suggested ad valorem tax and/or increase in municipal and industrial water rates. We believe that it is reasonable to expect that individuals receiving the benefits should contribute to the cost of the project, while at the same time, as in other projects, some of the costs are being spread nationwide in the form of financial assistance through low Federal interest rates. A slight increase in taxes or water rates is a small price to pay to obtain water in an arid region. In no way will we oppose this type of financing, but we ask that all alternatives be considered.

Dams.—Immediate action should be taken to enclose Marble Canyon within an enlarged Grand Canyon National Park. We should like to see the same protection afforded to the proposed Hualapai dam and reservoir sites, but we do not oppose the suggestion that, for the present, final decision on this be reserved for future Congressional action. Congress should remove this site from the jurisdiction of FPC at once. We urge passage of Senate bills similar to HR 1305 and HR 1272.

California's 4.4.—We take no position on the subject of a guarantee to the State of California of 4.4 million acre feet per annum of Colorado River water. Probably the best solution would be to pro rate shortages in proportion to Compact allocations. Another possible solution arises out of the offer by northern California communities to augment Colorado River Basin water supplies with 2.5 million acre feet of their surplus water. Why not move this surplus directly to Southern California? Continued Federal assistance in the use of desalting plants on the Pacific coast may lead to the means of relieving the burden on the Colorado River.

National Water Commission.—We favor formation of a national water commission such as is provided for in the bill passed by the Senate (S 20). We hope that the commission will institute a new concept of planning. Before we start diverting rivers and pushing mountains around some wide-ranging studies and thoughtful examination of national goals should be undertaken. To maintain quality of life as we know it the commission should consider more than mere acre-feet of water. If the current minor crisis can threaten Grand Canyon, imagine the threat to scenic resources by the immense crisis that will face future generations. This crisis will bear down inexorably on our progeny if we continue to assume that an increase in our numbers is infinitely possible and inevitably good. Should immigration to resource-short areas be continually encouraged by attempting to import these resources? Quality as well as quantity of life must be considered. There is something paradoxical in our Governor forming a committee to stimulate Arizona's growth at the very moment he was in Washington crying water crisis caused by just such growth in the past. Good planning demands that future generations be left some maneuvering room and choice of alternatives regarding their environment. Their goals may be different from ours. (One such alternative might be encouraging people to move to the water instead of disfiguring the face of the earth to move water to them.)

Therefore we hope that the commission will be dominated neither by agencies responsible for construction of water works nor by the direct beneficiaries of these works. Too often interest in natural beauty decreases in direct proportion to one's economic gain in altering it. We can no longer trust our remaining heritage of natural, or even urban, beauty strictly to engineers. We may ask these good people for advice on how to obtain a given goal, but this goal must be determined by considering more than economic and engineering factors. This will require a commission staffed with persons of great vision and wide interests which hopefully, would make it unnecessary for private citizens to bear the burden of refuting the propaganda of government bureaus and of regional water interests.

Colorado River Basin Fund.—We approve the creation of a basin account from the surplus revenues after payout of currently existing projects. Such a fund could finance implementation of the recommendations of a national water commission. Congressman Reinecke pointed out that revenue from dams as envisioned in HR 4671 (89th Congress) would be too little and too late to finance the elaborate schemes of interbasin river diversions. We see no need at this time for additional sources of revenue for such a fund.

Part 2

We emphasize that we do not oppose CAP. However there are three points not covered above that require elaboration:

1. Last year Lawrence Mehren, then President and Chairman of the Central Arizona Project Association, in his statement "The Central Arizona Project Alternates" (a discussion of a state-financed CAP), proved that CAP can be built without some of the small peripheral units. By eliminating Buttes, Hooker and Charleston Dams and certain other miscellaneous items, a savings of \$124,290,000 could be effected. Such a savings should be equally good for a Federal project. AWWW, being a taxpayers organization, would like to see separate benefit-cost ratios published to justify construction of these items.

2. We should like to see a more definite determination of the manner in which CAP water is to be used. Will it replace, or be used in addition to, present usage? By replacing a portion of our present overdraft it will do nothing to aid our growing economy. By reducing our annual overdraft of groundwater from 3.5 million acre feet to 2.3 million acre feet it merely postpones the future crisis. On the other hand, if added to our present usage, CAP water does nothing to solve our imminent water problems, but does boost the state's economy (stimulating growth and thereby creating the need for even more water). We make this point to emphasize how little is really solved by CAP and how desperate is the need for a national water commission.

3. The report of Drs. Martin and Young in the March issue of the Arizona Review has caused much consternation in certain quarters. The study by these two Professors of Agricultural Economics at the University of Arizona concludes that the investment of a natural resource in the manner proposed by CAP is economically unsound. Although we do not necessarily support their position, we respectfully suggest that Congress give it very careful study in connection with the general principles of water use. Martin and Young spent 4 years and \$200,000 researching their subject and their conclusions should not be lightly dismissed. There have been two rebuttals publicized, one by State Water Engineer W. S. Gookin and the other by Agricultural Economist Dr. George W. Campbell.

Our studies have revealed that the Martin-Young conclusions are neither new nor unique. For example, in 1962 Dr. Andrew Wilson presented a paper before the International Geographical Union entitled "Economic Aspects of Decision-Making on Water-Use in Semi-Arid and Arid Lands," which was published by the United Nations. In 1963 his paper: "Tucson: A Problem in Uses of Water" was published by the American Association for the Advancement of Science in "Aridity and Man." Both of these documents support Martin and Young. Dr. Wilson, a Professor of Geography and Area Development at the University of Arizona, says that the Martin-Young article is a good document with sound conclusions based on excellent source material.

No doubt there is merit on both sides of the argument.

On this subject the following two documents have much pertinent information to contribute:

1. "Arizona Water," U.S. Geological Survey Water-Supply Paper 1648 (1966).
2. "Alternatives in Water Management." A Report of the Committee on Water, Division of Earth Sciences, National Academy of Sciences, National Research Council, Publication 1408 (1966).

Conclusion.—Having reiterated that we do not oppose CAP, it is evident from the foregoing that it is with some reservations that we support CAP. Most important, a CAP with one or more dams on the Colorado River is totally unacceptable to us. Two goals must be considered short range and long range goals. CAP is a short term stop-gap. It can hardly be said to solve our problems. But, since it does give us respite to determine and implement long range solutions, we do support the Administration position that a CAP bill should be enacted now. If it is not built soon it will have no value at all. Meanwhile the only hope we see for an intelligent long range solution lies in a national water commission.

Most important—our support of the CAP is predicated on the proposition that, while it performs a function at this time, dams in the Grand Canyon are totally unnecessary for present purposes. Again we respectfully urge passage of bills (a) authorizing construction of the Central Arizona Project without dams, providing for enclosure of Marble Gorge in an enlarged Grand Canyon National Park, and imposing a moratorium on FPC action on the Hualapai damsite, setting this aside for future Congressional action; and (b) creating a national water commission.

(Subsequent to the hearing, the following explanatory letter was received:)

ARIZONANS FOR WATER WITHOUT WASTE,
Tucson, Ariz., May 8, 1967.

Senator CLINTON P. ANDERSON,
Chairman, Subcommittee on Water and Power Resources, Committee on Interior and Insular Affairs, United States Senate, Washington, D.C.

DEAR SENATOR ANDERSON: When Dr. Robert Rawson, representing Arizonans For Water Without Waste, testified at your Subcommittee hearings last week, Senator Paul Fannin queried him concerning the substance of our organization. For the information of the Subcommittee we submit the following information.

We make no pretense of bigness and hold no grandiose aspirations. But, small and new as we are, we are not without substance. Hardly more than 8 months old and started by a handful of dedicated and loyal Arizonans, we have grown to a point where our following is fairly impressive. Having no formal membership it is hard to estimate the exact size of this following. However some idea can be gauged from certain statistics.

When we first organized we circulated a petition opposing the Grand Canyon dams. We obtained over 600 signatures in a very short time, then dropped the petition when HR 4671 died.

It entailed considerable expense to testify at both House and Senate subcommittee hearings. Some 242 Arizonans covered this entire expense with contributions. We reach into every part of our state. To indicate the coverage, these contributors reside in 22 different communities: Cave Creek, Chinle, Flagstaff, Fort Huachuca, Glendale, Grand Canyon, Green Valley, Kingman, Mesa, Nogales, Phoenix, Portal, Precott, Saint David, Scottsdale, Sedona, Sierra Vista, Sun City, Tempe, Tucson, Youngstown, Yuma.

These Arizonans are fully aware of the position that they are asked to support. That you may understand this, I am enclosing copies of the initial drafts of the statements made by Dr. Rawson and myself, together with the final revised drafts (as submitted to the Senate and House subcommittees). A careful comparison will reveal many major and minor changes. Before the initial draft of Dr. Rawson's statement was circulated it had been revised once, then sent to everyone on our mailing list. We received dozens of suggestions from our supporters. Wherever possible and pertinent, we tried to use not only their thoughts but their actual words. Dr. Rawson then revised his text five times in consultation with five separate members of our committee.

Our mailing list now consists of some 1000 pieces, which would account for at least double that number of citizens. To the best of our knowledge everyone on our list supports our position. There is no doubt that we have reached only a small fraction of those Arizonans who, if they knew of our existence, would support us. We hope to correct this situation soon through advertising in a major national newspaper.

When Senator Gordon Allott was interrogating Lawrence Moss, Senator Henry Jackson said that he would like to have included in the record information concerning the source of support and finances of all organizations testifying at the hearings. We therefore respectfully request that this letter be made a part of the record immediately following the testimony of Dr. Rawson.

Most sincerely,

JUEL RODACK, *Chairman.*

Senator HAYDEN. Mr. Stewart Brandborg, of the Wilderness Society, is the last witness.

Senator FANNIN. Mr. Chairman, I do have some documents here that I would like to introduce into the record, with your permission.

Senator HAYDEN. That may be done.

(The documents above-referred to, follow:)

COMMENTS CONCERNING THE CENTRAL ARIZONA PROJECT

(By R. E. Dennis and M. A. Massengale, Agronomists, University of Arizona)

Recent articles by certain members of the Department of Agricultural Economics, University of Arizona, concerning the feasibility of bringing water from the Colorado River to Central Arizona for the irrigation of field crops deserve comment by Agronomists. These comments will show that important factors

were overlooked by the Economists in their estimate of the situation and recommendations.

A key point concerning the discussion of agricultural uses of Colorado River water centers on the return to crops to be irrigated. Estimates concerning future returns from field crops in Central Arizona were misleading since relatively low crop yields were assumed. Thus, a look at past field crop productivity as a means of evaluating future yield potential is desirable.

Average crop yields for two five-year periods: 1942-1946 and 1962-1966 are shown in Table I. These data indicate the progress being made by Arizona growers. The data in Table I show that the average yields of Arizona field crops have approximately doubled in the past 20 years. Future yields cannot be precisely predicted, but according to all indications the trend will surely be up. The continued upward trend is virtually assured since many Arizona growers are now producing more than double the state average yield for each of the crops listed in Table I. For example, the present yield of alfalfa produced by many growers in Central Arizona already surpasses 10 tons per acre.

TABLE I.—*Comparison of State average yields of major Arizona crops between the years 1942-46 and 1962-66¹*

	Average yield per acre	
	1942 to 1946	1962 to 1966
Cotton (lint).....	398 lbs.	1,049 lbs.
Alfalfa (hay).....	2.6 tons	5.1 tons.
Sorghum (grain).....	1,996 lbs.	4,082 lbs.
Barley (grain).....	1,776 lbs.	3,226 lbs.
Wheat (grain).....	1,326 lbs.	2,628 lbs.

¹ Data obtained from the Arizona Crop and Livestock Reporting Service.

A doubling of the state average yields for cotton, alfalfa, sorghum, barley and wheat by 1986 seems reasonable. This increase in productivity can be expected to double the per acre gross income, even assuming present-day prices. The laws of supply and demand may cause the relative price of food to rise, a factor not considered by opponents of the Central Arizona project in their analysis. Higher yields and higher prices should improve the profitability of crops produced by farmers.

America's agriculture is dedicated to improving quality and increasing yields and efficiency. Abundance of food and fiber has made possible a continued decline in the relative price of the products of agriculture to all people. Now only 18 cents of the wage earner's dollar is required to buy food for his family, in the United States. Many of the foods purchased today were not even on the market 25 years ago. If consumers would be content to buy and eat the same kinds of food used in 1935-1939, only 13 percent of their disposable income would be required.

Demographers state that the world population is increasing at a pace more rapid than that of food production. Soon our nation may be faced with food shortages if production is permitted to lag. Inadequate and starvation diets are common in many parts of the world. The very field crops questioned in the articles written by the authors must be produced to help or at least reduce food shortages that will surely occur. From a moral if not from an economic standpoint, it could well become the responsibility of Arizona to produce all of the food possible.

Estimates that indicate a doubling of crop yields during the next 20 years are conservative. Several examples may be cited to support such a hypothesis. Hybrid barley will soon be grown commercially by Arizona farmers. The yields obtained using the first hybrids will average more than 25 percent above currently adapted and recommended varieties. But this is only part of the story.

Even more significant than the development of hybrid barley is the possibility that Arizona growers, because of climatic conditions that improve cross pollination and final yields, will produce hybrid barley planting seed for the rest of the nation and many parts of the world. When this happens, the use of hybrid barley seed will improve yields and the profitability of barley in other states and nations. The impact of this development on the yield and total production of barley in the United States will make a major contribution in the efforts of American farmers to provide abundant food.

There is reason to believe that we are on the threshold of dramatic yield increases in wheat. In a 1966 variety test in Maricopa County, Sonora 64, a new strain of wheat, produced 75% more grain, than varieties presently grown. New and even better varieties, from the breeding program that produced Sonora 64, have been announced. Clearly, the future of field crops in Arizona is bright.

Continuing research is strengthening basic crops now grown and developing other crops on a more profitable basis. One research development after another has enabled safflower to become an established and profitable oilseed crop in Central Arizona. Hybrid safflower is now becoming a reality. Other examples of high value seed crops could be cited. Such crops will be grown on increasing acreages in the state.

With each achievement, Agricultural Scientists move their goals a little higher. Continuing studies will lead to the development of new varieties that are more efficient in their water use. The work of these Scientists is also discovering other methods to increase significantly the pounds of dry matter produced per unit of water consumed. These studies add a new dimension to the economic returns from water.

The articles criticizing the use of water for feed crops make no mention of the value of these crops in increasing the yields of so called, high-value crops. Feed and forage crops help to conserve the soil, control disease and insect pests, maintain soil structure and fertility, provide feed for the beef and dairy industries, and help to stabilize the manufacture and distribution of fertilizers and other agricultural chemicals. Surely these crops play a vital role in the state's economy and such contributions cannot be overlooked in evaluating them.

The Economists who question the Central Arizona project compare probable water cost from the project with present-day pumping costs for water from wells. Costs of pumping water from wells will increase with each increase in lift. Although initially expensive, the cost of water from the Central Arizona project would not increase nearly as rapidly as water pumped from wells that have declining water levels. Then too, for most wells, the content of undesirable dissolved salts increases with increased pumping depth. For example, a recent survey of a well in the Avra Valley area of Pima County found that water at 500 feet below the soil surface contains a mineral content too high for human consumption. To make such water useable, expensive processing plants will have to be constructed, operated and maintained.

Bringing water to Central Arizona from the Colorado River is agronomically sound. It represents an investment in the future of Arizona. It will mean immediate benefits as well as benefits for succeeding generations.

COMMENTS ON ARTICLE "ECONOMICS OF ARIZONA'S WATER PROBLEMS"

(Published in *Arizona Review* by Frank Wiersma, Acting Head; Allen Halderman, Extension Irrigation Specialist; C. D. Busch, Associate Professor; and Wayne Clyma, Assistant Professor; Department of Agricultural Engineering, The University of Arizona, Tucson, Arizona 85721.)

In view of the widespread controversy relative to the solution of Arizona's water problems and the apparent impact made by the recent article, "Economics of Arizona's Water Problems" by Martin and Young, a few comments on the subject seem appropriate.

1. On a pure cost-return analysis, the economics of the C.A.P. may be questionable. However, it appears the balance can be swung either way, oftentimes depending on the preconceived desires of the analysts. The widespread discrepancy between the values per acre foot cited by the authors for direct and indirect benefits from irrigation and the values presented by the U.S.B.R. illustrate the lack of agreement regarding the economics of the Central Arizona Project. These differences and their underlying assumption should be resolved.

2. Per capita use of water in Arizona and the comparison with national per capita use is a statistic not pertinent to the issue. The per capita consumptive use of water by agriculture is inherently high in all states, but statistically high in Arizona because only a small portion is supplied by direct rainfall. To compare nationally, rainfall must be taken into account. Otherwise, the only significance of high per capita use in Arizona is as an indication that irrigation is required—a long since well established fact.

3. There are a number of intangibles not mentioned, for instance, the reticence of industry to establish new enterprises because of the uncertainty of a plentiful water supply and the willingness of the present population to consider expansion without assurance of additional water.

4. In assessing future municipal water costs the authors did not place a value on cost of compensation to the present owner of the water for his rights; nor did they include the additional costs of conveyance that the municipality must pay. Considering, for instance the value of land as a farm compared to its value as residential development, the value of the water could become speculative and the cost would increase exponentially as the supply declined.

5. The low value the authors have placed on agriculture as one of the state's basic industries and its impact on the other "higher return per acre foot" industries in Arizona is open to question. Other economists have assigned a value of 7 to 14 times the value of the produce from the water. In Table 1, only mining or primary metals could conceivably be unaffected directly by changes in agricultural output. Removing the basic income generating ability of agriculture from the other sections would require a complete re-evaluation of their worth. Part of the stated value constitutes the income generating ability of water used in agriculture. The example of a slaughterhouse cited by the authors is an illustration of this point. This is indeed a high return industry, but dependent on an agricultural product. The selection of location in Tolleson reflects the recent trend in decentralization of processing industries to areas near both the source of input materials and the consumer of output product.

6. The estimate of a 170-year supply of water in storage is based on approximate knowledge of the ground water basins. Even in the Tucson Basin, where intensive investigations have been made, annual recharge and total volume of water in storage are not precisely known. Also, it is strongly suspected that sources at lower depths contain water of poorer and perhaps unacceptable quality for many uses. Movement of water from the source to the point of use would be a major distribution problem involving conveyance costs in addition to pumping costs. The 170-year supply of water assumes no changes in water quality and the economic ability to transport the water to the point of use.

7. In spite of certain fallacies in the article, it should not be refuted or discarded in total. The first reaction of an hydrologist favoring the C.A.P. would likely be, "What does an economist know about water and hydrology?" An economist would have to admit to a limited knowledge of hydrology but could counter with a question of an hydrologist's knowledge of economics. It would seem to us these defensive reactions could best be replaced by an objective evaluation of all aspects by all disciplines working together so all factions of knowledge could be focused toward the solution most beneficial to the people of Arizona.

MARCH 20, 1967.

MEMORANDUM

To : Congressman Morris K. Udall.

From : W. S. Gookin, State Water Engineer.

Subject : Review of articles by Dr. W. E. Martin and Dr. Robert A. Young.

You have asked for a review of the findings by Dr. Martin and Dr. Young relative to economic aspects of the Central Arizona Project. Three articles prepared by the Doctors on this general subject have come to my attention. The first was titled "The Value of Colorado River Water For Agriculture Uses in Central Arizona." The second was titled "Arizona's Water Problem: An Economic Evaluation," and the third was titled "The Economics of Arizona's Water Problem." The last named article appeared in the March 1967 edition of "Arizona Review," published by the College of Business and Public Administration of the University of Arizona in Tucson. The fact it was published does not necessarily indicate that the views expressed in the article are endorsed by the College of Business and Public Administration or by the University.

Each of the articles appears to be a revised version of the preceding one. The conclusion supported by each is the same, namely, that there is no water shortage in Arizona because irrigation is an uneconomic use of water and should be abandoned or drastically curtailed.

In each of the articles, a "typical farm" in Pinal County is analyzed and the income and expenses thereof estimated under alternative conditions. In the first

article this farm was forecasted to operate at a loss of \$4,987 annually without the Central Arizona Project. In the last two articles the farm was forecasted to operate at a profit of \$536 without the Central Arizona Project. This variation demonstrates that under the method of analysis used by the Doctors a few relatively minor changes in assumptions as to prices received and prices paid can radically alter the results of the studies and the conclusions to which the studies lead. Of course, as a practical matter, the "typical farmer" in Pinal County nets more than either figure developed by the Doctors, else the "typical farm" would no longer be in operation.

As an illustration of the wide range of potential results, the typical farm analyzed by the Doctors produced a gross income of \$105,755 in their first article which was modified to \$130,681 in the published article. Were the price projections used by the Bureau of Reclamation applied to the "typical farm" hypothecated by the Doctors, the gross income would be approximately \$170,000.

The most important single assumption fundamental to the Doctors' analyses is that the price of cotton will be 25¢ per pound and remain at that level with no corresponding decline in prices paid and no increase in crop yields. As an indication of the significance of this assumption, were it assumed that cotton would sell for 31¢ a pound as has been assumed in virtually all of the other studies made to date, the net profit to the typical farm hypothecated by the Doctors would be increased by approximately \$18,500 annually. Thus, one modification alone would completely destroy the conclusions drawn from the Doctors' published article.

Doctors Martin and Young, in their most recent article, have analyzed their typical farm on the assumption that the farmer continues to pump from his present supply (an assumption which is in itself unrealistic) or, in the alternate, purchases all of his water from the Central Arizona Project at \$10 per acre-foot at canal side, or, in the second alternate, purchases approximately 40 percent of his water from the Central Arizona Project and continues to pump the remainder. In all of the three above-named alternatives, it was assumed Central Arizona Project water would be delivered to a farm which had no existing distribution system and that it would be necessary to construct, operate and maintain a distribution system and charge the entire cost thereof to whatever portion of Central Arizona Project water was purchased.

In the first analysis, the Doctors found the farm would return \$536 to management and investment in land and improvements if no water were taken from the Central Arizona Project. The farm which took all of its water from the Central Arizona Project would return a minus \$7,024 to management and investment, whereas that which took 40 percent of its water from the project would return a minus \$9,649. The Martin and Young reasoning is that a partial supply from Central Arizona Project results in a greater deficit than either no supply or a full supply because they assume the full cost of the distribution system would have to be borne by a partial supply and that the farmer's pumps which could be abandoned with a full supply would have to be kept operative with a partial supply.

The Doctors also analyzed the typical farm under a fourth hypothesis, namely, that the farm was located in an existing irrigation system and that the Central Arizona Project would furnish an unspecified portion of the total supply. The Doctors concluded that: "No difficulty in the farmers affording to buy the water is envisioned in this instance." However, even under this analysis the Doctors use an involved rationale and conclude that the Project is infeasible.

It is basic to the philosophy the Doctors have adopted to assume that the worth of water to the farmer is no greater than its value when applied to that crop which produces the lowest net income per acre. The conclusion which the Doctors reach is that Arizona could afford to forego the production of such low income producing crops as forage crops. The Doctors, despite their academic qualifications in agriculture, have ignored the importance of low value crop production to the production of high value crops. Certainly they must be aware of the value of forage crops in such items as insect control, disease control, soil building, etc. Yet the Doctors suggest that as an alternate to the Central Arizona Project that Arizona balance its water budget by eliminating production of forage crops.

In the field of hydrology, the Doctors appear to be under the impression that the 1.2 million acre-feet which has been frequently mentioned as the proposed capacity of Granite Reef aqueduct under the Central Arizona Project accounts for all of the uncommitted portion of the 2.8 million acre-feet allocated to Arizona from the mainstream of the Colorado River. As has been well established in the testimony presented in connection with the authorization of the Central

Arizona Project, Arizona's existing and committed mainstream uses from the Colorado River now total 1,230,000 acre-feet. There, therefore, remain for development 1,570,000 acre-feet instead of the 1,200,000 acre-feet cited by the Doctors. Obviously the Doctors are ignorant of the history and rationale underlying the 1,200,000 acre-foot figure.

It is apparent at several places in their articles that the Doctors have not realized that the allocations made by the Supreme Court are in terms of diversions less return flow rather than in terms of gross diversions. A case in point is the discussion which the Doctors wrote concerning uses on areas adjacent to the Colorado River.

It is also readily apparent that the Doctors are uninformed as to the practical aspects of ground water recovery. They allege that at the current "... rate of withdrawal, there will be an economically available supply for some 170 years." In one of their earlier articles they recognize that on 25 percent of the farms in the Central Arizona Project area water tables are declining at the rate of 5.12 feet per year; on 50 percent of the farms, water tables are declining at the rate of 8.15 feet per year; and on 25 percent of the farms, the rate of decline is 12 feet per year. It follows that the Doctors must believe that an increase in pumping lift ranging from 870 to 2,040 feet will not affect the economic availability of the ground water supply. This failure to realize that the farmer doesn't have the alternative of continuing to pump from present depths underlies virtually all of the article.

They have, of course, also ignored the physical limitations of water quality problems alleging these to be exceptions rather than the rule. The Casa Grande area where physical limitations exist and the Eloy area where quality problems are found are but two of several areas which serve to demonstrate that the Doctors have made an unwarranted assumption.

Actually, the figure of 700,000,000 acre-feet used by the Doctors as being economically recoverable is predicated upon the roughest sort of approximations. If this figure is accurate, which is, to say the least, doubtful, it is so highly theoretical and impractical as to be wholly misleading.

Ignoring for a moment the accuracy of the figures for water use and water supply, the water equation for the State of Arizona which the Doctors develop is such an over-simplification of a complex problem as to be extremely misleading. For example, the complete elimination of all of the alfalfa and forage crops grown in the Yuma area would do little to alleviate the water shortages in Maricopa or Pinal Counties. Nevertheless, implicit in the water equation and the conclusions reached by the Doctors is the assumption that just that would happen.

Of course, the figures themselves are subject to considerable question because they are a composite of approximations which are at least to some extent unlike. For example, the one million acre-foot figure used by the Doctors as present net diversions from the Colorado River includes some portion of unmeasured returns. Some idea of the inexactitude of these figures becomes apparent when it is recognized that the total acreage cropped in Arizona has not exceeded 1,200,000 acres since 1961. The Doctors assume 6,000,000 acre-feet annually as the total consumption by cropland irrigation. Thus it follows that there is an assumed consumption in excess of 5.0 acre-feet per acre. This is inconsistent with the assumption that deliveries to the farms in Central Arizona are 4.0 acre-feet per acre which obviously could not be 100 percent consumed. It is certainly known to the Doctors that the croplands in the higher elevations receive less water than in central Arizona and that while the croplands in the Yuma area receive more, the irrigated area in Yuma County is less than 200,000 acres and not all of the water delivered to the farms in that area is consumed either.

The Doctors would seem to criticize Arizona by the allegation that the annual per capita consumption of water "ranks among the highest in the nation, if not in the world." One wonders whether the Doctors would expect a low annual consumption in a desert area. Their articles are further misleading in that they allege the use of water in Arizona to be "about 4,700 gallons per person per day, some three times the average for the United States." To derive this figure they have divided $6\frac{1}{2}$ million acre-feet by the number of people in Arizona. The absurdity of reducing irrigation use to a per capita use should be obvious. However, even though such a reduction were logical, they have failed to recognize that irrigation wherever practiced, is a supplement to rainfall in the production of crops. Therefore, if we should include irrigation water in determining the per capita consumption in Arizona, we should increase that per capita consumption

by that portion of the consumptive use of crops supplied by rainfall and similarly should include irrigation use when analyzing other areas and add to the per capita consumptive use in other areas that portion of the consumptive use by crops which is supplied by rainfall. The figures thereby derived are obviously meaningless, as is the 4,700 gallons per person per day.

In evaluating the economic aspects of the Central Arizona Project, the Doctors have adopted a new approach. They have developed what they term "multipliers" which they apply to the net profit from the farm to determine both the direct and indirect economic benefits to the agricultural sector of the economy resulting from water. The end result of the application of such multipliers in this case is to show benefits that are much lower than the benefits derived by standard methods of benefit evaluation. None of the articles present detailed data as to the derivation of the multipliers, although references are made to publications which would presumably clarify the process and rationale. Regardless of the method whereby the Doctors have derived their multipliers, it would seem to be wholly illogical to apply the multipliers designed to evaluate the indirect benefits to the agricultural sector of the economy against the net profit resulting from the use of water for irrigation. Under the Doctors' procedure if a farm were to break even, that is, show no profit and no loss, it would make no direct or indirect contribution to the agricultural sector of the economy. The fallacy of this basic premise should be self-apparent when it is recognized that a farm at the break-even point could well form the basis for the support of rather extensive processing industries, service industries, schools and tax base.

In their published article, the Doctors question whether large acreages have actually been abandoned by reason of water shortage. They point to statewide statistics to support their doubts. One would assume that the Doctors would be aware that the underground water resources of Arizona are not wholly located within one freely connected basin. There are within the state some relatively small and relatively independent basins which have been progressively developed over recent years so that new areas may be brought into cultivation in such regions as the Harquahalla Valley, the Theba area, Moon Valley, and numerous others, while existing areas in Pinal County and Maricopa County are going out of production as the water supplies become (a) exhausted, (b) too deep to permit economic pumping, or (c) too saline for further utilization. It is unfortunate that the Doctors did not have the opportunity to accompany the House Committee in 1965 when they toured some of the abandoned irrigated areas in Arizona. Perhaps they would then have understood that the farmer who loses his farm and home draws little comfort from the fact that another farmer has developed an equivalent acreage in a new hitherto untapped groundwater basin.

The entire procedure, rationale and principles embraced by the Doctors, if applied elsewhere in the United States, would demonstrate that agriculture in general should abandon the production of low income producing crops such as feed and food grains and forage, and that irrigated agriculture should not be practiced not only in Arizona but in any other state. In fact, the Doctors are reputed to have claimed to various individuals at various times that they have applied their analysis to the Central Valley Project and to the California State Water Plan and reached a conclusion that neither of these developments are economically feasible.—W. S. G.

COMMENTS ON "THE ECONOMICS OF ARIZONA'S WATER PROBLEM"

(By Dr. George W. Campbell, Agricultural Economist, the University of Arizona, Tucson, Arizona, March 27, 1967)

The article "The Economics of Arizona's Water Problem" by Drs. Young and Martin published in the "Arizona Review," March 1967, is the most recent of several articles and manuscripts authored and/or co-authored by them on the same general subject—the economics of water distribution and use in desert and semidesert countries.

Any valid economic analysis (1) describes the *problem* that makes the analyses desirable, (2) sets forth possible alternative courses of actions that might *solve* or *alleviate* the problem, and (3) evaluate the probable consequences of alternative courses of actions.

PROBLEM ACCORDING TO DRS. YOUNG AND MARTIN

According to the authors the problem is that the means of development and allocation of water in Arizona as proposed in the Central Arizona Project will

not be those that will bring the most benefits to Arizona's population. The authors maintain that Arizona's water should be put to uses "which would maximize the aggregate (total) income of the State's population." In addition they would "require that no one segment of the population should gain an unfair advantage over any other segment in the distribution of income gains."

ALTERNATIVE SOLUTIONS ACCORDING TO DRS. YOUNG AND MARTIN

The present "target" of the author's economic analyses is the proposed construction of the Central Arizona Project. The authors assert that implementation of the CAP would subsidize farmers at the expense of the non-farmers. They conclude that "maximum economic growth" for Arizona (and therefore the most benefits to its population) can be obtained by *not* implementing the proposed Central Arizona Project, but by continuing present policies that reallocate present water supplies through "the dollars and cents discipline of the market place" and to "investigate the possibility of using the water (Arizona's Colorado River water requirement) near its source in the river." The authors refer to this as a "Western Arizona Project."

PROBABLE CONSEQUENCES OF THE VARIOUS ALTERNATIVES ACCORDING TO DRS. YOUNG AND MARTIN

The CAP.—The authors conclude that implementing the Central Arizona Project will result in either (1) subsidization of farmers in central Arizona by municipal and industrial water users and/or other Arizona residents or (2) farmers using CAP water will go bankrupt, (3) that cities would not be acting in the best interests of their citizens in buying water from the CAP, (4) that it is doubtful that the CAP "can generate economic benefits to the State in excess of costs entailed by its construction and operations," and (5) that "two thirds of the overdraft would remain, the groundwater-level would continue to fall and the basic 'water crisis' would be with us just as it is now."

Continue Present Practices and Abandon the CAP.—According to Drs. Young and Martin the present practices of allowing the "market" to determine the uses of water in Arizona will continue to allocate water "to its most productive use for the highest rate of economic growth."

(1) Surface water will continue to be used by agriculture until the water is needed for industrial and municipal uses. These users will buy the water away from agricultural users because they can and will pay a much higher price for the water.

(2) Groundwater will continue to be pumped for agricultural uses "as long as farmers can afford to pay the price."

(3) Total agricultural acreage will decline as land is taken out of forage and feed-grain crops.

(4) High-valued agricultural and domestic uses will continue to use pumped water until higher valued uses need this groundwater, at which time they "will bid it away just as they have done with surface waters."

A "Western Arizona Project."—Drs. Young and Martin state "there are no good data relative (pertinent) to this alternative." They do, however, say that "possibilities for further (agricultural) development include (1) the Yuma desert (where water requirements per acre are extremely high but which has a potential for citrus production); (2) areas adjacent to present irrigation projects (the Wellton-Mohawk in particular); (3) lands in the Cibola-Ehrenberg district, and (4) some of the valleys and plains which lie from 50 to 80 miles inland from the river (Cactus Plain, Ranegras Plain, McMullin and Butler Valleys). At least ten townships or 230,000 acres appear promising within these areas—more than enough to absorb the one million acre-feet of available water.

"As in central Arizona barley, grain sorghum and forages would be marginal users of water. But surely the cost of delivering water to these crops would be less than with the Central Arizona Project. Whether a 'Western Arizona Project' would actually provide benefits above its cost would require further investigation."

PURPORTED PROOFS ACCORDING TO DRS. YOUNG AND MARTIN

Drs. Young and Martin arrive at the above conclusions by purporting to prove (1) that the CAP is not necessary to "maximize the aggregate income of the State's population" since (a) there is enough underground water economically available at the present rate of withdrawal to sustain continued economic growth for 170 years without importing water (to Central Arizona) and (b)

that the desired economic growth can be achieved by continuing present practices of reallocating water supplies to those uses which generate the most "Personal Income" per acre-foot of water and (2) that the CAP will not pay its own way unless the farmers are subsidized by municipal and industrial water users [this "violates" the authors' "requirement" that "no one segment (irrigated agriculture) * * * should gain an unfair advantage over any other segment."]

Let us now examine these purported "proofs" and their underlying assumptions as presented by Drs. Young and Martin and determine whether they are sufficiently valid to support their conclusions.

Conclusion No. 1—Construction and operation of the Central Arizona Project is not necessary for the maximization of the aggregate income of the State's population.

According to Drs. Young and Martin there is enough underground water economically available to support a "desired" level of economic growth for 170 years at the present rate of net withdrawal.

Let us accept as a fact (even though proof may be lacking to support this "fact") that this *quantity* of water does exist. If the authors' "proof" that this water will support economic growth is to be valid, they have to assume that it is of sufficient *quality* (or can be economically made so) to be used for agricultural production and for municipal and industrial uses. There is considerable evidence from authoritative sources to indicate that the *quality* of water and not the *quantity* of water will likely be a severe limiting factor to its use as the depth to water increases. Or they will have to assume that sufficient water of sufficient quality can be economically transferred to the areas where economic growth is required.

There is presently no proven basis for either of these assumptions. It is therefore apparent that while the *quantity* of water may be sufficient to support the authors' conclusions it has yet to be proven that the economically available water would be of sufficient *quality* to warrant such a conclusion. In the absence of proof on the *quality* as well as the *quantity* of the economically available water the conclusion that a sufficient supply of *usable* water exists to support 170 years of economic growth is not valid.

According to Drs. Young and Martin the desired economic growth of Arizona can be achieved (without the CAP) by continuing present practices of allowing sales of water to the highest bidders. The authors' (on page 17) write that "with the exception of current plans for the Colorado River water under the Central Arizona Project, proper allocations are being made today." This statement appears to be a direct contradiction of the authors' statement on page 9 which states "They (most people in the arid Southwest) have felt that its (water) development and allocation should not be subject to the dollars and cents discipline of the market place." The only way one can eliminate the contradictions is to assume (1) that most people in the Southwest act contrary to their feelings or (2) that Arizona residents are, in this matter at least, different from other people in the Southwest.

Even if there were 170 years supply of water of suitable quality economically available Drs. Young and Martin would have to prove that this water would, in the absence of the CAP, be reallocated through the free market-for-water system in such a way as to "maximize the aggregate income of the State's population."

Drs. Young and Martin "prove" that such reallocation is presently being accomplished (and assume it would continue to be accomplished in the future) by using an "Input-Output Model" that purports to show the "Personal Income" generated per acre-foot of water intake by each major sector of the Arizona economy. Drs. Young and Martin assume that maximizing the Personal Income of Arizona's population is the criterion for the "best," or at least the "desirable" economic growth. Their economic analyses are designed to determine which of the available alternative courses of action will result in the greatest aggregate "Personal Income" for Arizona's population.

According to Drs. Young and Martin the following table (Table 1 in the article "The Economics of Arizona's Water Problem") shows the dollars of "Personal Income" per acre-foot of water generated by the various sectors of the Arizona economy. Although many competent agricultural economists doubt seriously that maximization of total personal income of a state's population is the valid criterion of the "best" economic growth of the state, let us assume in this instance that it is the valid criterion. Let us further assume for the moment that Table I does indeed accurately portray the capacities of the various sectors to generate "Personal Income."

TABLE I.—*Personal income per acre-foot of water intake in Arizona sectors and rank of each, 1958*¹

Sector	Dollars of personal income per acre-foot ²	Sector rank ³
Food and feed grains.....	14	10
Forage crops.....	18	9
High value intensive crops ⁴	80	8
Livestock and poultry.....	1,953	6
Agricultural processing industries.....	15,332	3
Utilities.....	2,886	5
Mining.....	3,248	4
Primary metals.....	1,685	7
Manufacturing.....	82,301	1
Trade, transportation, and services.....	60,761	2

¹ Adapted from Anilkumar G. Tijoriwala, William E. Martin, and Leonard G. Bower, "The Structure of the Arizona Economy; Output Interrelationships and Their Effects on Water and Labor Requirements. Pt. I," "The Input-Output Model and Its Interpretation and Pt. II, Statistical Supplement," Arizona Agricultural Experiment Station Technical Bulletins 180 and 181 (forthcoming), 1967.

² Personal income is here defined to include wages and salaries, rents, profits and interest.

³ Ranked from highest to lowest value added.

⁴ Includes cotton, vegetables, citrus, and other fruits.

Even if we do assume that the above claims of Drs. Young and Martin are true there are basic underlying *incorrect assumptions* that destroy the validity of this "Input-Output Model" and the conclusions resulting from analyses depending upon the validity of the "model."

Drs. Young and Martin have *incorrectly assumed* that each sector can continue to exist and create "Personal Income" even though contributions of other sectors are drastically reduced—perhaps even to zero. Specifically, they assume that drastic reductions in the Food and Feed Grains and the Forage sectors of the economy will only reduce, but not eliminate the "Personal Income" generating capacities of the agricultural processing industries. Drs. Young and Martin purport to "demonstrate . . . that economic growth can continue in Arizona without importation of water by citing the following example . . ." Recently, a large meat processing company decided to build a livestock slaughter facility in Tolleson. Their water demands seem large—2 to 2.25 million gallons a day or about six to seven acre-feet. However, in a year this plant would use no more water than would, for example, 600 acres of sorghum. Six hundred acres of sorghum generate about \$58,500 per year of gross income and about 9,000 man-hours (or perhaps three and one-half man-years) of employment. The work force contemplated for the processing plant is about 225 employees, or some 65 times as large as the sorghum crop. The relative volume of income generated by the proposed plant would probably be even larger since wages in such employment are greater than in farming. Furthermore, much of the water used in this plant would not be lost in the process, as it would be in agriculture, but would be available for use again in crop irrigation after being suitably processed.

Drs. Young and Martin do not take into account what would appear to be an obvious fact: that the continued existence of a plant to slaughter cattle depends directly on the existence of the feeder cattle industry in the area, and that the feeder cattle industry depends for its existence on the feed grains and forages produced in the area.

The relationship is simple indeed: No feed grains and no forage=no cattle feeding industry. No cattle feeding industry=no cattle to slaughter. No cattle to slaughter=no slaughter plant. No slaughter plant=no "Personal Income" generated by the plant.

Drs. Young and Martin, however, by using their "Input-Output Model" relationships conclude that feed grain and forage crops can be drastically reduced, or even eliminated by being "outbid" by "higher" water users without affecting the "Personal Income" generating capacity of the Agricultural Processing Industries—specifically that of the new cattle-slaughtering facility now under construction in Tolleson.

The "Input-Output Model" also assumes that no direct relationship exists between the production of food and feed grains and forages and the production of high value intensive crops. Drs. Young and Martin are agricultural economists. Surely they are aware that actual farming practices as well as a great deal of scientific knowledge, furnishes evidence to support the contention that crop rota-

tion practices *do* beneficially affect the production of the high value intensive crops.

Drs. Young and Martin, however, by using the "Input-Output Model" relationships conclude that drastically reduced production of food and feed grains will not adversely affect the production of high value crops.

This conclusion is based, at best, on an *unproven* assumption—and perhaps on an *incorrect* one. Once again the "model" has not accurately portrayed the existing relationship between two of the sectors.

The failure of the "Input-Output Model" to portray accurately the interdependence that exists in real life among various sectors of the economy invalidates conclusions resulting from any analysis that depends on relationships erroneously portrayed by the model.

We must therefore conclude that the conclusions resulting from use of such an incorrect "model" cannot be proven valid by analyses depending on the use of the "Input-Output Model" for their validity.

Let us, however, assume for the moment that the "Input-Output Model" does, in fact, actually portray the real life relationships existing among the various sectors of the economy, and examine the validity of the assumption of Drs. Young and Martin that "Personal Income" generated is the sole indicator of economic growth.

Drs. Young and Martin define "Personal Income" as "the sum of wages, rents, profits, and interest received by persons in each sector of the economy."

Let us assume the following:

1. A New Mexico farmer and his three grown sons have inherited an abandoned farm in Arizona. The farm has 1,000 acres of tillable land.
2. They sell their farm in New Mexico for \$400,000 and move to Arizona.
3. They "rebuild" the Arizona farm and operate it at *no profit* for 15 years, then abandon the farm and go back to New Mexico.
4. They did all the work themselves and never borrowed any money. They had \$100,000 of the original \$400,000 left when they returned to New Mexico.
5. While in Arizona, they paid taxes of \$50,000, paid \$60,000 for machinery, \$15,000 for groceries, and \$3,000,000 for other items—mostly farm—production input items.

This farmer and his three sons made *no profit*, neither paid nor received any *wages, rents, and/or interest*.

According to Drs. Young and Martin, these men had received no "Personal Income" and therefore had made no contribution to the economic growth of the State of Arizona.

The generation of "Personal Income" as defined above by Drs. Young and Martin is obviously an erroneous indicator of the contributions made to the economic growth of the State by individuals, business firms, and/or various sectors of the economy. Its use in analyzing such contributions can lead only to incorrect and misleading conclusions. Any conclusions derived from its use would be invalid.

Conclusion No. 2—The CAP will not pay its own way unless the farmers are subsidized by municipal and industrial users of CAP water.

In arriving at this conclusion Drs. Young and Martin ignore the fact that much of the anticipated revenue resulting from the CAP would come from the sale of surplus electrical power (surplus to CAP pumping requirements) generated by a dam (or dams) in the main stream of the Colorado River. Some knowledgeable people believe that proceeds from the sale of such power would be great enough to allow CAP water sales to agricultural and other users at prices comparable to what users are now paying for water.

There is no evidence presently available to indicate that any responsible person advocates the construction of the Central Arizona Project if the means of generating such surplus electrical power is not an integral part of the CAP.

Any valid and meaningful analysis of the ability of the CAP to "pay out" without bankrupting agricultural users of CAP water and "swindling" municipal users cannot be made if—CAP—generation and sale of surplus electrical power is not considered in the analyses.

There is nothing of record that Drs. Young and Martin have given any consideration to this essential feature of the CAP in their analyses. For this reason alone any conclusions they make from their analyses would be seriously suspect.

Drs. Young and Martin have concluded that farmers in "Central Arizona" cannot afford to pay the proposed cost of CAP water for irrigation.

They base this conclusion on their analysis of the costs and returns of a "typical" farm in central Arizona.

They claim that the characteristics of this farm and its financial costs and returns are "based on a 1964 survey of over 600 Arizona farmers under the project."

In actuality, their "typical central Arizona farms" appear to be based on a survey of 120 farms in Pinal County and not on a survey of 600 farms under the project.

Even if one assumes that all prices, yields, costs, and returns data used in the analysis of the "typical farm" described in the article "The Economics of Arizona's Water Problem" were correct, no valid conclusions could be drawn from their analyses because (1) a "typical" Pinal County farm is not a "typical" farm for the area proposed to be served by the CAP and (2) the "typical Pinal County Farm" as described in various articles and manuscripts by Drs. Young and Martin is so different from one article to the next that one must conclude that Drs. Young and Martin have great difficulty in deciding what is a "typical Pinal County farm."

The following are descriptions of two "typical Pinal County farms" according to Drs. Young and Martin:

THE "TYPICAL" PINAL COUNTY FARMS OF DRS. ROBERT YOUNG AND WILLIAM MARTIN

Drs. Young and Martin in two separate reports presumably based on the same research data described the characteristics of and analyze the costs and returns for the typical central Arizona (Pinal County) farm. In the article "The Value of Colorado River Water for Agricultural Uses in Central Arizona" this "typical" farm seems to bear little relation to the "typical" central (Pinal County) Arizona farm described and analyzed in the article "The Economics of Arizona's Water Problem" printed in the March 1967 issue of the *Arizona Review*. These characteristics and results of Drs. Young and Martin's analysis are shown below.

Characteristics of typical Pinal County farm (according to Drs. Young and Martin)

Item	As described in "The Value of Colorado Water for Agricultural Uses in Central Arizona"			As described in "The Economics of Arizona's Water Problem"		
Total cropped acres.....	480			700		
Acres in cotton.....	264			273		
Percent of cropped acres in cotton.....	55			39		
Acres in Alfalfa.....	43			112		
Percent of cropped acres in alfalfa.....	9			16		
Acres in barley.....	120			175		
Percent of cropped acres in barley.....	25			25		
Acres in sorghum.....	53			140		
Percent of cropped acres in sorghum.....	11			20		
Pumping lifts in feet.....	210	295	510	315	460	540
Variable pumping costs per acre-foot.....	\$4.50	\$8.50	\$11.00	\$7.05	\$10.30	\$12.08
Water used per acre (acre-feet):						
Cotton.....	5.0	5.0	5.0	6.0	5.0	5.0
Barley.....	2.5	2.5	2.5	3.0	2.5	2.0
Alfalfa hay.....	4.25	4.25	4.25	6.1	6.1	6.1
Sorghum grain.....	2.75	2.75	2.75	3.3	2.75	2.2
Total dollar income per acre:						
Cotton.....	\$330.10	\$330.10	\$330.10	\$320.54	\$310.46	\$310.46
Barley.....	77.55	77.55	77.55	91.27	85.00	77.80
Alfalfa hay.....	112.75	112.75	112.75	159.50	159.50	159.50
Sorghum grain.....	84.05	84.05	84.05			
Total number variable costs:						
Cotton.....	212.93	233.53	246.37	187.01	193.53	200.78
Barley.....	50.36	60.55	68.91	59.47	62.97	60.04
Alfalfa hay.....	79.95	99.21	111.26	126.56	146.27	154.17
Sorghum grain.....	58.28	69.52	76.55	70.92	74.78	71.14
Income in number over variable costs:						
Cotton.....	117.17	96.57	83.73	133.53	116.93	109.68
Barley.....	27.19	17.00	10.64	31.80	22.03	17.76
Alfalfa hay.....	32.80	13.54	1.49	32.94	13.23	5.33
Sorghum grain.....	25.79	14.53	7.50	33.32	22.64	17.78
Return to management and investment in land and improvements (per acre of cropped land).....	35.56	14.71	1.21	18.48	.77	-7.09
Management return per cropped acre (with land and improvements per acre equals \$500 and interest at 5 percent).....	10.56	-10.29	-23.79	-6.52	-24.23	-32.09

Let us assume for the moment, however, that the "typical Pinal County" farm described in the article "The Economics of Arizona's Water Problem" is indeed representative of the farms under the project and that all data and assumptions used in the analysis by Drs. Young and Martin are correct.

According to Drs. Young and Martin this farm even with the least amount of assumed pumping lift (315 feet) would have a *minus* \$6.52 per acre as the returns to management, and under the assumed 540 feet of lift would have a *minus* \$32.09 per acre as the returns to management.

Even the most enthusiastic and optimistic supporter of the CAP knows it will be at least ten years after its construction begins before it will be operational.

It is indeed questionable that this "typical farm" could remain financially solvent under these conditions and be an operating farm under the CAP.

It is also questionable that any farm with a negative return to management could realistically be considered as "typical" in an area where the net farm income per farm is almost twice as great as net farm income per farm in the state whose farms have the second greatest net farm income per farm in the U.S.

I agree with Drs. Young and Martin that it is important to examine the economics of Arizona's water problems.

I believe the results of these "examinations" should be made available to the people of Arizona—whether such results are "favorable" or "unfavorable" to the construction and operation of the Central Arizona Project.

I do not believe that the article "The Economics of Arizona's Water Problem" by Drs. Young and Martin is a valid report of a valid "examination" of the economics of Arizona's water problems.

STATEMENT OF STEWART M. BRANDBORG, EXECUTIVE DIRECTOR, THE WILDERNESS SOCIETY, WASHINGTON, D.C.

Mr. BRANDBORG. I am Stewart M. Brandborg, executive director of the Wilderness Society, a national, nonprofit conservation organization with some 36,000 members. Our headquarters are at 729 15th St. NW., Washington, D.C. The broad purpose of the society is to increase knowledge and appreciation of wilderness and to support measures for its protection and appropriate use.

The bills now under the committee's consideration for the development of the Lower Colorado River contain proposals and provisions which directly affect wilderness resources of the national park and national wilderness preservation systems.

In the past, the society's interest in these measures has centered on the consideration of the impact upon park and wilderness lands of the proposed Marble Canyon and Bridge Canyon Dams. In our study of these proposals we have been keenly aware of the critical water needs of States in the Lower Colorado River Basin, and it is our hope that these may be met with alternative projects and programs that do not impinge upon the wilderness lands of either the national park system or the national wilderness preservation system.

Passage of S. 1013 and S. 1004, through their provisions for the central Arizona project in the absence of authorizations for the Marble Canyon or Bridge Canyon (Hualapai) projects, would relieve our previously expressed concerns about the impact of these dams upon the Colorado River and the incomparable wilderness features of the Grand Canyon, and both Grand Canyon National Park and Grand Canyon National Monument.

In earlier hearings, the society has opposed proposals for authorizing either of these dams in the Grand Canyon. Some of the present measures before Congress have eliminated the authorization for the Marble Canyon unit while changing the name of the Bridge Canyon unit to Hualapai Dam and Reservoir.

I wish to state that the Wilderness Society firmly opposes both of these projects and that our previous opposition to Bridge Canyon Dam can be applied to the Hualapai project as provided for in some of the measures before this committee.

The society supports and commends provisions of S. 1013 and S. 1004 which provide alternate sources of power for the central Arizona project without calling for the construction or authorization of either the Hualapai (Bridge Canyon) or Marble Canyon Dams in the Grand Canyon. We also wish to endorse the provisions of S. 1013 that would withdraw licensing authorities of the Federal Power Commission (under pt. I of the Federal Power Act) for these projects.

In earlier testimony we expressed concern for the water needs of the people of the Southwest. We wish to reemphasize our concern about these needs and to encourage alternative programs to meet these requirements without the construction of dams within the Grand Canyon or on the Gila River that would violate the integrity of the national park system or the national wilderness preservation system. If the National Water Commission, as proposed in the Senate's Act, S. 20, can function as outlined, it is hoped that Congress may find it unnecessary to authorize any dam which would invade the boundaries of any dedicated lands of either the national park or the national monument. The society supports the proposal for the National Water Commission and urges that its studies be comprehensive and of national scope and that they fully consider recreational, scenic, fish and wildlife, esthetic, and wilderness values.

The society does not oppose proposals for the central Arizona project in the absence of authorization for dams in the Grand Canyon if there can be a definite prospect of downstream alternatives to the Hooker Dam in New Mexico. The Wilderness Society's interest in the proposed Hooker project stems from a continuing concern over a period of many years for protection of the wilderness of the Gila Wilderness Area and the Gila Primitive Area.

Establishment of the Gila Primitive Area in 1924 marked the beginning of the preservation of American wild lands in the national forest. In 1964, upon passage of the Wilderness Act, the Gila Wilderness Area became a unit of the national wilderness preservation system. Against this background, and the society's long-established interest in preserving this unit of national forest wilderness, we have attempted to evaluate both the Hooker Dam proposal and alternative projects. In working with our cooperators in the Colorado River States, we have found relatively little in the way of current detailed technical information presently available on either the Hooker Dam or possible downstream alternatives.

There is apparently no detailed engineering or feasibility study to provide documentation to Congress and the public for the Hooker project, or to furnish detailed information and specifications for this dam and its facilities.

The proposed site for Hooker Reservoir would cover a strip of the primitive area about one-half-mile wide to the west of the Gila Wilderness Area. Water backed up in the Gila River by the high Hooker Dam—285,000-acre-foot capacity—a structure rising 330 feet above the streambed—would flood this strip of the primitive area and over 7 river miles of the canyon within the wilderness area proper.

The Hooker Reservoir would also back into Turkey Creek and into the wilderness area within its watershed. This provision of the bills before the committee would also authorize a dam of lower height at the Hooker site which would furnish 98,000-acre-feet capacity in a reservoir that would back approximately 4 to 5 miles up the Gila River Canyon into the wilderness area.

Both of these intrusions of the reservoir upon the wilderness designations and wilderness boundaries in the future and would represent erosion of the protection assured these areas by the Wilderness Act. It is our strong recommendation, therefore, that there be full study and exploration by the committee of an alternative location of this project downstream from the proposed Hooker site at the Connor site.

Located near Redrock, N. Mex., only 26 miles downstream from the proposed Hooker Dam, the Connor project would intercept floodwaters from several drainages downstream from Hooker—Mangas Creek, Duck Creek, Mogollon Creek, Bear Creek, and tributary canyons in Redrock Canyon. Because of the substantially larger drainage area above it, the Connor Dam would more than double the flood water catchment capacities of the proposed Hooker project.

The uncontrolled flow of these downstream tributaries of the Gila River was a major source of the past catastrophic floods which were responsible for serious losses to the communities of Virden and Redrock.

The narrow canyon gorge of the "Gila middle box" above the Connor Dam site compares favorably in its storage potentials to the Gila Gorge within the wilderness area. Because of this narrow gorge, a Connor Dam of about 240 feet in height—approximately 85,000-acre-feet capacity—could be built at either of the Connor sites with evaporation loss that would be about the same as those of the Hooker project of comparable capacity.

This reservoir would cover little farmland, but would serve extensive downstream irrigation districts below Redrock, N. Mex. Almost all of the lands covered by such a reservoir lie within the Gila National Forest in an area where reservoir fishing, boating, and the fullest possible mass recreation uses and access could be provided for nearby communities of New Mexico and Arizona.

We strongly urge that the Connor site be studied to fully determine its flood control, reclamation, recreation, and other benefits and that, with the establishment of its feasibility, be constructed as a practical and acceptable means of preventing intrusion upon the Gila Wilderness Area and the national wilderness preservation system.

We would recommend also that the committee request impact studies of the Hooker project from the Department of Agriculture to show the effect of this project upon the Gila Wilderness and Primitive Areas and that full and detailed feasibility data and project specifications for the Hooker and Connor projects be obtained for the public record and for needed comparisons and consideration of the Connor Dam as an alternative.

Thank you for the privilege of presenting this statement.

Senator JACKSON. Thank you, Mr. Brandborg. We appreciate having your statement. I take it that your headquarters is here in Washington, D.C.

Mr. BRANDBORO. Yes, sir.

Senator JACKSON. And you are the paid executive director of the Wilderness Society; is that correct?

Mr. BRANDBORG. Yes, Mr. Chairman.

Senator JACKSON. Senator Fannin?

Senator FANNIN. No questions.

Senator JACKSON. No questions.

We appreciate having your statement. Your ideas will certainly be helpful in trying to go through this record and analyzing the various proposals that have been made here. We are sorry you had to wait so long.

Mr. BRANDBORG. Thank you for the opportunity.

Senator JACKSON. By the way, I notice that the figures we have here is that 77 acres out of a total of 1,130 acres would be in the primitive area. Just 77 acres would be in the primitive area and 110 would be in the wilderness area.

Mr. BRANDBORG. I think there is some variation.

Senator JACKSON. That is a smaller project. That is a 98,000-acre-foot reservoir. The 265,000-acre-foot reservoir would have 141 acres in the primitive area and 480 in the wilderness.

Mr. BRANDBORG. I believe the figures are approximately correct. We have had great difficulty, Mr. Chairman, in getting data on the impact of the Hooker project upon the Gila Wilderness Area. Most of the information that we have has been obtained through the inquiries and research of our local members and people within the Colorado River States.

Senator JACKSON. Thank you very much.

The Chair wishes to announce that the record will remain open for 10 days. Some statements, I am certain, will be made by people who were unable to be present, and we want to provide an opportunity for those who did not present a statement to present them. There also may be additional comments from individuals who testified, and who want to supplement their statements.

In addition, individual members have questions undoubtedly that they may wish to submit to appropriate Departments or individuals for response, and that will give us time to obtain that information.

The committee will stand adjourned, with that understanding.

(Whereupon, at 5:10 p.m., the committee adjourned.)

APPENDIX

(Under authority previously given, the following statements, communications, and resolutions were ordered printed:)

UPPER COLORADO RIVER COMMISSION,
Salt Lake City, Utah, February 25, 1967.

HON. CLINTON P. ANDERSON,
*U.S. Senate,
New Senate Office Building,
Washington, D.C.*

DEAR SENATOR ANDERSON: Enclosed is a resolution adopted unanimously by the Upper Colorado River Commission at an adjourned annual meeting assembled in Cheyenne, Wyoming on February 22, 1966.

By means of this resolution the Upper Colorado River Commission is requesting the Second Session of the 89th Congress to appropriate sufficient funds for a construction program of at least \$7,500,000 for fiscal year 1967 for continuing construction of the Bonneville Unit of the Central Utah Project, a participating project of the Colorado River Storage Project.

Sincerely yours,

IVAL V. GOSLIN, *Executive Director.*

[Enclosure]

RESOLUTION BY UPPER COLORADO RIVER COMMISSION

IN SUPPORT OF APPROPRIATIONS OF FUNDS BY THE 89TH CONGRESS, SECOND SESSION,
FOR CONSTRUCTION OF THE BONNEVILLE UNIT OF THE CENTRAL UTAH PROJECT

Whereas, the Bonneville Unit of the Central Utah Project was authorized for construction as a participating project of the Colorado River Storage Project by the Colorado River Storage Project Act of 1956 (70 Stat. 105), ten years ago; and

Whereas, the Central Utah Project will provide municipal, industrial, and irrigation water to a seven-county area of the State of Utah which includes approximately sixty percent of the population and assessed valuation of the State; and

Whereas, the economy of the State of Utah will be seriously jeopardized if adequate water supplies are not made available to meet rapidly expanding municipal and industrial requirements within the anticipated construction schedule as projected in the Bureau of Reclamation's Definite Plan Report: Now, therefore, be it

Resolved, That the Upper Colorado River Commission at its Adjourned Annual Meeting convened in Cheyenne, Wyoming on February 22, 1966, respectfully requests the United States Congress to appropriate sufficient funds for a construction program of at least \$7,500,000 for fiscal year 1967 in order that the construction of the Bonneville Unit of the Central Utah Project may proceed with a sound construction program capable of meeting the rapidly developing water requirements of the State of Utah; be it further

Resolved, That copies of this resolution be transmitted to the President of the United States, Director of the Bureau of the Budget, Secretary of the Interior, Commissioner of the Bureau of Reclamation, Members of the Congressional Delegations of the Upper Basin States, Members of the Congressional Appropriations Committees, and other interested parties.

CERTIFICATE

I, Ival V. Goslin, Executive Director of the Upper Colorado River Commission, do hereby certify that the above Resolution was unanimously adopted by the Upper Colorado River Commission at an Adjourned Annual Meeting held at Cheyenne, Wyoming on February 22, 1966.

Witness my hand this 25th day of February, 1966.

IVAL V. GOSLIN, *Executive Director.*

STATEMENT OF THE IDAHO WATER RESOURCE BOARD

The opportunity of presenting this statement on behalf of the Idaho Water Resource Board is appreciated.

We are in sympathy with and fully appreciate the urgent need for the Central Arizona Project. We also realize that there are other areas in the Pacific Southwest where water problems may occur. However, now that the surplus water of Northern California is under programming, ultimate benefits will be of measurable impact.

We also wish to point out that there are areas of great concern to us in Idaho. We have old established projects that are badly in need of supplemental water.

Like Arizona, we have experienced years of delay with some of our Idaho projects. The Southwest Idaho Water Development Project, which is now before your committee, has been in the mill for more than fifty years. It is the forerunner of development that contemplates the full usage of all waters of the Snake River within Idaho boundaries.

The people of Idaho are looking forward with enthusiasm to the ultimate development of the State's land and water resources. An amendment to the Constitution has been approved authorizing a State Water Agency. Implementing State legislation has been enacted. An Idaho Water Resource Board has been appointed. Adequate funds have been appropriated. A survey, to be completed in 1970, is now underway in cooperation with other Pacific Northwest States and coordinated with the Columbia-North Pacific Framework Study under the direction of the recently created Pacific Northwest River Basins Commission.

Idaho's interest in such a survey is to study and inventory the land and water resources of the State. This study will include the acreage of available irrigable land and the water supply available for irrigation, together with the amount of water required for full and complete development of all such irrigable lands within the State. The water requirements for industry, municipalities, hydroelectric power, recreation, fish and wildlife and all other uses will be also covered.

This survey, to be completed by the close of this decade will provide the long awaited information which must be available before complete development of Idaho's natural resources can be planned with intelligence.

At the present time, Idaho is irrigating three million acres, but the best information available now is that an additional six million acres can be brought under irrigation, thus bringing the total Idaho irrigated acreage to nine million acres. This additional acreage will require at least twelve million acre feet more water than is now being used, and that is more water than is now available in the Snake River.

We believe that it is very important and, therefore, we strongly urge that the Pacific Northwest River Basin Commission, operating under authority of the Water Resources Planning Act of 1965, be permitted to complete its coordinated studies of ultimate needs in Idaho as well as the other Pacific Northwest States, before the Secretary is authorized to undertake feasibility investigation involving export of water from the Columbia-Snake system. We respectfully urge that any Lower Colorado River legislation which contemplates trans-basin diversion of water from the Columbia River system be amended accordingly.

We urge that any lower Colorado River legislation should include a provision as follows:

Repayment contracts for the use of imported water for irrigation, water supply, power, quality control, ground water recharge, recreation, fish and wildlife and any other use shall contain a provision making it abundantly clear the area of origin shall have prior right to any water which it is proposed to export.

We also urge that the following provision be included in any Lower Colorado bill which may be enacted by the Congress.

"Nothing in this Act shall be construed to expand or diminish either Federal or State Jurisdiction, responsibility, or rights in the field of water resources planning, development, or control; nor to displace, supersede, limit or modify any interstate compact or the jurisdiction or responsibility of any legally established joint or common agency of two or more states, or of two or more States and the Federal Government; nor to limit the authority of Congress to authorize and fund projects."

The above language is identical to Section 3 of the Water Resources Planning Act of 1965—Public Law 89-80, and we feel strongly that it should be included in this bill.

The economic justification of spending millions of dollars to transport water a thousand miles or more for the production of farm crops can be questioned, especially when competitive crops can be grown on the sagebrush plains of Idaho where water is readily available.

In closing, to repeat—the citizens of Idaho are looking forward with optimism and enthusiasm to the ultimate development of the State's natural resources, but this can only be accomplished if we are permitted to retain for use in Idaho, the water which we believe rightfully belongs to the State of Idaho.

STATEMENT OF STEPHEN C. JETT, PH.D., ASSISTANT PROFESSOR OF GEOGRAPHY,
UNIVERSITY OF CALIFORNIA, DAVIS

TOURISM, RECREATION, AND THE GRAND CANYON DAMS

I am Dr. Stephen C. Jett, Assistant Professor of Geography, University of California, Davis. I am submitting this statement as an individual.

I am author of the book *Tourism in the Navajo Country: Resources and Planning*,¹ and my research on scenic resources and tourism in the Southwestern United States entitles me to comment on the alleged damages and benefits to recreational potentials that would result from construction of the proposed Hualapai and Marble Canyon Dams.

Tourism—that is, travel for purposes of visiting scenic areas and historic landmarks—is a major American industry. The Outdoor Recreation Resources Review Commission stated in 1962 that national "tourism expenditures have been estimated at about \$25 billion annually."² More than half the states consider tourism to be one of their three major sources of revenue.³ This industry is especially important in the Southwest. The Bureau of Business and Public Research of the University of Arizona estimated in 1959 that the total tourist (including resort) expenditure in that state was nearly 500 million dollars, making tourism the largest industry in the state.⁴ An estimated \$89,700,000 was spent by tourists in 1959 in Utah,⁵ and one observer wrote, in 1952, that "in New Mexico tourism is the leading industry," yielding about \$150,000,000 even as far back as 1961.⁶ But although tourism is already of prime importance, "what is more significant," says a University of Arizona study, "it . . . has probably the greatest potentialities for future growth" of any of the regions' industries.⁷

In assessing the relative economic impact of tourism vs. water-based recreation on the region, the probable future trends of these two activities must be kept in mind. Marion Clawson, of Resources for the Future, Inc., who is probably the country's greatest expert on recreation statistics, predicts that the demand for use of recreation areas, such as the proposed reservoirs, will increase perhaps 16 times over 1950 levels by the year 2000 but that the demand for use

¹ *Navajoland Publications*, Series A. Navajo Tribal Museum, Window Rock, 1967.

² *Outdoor Recreation for America: A Report to the President and to the Congress by the Outdoor Recreation Resources Review Commission*. Washington, 1962.

³ Anon. Tourism is Big Business. *The Navajo Times*, Vol. 7, No. 52, p. 6. Window Rock, 1966.

⁴ Robert E. Waugh. A Billion Dollar Tourist Business for Arizona? *Arizona Business and Economic Review*, Vol. 8, No. 4, pp. 2-3. 1959.

⁵ Research Section, Utah State Department of Highways. *Utah Tourist Study*, p. 5. Salt Lake City, 1960.

⁶ Clifford M. Zleror, Tourism and Recreation in the West, *The Geographical Review*, Vol. 42, No. 3, p. 464. 1952.

⁷ L. W. Cassaday. *The Role of the Tourist Industry in Arizona's Expanding Economy*. Bureau of Business Research Miscellaneous Publications. Tucson, 1950.

of scenic areas by sightseers will increase by as much as 40 times.⁸ The Outdoor Recreation Resources Review Commission, although presenting more conservative predictions, also predicts that, given opportunity, sightseeing will grow more rapidly than boating, fishing, or swimming.⁹ This is particularly relevant when one considers the extremely limited access to the proposed reservoirs and the large number of alternative water recreation areas in the region, facts which have been pointed out by the Bureau of Outdoor Recreation in the Pacific Southwest Water Plan.¹⁰

Dam proponents frequently argue that the proposed reservoirs would do no damage to scenery presently visible from Grand Canyon National Park's developed viewpoints. In addition to ignoring the fact that the view from Grand Canyon National Monument's principal viewpoint, Toroweep Overlook, would be severely damaged,¹¹ this argument is based on the assumption that the presently little-visited scenic areas will never be visited. However, this is an unwarranted assumption, for the following reasons:

1. The scenic attributes both of Marble Gorge and of lower Grand Canyon are unquestionably of National Park quality, as I can personally attest from observation of these areas both from the air and on the ground. In fact, early tourists visiting the Grand Canyon did so in the area of Diamond Creek, which is on the Hualapai Reservation, and not at the presently developed viewpoints, which happened more or less accidentally to be developed because of a railroad line built to provide access to mines near the South Rim of the Canyon.¹² The Navajos have established Tribal Parks to protect the scenic values of Marble Gorge.¹³

2. The areas that would be partially inundated by the Hualapai and Marble Canyon Dams are, in fact, much nearer the region's through highways than are presently developed viewpoints within the Park (see Table 1) and could thus be very easily provided with access roads. Such developments would provide the poverty-stricken Hualapai and Navajo Indian Tribes in these areas a source of income superior to that which would be afforded by the proposed reservoirs.¹⁴

TABLE 1.—Distances of various points on the rim of Grand Canyon from nearest through highways

Locality	Nearest through highways	Distance
South rim (Grand Canyon Village).....	U.S. 66.....	59 miles.
"Do....."	U.S. 89.....	57 miles.
South rim (desert view).....	U.S. 89.....	31 miles.
North rim, Grand Canyon National Park.....	U.S. 89.....	44 miles.
"East rim" (lower Marble Gorge section).....	U.S. 89.....	20 miles.
Upper Marble Gorge.....	U.S. 89.....	0 mile.
Hualapai Rim (lower Granite Gorge).....	U.S. 66.....	17 miles.

3. The rising demand for scenic resources is putting more and more pressure on existing developed scenic areas. This is true generally, as well as specifically for Grand Canyon National Park, where rapidly increasing visitation reached an annual figure of 1,806,033 in 1966. If overcrowding is to be avoided, new scenic overlooks will have to be developed, primarily outside of present park boundaries. As long ago as 1950, when visitation was 665,281, the National Park Service reported: ¹⁵

⁸ Marion Clawson, "The Crisis in Outdoor Recreation," *American Forests*, Vol. 65, No. 3, pp. 40-41, 1959.

⁹ *Outdoor Recreation for America: A Report to the President and to the Congress by the Outdoor Recreation Resources Review Commission*, p. 220, 1962.

¹⁰ "Revised Report of the Bureau of Outdoor Recreation on Pacific Southwest Water Plan," *Pacific Southwest Water Plan, Appendix of August 1963 as Modified January 1964*, U.S. Dept. of the Interior, pp. 2-3, Washington.

¹¹ U.S. Dept. of the Interior, National Park Service, *A Survey of the Recreational Resources of the Colorado River Basin*, p. 136, Washington, 1950.

¹² Henry F. Dobyns, in record of the hearings (Part 2, 1965) before the House Subcommittee on Irrigation and Reclamation on H.R. 4671, p. 1581; J. H. Butchart, *The Grandview Trail, Plateau*, Vol. 31, No. 2, p. 38, Flagstaff, 1958.

¹³ Little Colorado River, Grand Canyon, and Lake Powell Tribal Parks.

¹⁴ For further details, see my testimony in the record of the hearings on H.R. 4671, pp. 1881-5, and the record of the March 1967 hearings on H.R. 3300, pp. 490-516.

¹⁵ National Park Service, Branch of Statistics Analysis, U.S. Dept. of the Interior, *Public Use of the National Parks, a Statistical Report*, 1951, 1966.

"Probably the best use that can be made of the Grand Canyon area from the standpoint of the American people as a whole is to reserve and develop the entire canyon and bordering plateaus as a place for recreation, primarily of the inspirational type. To those who contend that the present development in Grand Canyon National Park is sufficient to meet this need, it should be pointed out that already increased population and travel make the developed areas in the park so crowded and congested at certain seasons that chances for rest and contemplation are virtually nonexistent. The extension of opportunities to use Grand Canyon, especially the little-known western part, would greatly help in solving the future problem of adequate space for meeting the recreational needs of an increasingly large group."

Thus, it may be concluded that *negative* recreational benefits would accrue if one or both of these dams were built, and, therefore, recreational benefits cannot legitimately be claimed to justify dam construction or to justify some of the costs of these dams being classified as nonreimbursable. Rather, damage to recreational resources should be added to the costs column of benefit-cost analyses of the dams' feasibility.

SOUTHERN CALIFORNIA WATER CONFERENCE,
Los Angeles, Calif., May 3, 1967

Re H.R. 3300 and related Colorado River bills.

HON. CLINTON P. ANDERSON,
*Chairman, Water and Power Resources Subcommittee,
U.S. Senate, Washington, D.C.*

DEAR SENATOR ANDERSON: The Southern California Water Conference, which is made up of representatives from the major water distributing agencies in Southern California, has reviewed the testimony of William R. Gianelli, Director of the Department of Water Resources of the State of California, as presented to your Subcommittee today, May 3, 1967.

The Conference has had an opportunity to discuss Mr. Gianelli's statement in depth at its most recent meeting, and by resolution has authorized me, as its Chairman, to convey the full support of his testimony and the Department's position regarding the above bills.

The Conference recognizes that augmentation of the Colorado River is essential to both the survival and growth of the Colorado River Basin States, and the entire Pacific Southwest. It is also mindful of the immediate and acute need of the State of Arizona for the authorization and construction of a Central Arizona Project, and the Conference supports legislation authorizing that project if California's existing uses on the River are protected to the maximum provided in the California Limitation Act.

We feel with a sense of urgency that every effort must be made by national water leaders to break the deadlock on the development of water resources for the Pacific Southwest. We look to you and the leaders from the other Basin States and California to make substantial progress toward that end in this 90th Congress.

Very truly yours,

JAMES H. KREIGER, *Chairman.*

NATIONAL RECLAMATION ASSOCIATION,
Washington, D.C., May 2, 1967.

THE CHAIRMAN,
*Water and Power Resources Subcommittee, Senate Committee on Interior and
Insular Affairs, New Senate Office Building, Washington, D.C.*

DEAR CHAIRMAN ANDERSON: The Board of Directors of the National Reclamation Association directed me to submit, for the record of hearings on the Colorado River, the enclosed resolution applicable to Bridge Canyon (Hualapi) Dam.

This resolution (No. 66-7 titled "Multi-Purpose Concept") was adopted at Albuquerque in November of 1966 by the full convention, and states the policy of the Association to support multi-purpose concepts of development as opposed

to single-purpose uses. The Board considers the Hualapai project to be multi-purpose within the indorsement of Resolution No. 66-7.

Sincerely,

CARL H. BRONN.

[Enclosure]

RESOLUTION NO. 66-7, MULTIPURPOSE CONCEPT

Whereas, the wise conservation and use of our natural resources is an integral part of the continuing philosophy of the National Reclamation Association and is better served by well planned multi-purpose projects than through single purpose conservation efforts; and

Whereas, reclamation projects, being local or regional, have local or regional support while the single purpose preservationist groups is now being directed at proposed large and small multi-purpose projects in various parts of the nation; and

Whereas, many proposed multi-purpose projects of great potential benefit become the targets of organized opposition from "single purpose preservationist" groups even though such projects offer vitally needed benefits to the Nation: Now, therefore, be it

Resolved, That the National Reclamation Association continues to support the multi-purpose concept of development and conservation of our natural resources and urges elected and appointed officials to give full consideration to the total benefits offered by proposed reclamation and conservation projects, and not be dissuaded by the self-serving protests of the single purpose preservationist groups who seek to preserve all natural resources inviolate in their natural state.

THE NAVAJO TRIBE,
Window Rock, Ariz., May 3, 1967.

HON. CLINTON P. ANDERSON,
*Chairman, Subcommittee on Water and Power Resources, United States Senate,
Washington, D.C.*

MY DEAR SENATOR ANDERSON: With reference to the hearings to be held before your subcommittee on May 2, 3, 4 and 5, 1967, concerning the Colorado River Project and Central Arizona Project bills, the Navajo Tribe wishes to express its position and would appreciate greatly having this letter with its enclosures included in the record of said hearings.

The Navajo Tribe expressed its opposition to the construction of any dams on the Colorado River in the Grand Canyon in Navajo Tribal Council Resolution CAU-97-66, passed on August 3, 1966. That resolution was included at page 138 of House Report Number 1849 on HR 4671 in the 89th Congress, a copy is enclosed herewith.

The Navajo Tribe reaffirmed its opposition to the construction of any dams, diversions or obstructions in Marble Gorge or in any other portions of the Grand Canyon in Resolution CJA-13-67, passed unanimously by the Navajo Tribal Council on January 27, 1967, a copy is enclosed herewith. It found that the construction of these dams would not be in the best interest of the Navajo Tribe nor of the American public for the reasons expressed in those resolutions. The economic data and social considerations justifying these reasons have been fully and well presented in the House Hearings on the Colorado River Project in 1965 and in 1966, and in the Navajo Tribe's pleadings submitted in January and February, 1967, to the Federal Power Commission in the application of the Arizona Power Authority, Project Number 2248, for a license to construct the Marble Canyon Dam.

Reflecting the validity of the Navajo Tribe's opposition is the modification by the Department of the Interior of its position in respect to the construction of the proposed dams. It is indicated in the recent Statements released by the Department of the Interior and made by the Secretary on March 14, 1967 before the House Subcommittee on Irrigation and Reclamation that the Department recognizes that the irreplaceable scenic value of the Grand Canyon and the greater economy of producing electrical power by coal fired thermal generation rather than by hydroelectric dams.

The Navajo Tribe supports, in principle, the recommendations made now by the Department of the Interior and proposed by S. 1013 to authorize the Central Arizona Project, to provide federal financial assistance for the construction of a thermal generating plant near Page, Arizona, and to remove the Hualapai and Marble Canyon dam sites from the license granting authority of the Federal Power Commission. The Navajo Tribe favors this solution to the water needs of central Arizona and has opposed the Colorado River Project only because it was clear that the provisions in that proposed legislation did not provide the best solution to the problem of financing the Central Arizona Project and supplying water to the Southwest. I believe the correctness of this position will be established further in future studies by the proposed National Water Commission or other appropriate bodies.

Concerning the Animas-La Plata Project proposed by the Department of the Interior and included in the Senate Colorado River Project bills, the Navajo Tribe must reserve its endorsement at this time. As the Animas-La Plata Project is presently planned, it would divert 57,400 acre feet per year from the Animas and La Plata rivers which would result in an annual depletion of 34,100 acre feet from the San Juan River, almost all to be used for non-Indian purposes. The Navajo Tribe views this proposed depletion of the San Juan River for non-Indian uses, to which it has the paramount right, with considerable apprehension, particularly in view of the fact that it has not received and has no assurance of receiving its benefits agreed to and approved by Congress in the Navajo Indian Irrigation Project Act of June 13, 1962.

Some of the recent events which gives rise to this concern of the Navajo Tribe are:

1. The reduction in size of the main canal of the Navajo Irrigation Project from 2,100 c.f.s., originally planned, to 1,800 c.f.s.
2. While the project was authorized to have a capacity to irrigate 110,630 acres with additional capacity to supply municipal and industrial requirements, it will now be necessary to construct the Gallegos and supplemental reservoirs to supply either the full acreage authorized or the municipal and industrial requirements, but even these additional reservoirs apparently will not be capable of supplying both.
3. There is no optimistic prospect of the appropriations required to construct the Gallegos reservoir being approved by Congress.
4. The appropriations for the other facilities of the Navajo Irrigation Project have been cut drastically from the originally planned schedules resulting in serious delays in the completion of the project, while much less than proportionate reductions have been made in the appropriations for the San Juan-Chama Project.
5. The unexplained delay in the approval of the Navajo Tribe's water contract submitted in 1964.
6. The failure so far to approve the water contract submitted by the Utah Construction Company necessary to permit the mining of coal from the Navajo Reservation.

Because the above mentioned factors cause great uncertainty as to the quantity of water which will be available to the Navajo Reservation from the San Juan River, the Navajo Tribe is not now in a position to compromise further any of its rights to the water of that river, and therefore, cannot support the authorization of the Animas-La Plata Project until the supply of water to the Navajo Tribe and its interests becomes more certain.

The Navajo Tribe will be most grateful to have this letter and its enclosures included in the record of your subcommittee hearings on the Colorado River Project and other related bills.

Very truly yours,

RAYMOND NAKAI,
Chairman, Navajo Tribal Council.

[Enclosures]

RESOLUTION OF THE NAVAJO TRIBAL COUNCIL

Whereas—

1. There is now pending before the Federal Power Commission an application by the Arizona Power Authority, identified as Project No. 2248, for a license to construct a dam at Marble Gorge on the Colorado River to be used for the generation of electrical power, and

2. On May 22, 1961, the Navajo Tribal Council passed Resolution CMY-28-61 urging construction of the Marble Canyon Dam by the Federal Government and

authorizing the Chairman to seek enactment of legislation by Congress to construct the dam at Marble Canyon as a Bureau of Reclamation project for the purpose of assuring the availability of electrical power to and its purchase by the Navajo Tribe, and pursuant to said resolution the Navajo Tribe did intervene in the proceedings before the Federal Power Commission, and

3. By the Act of August 27, 1964 (Public Law 88-491, 78 Stat. 607), Congress declared that no licenses or permits shall be issued for the reach of the Colorado River between Glen Canyon Dam and Lake Mead during the period ending December 31, 1966 for the purpose of providing Congress with the opportunity to pass upon a comprehensive plan for a unified integrated system of such projects on the entire Colorado River basin, and

4. Among other House and Senate companion bills, H.R. 4671 was introduced in the House of Representatives on February 9, 1965 proposing such a plan for the construction, maintenance and operation of a Colorado River basin project and extended hearings in Committees of Congress were held on said bill during the 89th Congress. Also introduced in Congress was H.R. 14176 on March 31, 1966 and other similar bills which proposed enlarging the borders of the Grand Canyon National Park to include the Marble Gorge. But Congress adjourned before the Senate or the House voted on either of the bills, and

5. During the year subsequent to 1961 when CMY-28-61 was passed by the Navajo Tribal Council, factors causing the Tribe to support the construction of the Marble Canyon Dam by the Bureau of Reclamation had changed, namely that the construction of a dam at Marble Gorge would now be contrary to the best interests of the Navajo Tribe in the following respects:

(a) Hydropower produced by such a dam would inevitably compete with thermopower produced from other sources in the same area which ultimately would decrease the value and saleability of the huge deposits of coal located on the Navajo Reservation;

(b) Having more than sufficient supplies of electrical power available to the Tribe from the Four Corners project and other proposed thermo-generating plants, the Tribe has no need for the additional electrical power which might be made available to it from the hydro-generating plant;

(c) The potential tourism benefits to the Navajo Tribe are great if the Grand Canyon is left in its natural state than if another huge body of water were impounded, particularly considering that the Navajo Tribe already has available to it the means for developing water and boating recreation in the same geographic area by the already existing Lake Powell;

(d) The Arizona Power Authority has not offered and therefore it must be assumed that it will not offer reasonable compensation to the Navajo Tribe for the taking of Tribal lands; water and other rights by its proposed project;

and the construction of a dam at Marble Gorge would be contrary to the best interests of the American public in the following respects:

(a) the construction of a dam in the Grand Canyon would irreparably damage one of the greatest and last natural scenic wonders and nature refuges remaining in the United States;

(b) the cost of electricity, which must eventually be borne by the consumers, will be greater if it is produced by means of hydropower rather than by coal or nuclear powered generating plants.

6. As a result of these changed conditions, the Navajo Tribal Council passed Resolution CAU-97-66 on August 3, 1966 revoking Resolution CMY-28-61 and opposing the construction of dams in Marble Gorge and other portions of the Grand Canyon, and

7. Anticipating that the moratorium on the Federal Power Commission expires on December 31, 1966, the Arizona Power Authority filed on December 27, 1966 a "Motion for Commission Decision and Order Issuing License."

Now, therefore, be it resolved that—

1. The Navajo Tribal Council hereby affirms the position of the Navajo Tribe as opposing the construction of any dams, diversions or obstructions in Marble Gorge or in any other portions of the Grand Canyon.

2. The Navajo Tribal Council hereby authorizes the General Counsel and/or the Legal Department of the Navajo Tribe to continue to represent the Navajo Tribe to carry out its position as hereinbefore stated before the Federal Power Commission, the Congress of the United States, and before any and all other courts, tribunals or legislative bodies to which this matter may be presented or appealed.

3. Any and all costs, including but not limited to witness fees, travel expenses, telephone and telegraph expenses, special stenographic or reporting costs, including transcripts of records and preparation of pleadings and any and all other expenses necessary to carry out the purposes of this resolution shall be paid by the Navajo Tribe pursuant to any appropriation heretofore made or special appropriation to be hereafter made when the amounts of these costs and expenses become known.

CERTIFICATION

I hereby certify that the foregoing resolution was duly considered by the Navajo Tribal Council at a duly called meeting at Window Rock, Arizona, at which a quorum was present and that same was passed by a vote of 57 in favor and 0 opposed, this 27th day of January, 1967.

RAYMOND NAKAI,
Chairman, Navajo Tribal Council.

RESOLUTION OF THE NAVAJO TRIBAL COUNCIL

Whereas—

1. A bill is under consideration in the Congress of the United States to build Hualapai (Bridge Canyon) and Marble Canyon hydroelectric dams on the Colorado River in the Grand Canyon at an estimated cost of \$511,239,000.00 for the Hualapai (Bridge Canyon) Dam and \$239,000,000.00 for Marble Canyon Dam, and

2. Although the eastern end of the proposed Marble Canyon Dam would of necessity be based upon Navajoland, flooding approximately 46 miles of Navajo Reservation land above Marble Canyon Dam, no consultation with, or consent to said construction, has been sought from the Navajo Tribe and no information and advice has been given to the Navajo Tribe in respect to this proposed trespass upon Tribal property, and

3. In 1961, in order to forestall the construction of a dam at Marble Canyon then urged by the Arizona Power Authority before the Federal Power Commission, the Navajo Tribe was led to believe that a Federal dam would be more to the advantage of the Tribe than a privately constructed dam in affording to the Tribe preferential treatment for purchase of power, and therefore, the Council passed a resolution of May 22, 1961 (CMY-28-61), entitled "Resolution of the Navajo Tribal Council Urging Construction of Marble Canyon Dam by the Federal Government as a Bureau of Reclamation Project," which said resolution should now be repealed in the best interests of the Navajo people inasmuch as the Tribe has secured many times more electric power than it can anticipate needing from the six utilities at the Four Corners plant and would benefit from establishment of coal-fired plants rather than the development of competitive hydro-power, and

4. The Federal Government, according to present plans, like the Arizona Power Authority in 1960-1961, seeks to ignore and disregard the Navajo fee-title ownership of the lands on the east bank of the Grand Canyon at Marble Gorge, as established by the Act of May 23, 1930 (46 Stat. 378, 379), whereby a portion of the Tusayan National Forest was added to the Navajo Reservation, on which one end of the proposed Marble Canyon Dam would necessarily be based, all without payment of compensation to the Navajo Tribe, and

5. The development of coal-fired generating plants based upon coal being mined in the Four Corners area of the Navajo Reservation and, more recently, coal-mining operations in the Black Mesa area to supply two 750,000 kw generators at Mohave, Nevada, and two additional generators of 750,000 to 1,000,000 kw generators in the vicinity of Page, Arizona, have proven and established a cheaper form of generating electricity than existing or proposed hydro plants can demonstrate, thereby rendering wasteful and needless the immense costs of constructing additional hydro-generating plants, which latter sources of power have declined to approximately 15% of the country's supply because said hydro plants can no longer compete with coal-fired generators for base power or nuclear generators for base or peak power, and

6. The testimony of Congressman Udall and of others in the Department of the Interior that the area of the Grand Canyon proposed to be flooded by the two dams "can't be seen from any point on the canyon rim within Grand Canyon National Park" is a provincial, biased, and erroneous view, misleading and misrepresenting the facts to the public in that it disregards and ignores the presently undeveloped but developable viewpoints overlooking Marble Gorge of the Grand Canyon from the Navajo Rime between Lee's Ferry and points below the proposed Marble Canyon Dam, as well as viewpoints in the Hualapai area, and

7. The proposed Marble Canyon Reservoir would have no practical point of access from the Navajo side of Marble Gorge, due to sheer cliffs, and access to what Congressman Udall claims is "another water path to an outstanding scenic area," would be confined to the Interior Department's area at Lee's Ferry, and

8. The proposed flooding of the Colorado River in the Grand Canyon, which now offers one of the last great canyon wilderness waterways, would impair and destroy many scenic beauty spots and tourist attractions in the canyon along said route, thereby partially destroying one of the greatest resources of the Navajo people, the Marble Gorge of the Grand Canyon, embraced within the Grand Canyon Navajo Tribal Park, which area affords various spectacular viewpoints along the Marble Gorge of the Grand Canyon at distances approximately one-third as far from Route 89 as the South Rim of the Grand Canyon is from Highway 66, and

9. Great natural tourist routes, heretofore little advertised by the Department of the Interior, through the Grand Canyon Navajo Tribal Park, and spectacular views of natural wilderness scenery lying intact for millions of years, would be removed from tourist use or reduced to one more water sports area, which are already available at Lake Powell with its scenic access to the "Navajo Fjords" in said lake, and

10. The best interests of the Navajo Tribe and of the American public would be better served for all times if bills pending in Congress to expand the Grand Canyon National Park (H.R. 14176 or similar bills) should be adopted, subject only to administration of the Navajo Rim area of the Grand Canyon by the Navajo Department of Parks and Recreation in cooperation with the United States National Park Service.

Now, therefore, be it resolved that—

1. The Navajo Tribal Council hereby rescinds and revokes the resolution of May 22, 1961 (CMY-28-61).

2. The Navajo Tribal Council condemns as a needless waste of public funds the immense cost of constructing Hualapai and Marble Canyon Dams or similar structures in the Grand Canyon or its tributary canyons in face of established methods, already in operation upon the Navajo Reservation, of generating power through coal-fired generating plants for so many years to come that the high cost hydroelectric power is rendered obsolete and unnecessary, especially when nuclear plants can ultimately generate power at vastly less cost than hydropower.

3. In lieu of and instead of the construction of Hualapai and Marble Canyon Dams, the Navajo Tribal Council urges and memorializes the Congress to consider favorably H.R. 14176 or similar bills to enlarge the Grand Canyon National Park, to include the entire area of the Grand Canyon, provided, however, that the Navajo Rim of the Grand Canyon, namely the Grand Canyon Navajo Tribal Park, shall be administered by the Navajo Department of Parks and Recreation in cooperation with the National Park Service respecting tourist facilities in any portions of the area embraced in the Grand Canyon National Park which lies within the Navajo Reservation.

4. The Navajo Tribal Council, on behalf of the Navajo People, condemns the ruthless character of the promoters of the Lower Colorado River Basin Project and takes note of the charge by one Congressman to Congressman Udall ". . . You have violated the policy of the administration, you have violated the wishes of the President, you have violated the Park Service, you have violated the recommendations of the Bureau of the Budget, you have violated the recommendations of your own brother," to which charge we add that the Congressman and his brother, The Secretary of the Interior, have ignored the property rights and interest of the Navajo Tribe, while at the same time securing the support of the Hualapai Indians by paying \$16 million to said tribe for its rights at Hualapai Dam.

5. The officers, councilmen, and representatives of the Navajo Tribe are authorized and instructed to send copies of this resolution to the President of the United States, members of the Congress, the press, and other interested parties.

CERTIFICATION

I hereby certify that the foregoing resolution was duly considered by the Navajo Tribal Council at a duly called meeting at Window Rock, Arizona, at

which a quorum was present and that same was passed by a vote of 29 in favor and 2 opposed, this 3rd day of August, 1966.

NELSON DAMON,
Vice Chairman, Navajo Tribal Council.

INTER TRIBAL COUNCIL OF ARIZONA,
May 1, 1967.

Senator HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs, Office of the United States Senate, Washington, D.C.

DEAR SENATOR JACKSON: All Arizonans are vitally concerned with the favorable consideration by Congress of the pending legislation which would authorize the Colorado River Basin Project. The representatives of Indian tribes and members of the Inter-Tribal Council of Arizona, have met, to discuss and pledge our support to those bills now pending before the committees of the 90th Congress as long as Hualapai Dam is a part of said Project.

The great reservations in Arizona vary considerably in land uses. Some of the tribes benefit primarily from their farmland. The economy of other tribes is dependent upon recreational use of lakes. Water from the Colorado River is the only firm source for our needs.

We know the Hualapai Tribe, a member of our Inter-Tribal Council, has requested support in making sure that Hualapai Dam remains in the Project bill that may be passed by Congress. We respectfully urge you to support the Hualapai Tribe in its endeavor to become economically independent by the building of Hualapai Dam and the benefits that would accrue from this source.

There are some who call themselves conservationists who find a great sanctuary in our scenic wilderness and want to leave it as it is. We Indian people not only want to share our many and varied beautiful sites with all people to see and enjoy but we also want to be builders so we can strengthen our economy and raise our standard of living.

The passage of legislation that includes the Central Arizona Project as a part of the Colorado River Basin Project and which also must include Hualapai Dam is in the interest of our Indian Citizens in Arizona and we respectfully urge and request your support of this worthwhile legislation.

Yours very truly,

FILMORE CARLOS, *President.*

DESOMOUNT CLUB,
Los Angeles, Calif., May 2, 1967.

WATER AND POWER RESOURCES SUBCOMMITTEE,
Chairman, Senate Committee on Interior and Insular Affairs, Washington, D.C.

MR. CHAIRMAN: Desomount Club endorses the administration plan calling for NO DAMS on the Colorado River. We would amend this to the extent that Bridge Canyon be Permanently Ruled Out as a dam site.

Thermal and nuclear production of power as a substitute for hydropower not only would *not* disturb the grandeur of our Grand Canyon but would be *more economical*.

As far as Colorado water is concerned sooner or later we will have to face the fact that "Each New Influx of People and Industry Creates New Water Demands; Each New Water Supply Makes Possible a Further Influx of People . . . But This Positive 'Feedback' Cannot Continue Ad Infinitum." The dams would not create more water, but through evaporation in their reservoirs, actually waste it.

We support H.R. 1305 to enlarge boundaries of Grand Canyon National Park as a further protection to keep the Canyon in its natural state.

We welcomed establishment of a National Water Commission as "water is a single national problem, not just a host of local problems". The present and future needs of *those who have water* should in all fairness be considered along with the needs of *those who have not*.

No More Dams on the Colorado!

Respectfully yours,

EVELYN GAYMAN,
Conservation Chairman.

COLORADO RIVER WILDLIFE COUNCIL,
Salt Lake City, Utah, April 20, 1967.

HON. CLINTON P. ANDERSON,
*Senator of New Mexico,
New Senate Office Building,
Washington, D.C.*

DEAR SENATOR ANDERSON: The Colorado River Wildlife Council, composed of the states of Arizona, California, Colorado, Nevada, New Mexico, Wyoming, and Utah, was organized explicitly to conserve and perpetuate the wildlife resources of the Colorado River drainage. The Council further points a coordinated approach to the fish and wildlife management of this large and productive wildlife area.

Enclosed are resolutions adopted by the Colorado River Wildlife Council at their annual meeting on March 27-28 in Las Vegas, Nevada. The Council was deeply concerned with the subjects of these resolutions and sincerely hopes you will be able to react favorably to these resolutions.

Sincerely,

DONALD ANDRIANO, *Secretary.*

[Enclosure]

RESOLUTION NO. 3. ENLARGEMENT OF THE GRAND CANYON NATIONAL PARK

Whereas, there are now in the Congress of the United States several legislative proposals which would enlarge the boundaries of the Grand Canyon National Park in the State of Arizona; and

Whereas, enlargement of the Grand Canyon National Park would include portions of the Grand Canyon National Game Preserve in the Kaibab National Forest, the Lake Mead National Recreation Area, and other public lands adjacent to the present boundary of the National Park; and

Whereas, by Act of Congress and proclamation of the President of the United States, the Grand Canyon National Game Preserve was set aside for the protection and production of the Kaibab mule deer and other native wildlife; and

Whereas, the area known as Kaibab North has attained national recognition because of its ability to provide outstanding hunting and to produce outstanding trophy mule deer; and

Whereas, the Kaibab North and other public lands in this area provide an outstanding example of multiple-use resources management; and

Whereas, the Kaibab North and other public lands have been open to public hunting in the past, and

Whereas, it is the policy of the National Park Service to exclude public hunting from national parks; and

Whereas, hunting is necessary for proper management of the deer herd, keeping it in balance with the sustaining capability of the environment; and

Whereas, enlargement of the Grand Canyon National Park would therefore eliminate public hunting opportunities from lands now open to public hunting within the proposed enlargement of the park; and

Whereas, the elimination of hunting from these additional lands within the proposed enlargement of Grand Canyon National Park would undoubtedly be responsible for the re-occurrence of the tragic deer die-offs that have happened several times in the past; and

Whereas, inclusion of that portion of the Kaibab North known as the South Canyon Buffalo Range in the Grand Canyon National Park would interfere with proper management of the buffalo herd by the Arizona Game and Fish Department which includes hunting: Now, therefore, be it

Resolved by the Colorado River Wildlife Council now in session March 27 and 28, 1967 at Las Vegas, Nevada, That they are hereby unalterably opposed to legislative proposals to enlarge the boundary of the Grand Canyon National Park in such a manner as to eliminate public hunting and the management of wildlife by the Arizona Game and Fish Department within the additional area; and be it further

Resolved, That copies of this resolution be directed to the governors and congressional delegates of all seven Colorado River Basin States and to the Legislative Committee of the International Association of Game, Fish and Conservation Commissioners.

STANFORD CONSERVATION GROUP,
Stanford, Calif., May 9, 1967.

Senator HENRY JACKSON,
Chairman, Senate Committee on Interior and Insular Affairs,
Senate Office Building, Washington, D.C.

DEAR SIR: On May 8, 1967, the executive committee of the Stanford Conservation Group adopted the following resolution:

"Whereas it is the policy of the Stanford Conservation Group to oppose the construction of dams in the Grand Canyon, be it hereby resolved that the Stanford Conservation Group supports HR 1305 (expanding Grand Canyon National Park), HR 1272 (extending for three years the moratorium on FPC licensing of Grand Canyon dams), and S 1018 (authorizing the Central Arizona Project without Grand Canyon dams). The Stanford Conservation Group oppose HR 6132 (abolishing Grand Canyon National Monument) and all bills for the construction of Hualapai and/or Marble Canyon Dams."

"The Secretary shall forward this resolution to the appropriate Congressional Committees."

Sincerely yours,

NEIL BOSTICK, *Secretary.*

WEST COVINA, CALIF., *May 4, 1967.*

HON. HENRY M. JACKSON,
Chairman, Senate Interior and Insular Affairs Committee,
Senate Office Building, Washington, D.C.

DEAR SENATOR JACKSON: As the Water and Power Resources Subcommittee of the Senate Interior and Insular Affairs Committee is convened to review factors related to water supply for the southwest including as I understand the current proposal of the administration for the Central Arizona Project and those several other bills that support in various combinations the construction of one or more dams in our Grand Canyon of the Colorado.

There is I think no compelling reason supporting the necessity for the dams and in fact there is in my opinion a substantial body of fact standing in behalf of the opposition to construction of the dams.

Though great volumes have been written and spoken as to the technical feasibility and necessity for these dams at Hualapai and Marble Gorge these arguments in general skirt what seems to be the core issue.

The core issue made reference to is that of the need for protecting our National Parks from ruinous intrusion. Though indeed the Grand Canyon is not the only area of superlative natural beauty that is threatened. I seek the consideration of the subcommittee in giving just and proper time for the consideration of the necessity of properly planning the approach to satisfying the nation's material needs in such areas as water supply with care to avoid the needless destruction of superb natural values.

I request that my views be included in the hearing record maintained for the hearings related to current proposals that include considerations to construct dams in the Grand Canyon of the Colorado.

Sincerely,

MRS. MARY BLOCK.

STATEMENT OF WILLIAM G. DUNN, CIVIL ENGINEER, WATER RESOURCES
DEVELOPMENTS, OCTOBER 1965

SUMMARY AND CONCLUSIONS

The Modified Snake-Colorado Project would divert up to 15 million acre-feet per year from the Columbia River at the mouth of the Snake River (elevation 340 feet). A large portion of this water can be diverted at points along the lower Snake River where water is available beyond the needs of the areas of origin. The water would be conveyed up the natural channel of the Snake River to Brownlee Reservoir (elevation 2,077 feet). It would then be pumped to elevation 5,150 feet and conveyed through a conduit 1,016 miles long that would take the water southerly through Eastern Oregon and Western Nevada. The water would be released into Lake Meade near Las Vegas after passing through five power plants with a total head of 3,660 feet. The Project also contemplates branch aqueducts delivering water into Idaho, Oregon and California and would have a substantial number of reservoirs serving various purposes within the system.

It is estimated that a water demand of 15 million acre-feet per year could be developed in eleven Western States over a period of 50 to 60 years. This would indicate the project should be constructed in three stages of 5, 10 and 15 million acre-feet per year, respectively, at intervals of 15 years. The records of runoff show that this water can be diverted from the Snake and Columbia Rivers with average lifts ranging from 3,170 to 3,700 feet.

A review of all the uses for which water may be needed in the Northwest Pacific States shows that this Project can be operated without adversely affecting any of these purposes. Even the use of water for the generation of power is affected only in a minor way that can be readily compensated for by replacement with energy from nuclear or conventional steam plants or by outright cash payments.

Washington, Oregon, Idaho and Montana would benefit from new and supplemental supplies of water made available to various areas in conjunction with Project storage units or taken directly from the Project aqueduct or its branches. It is proposed that a Basin Development Fund be established to receive money paid as compensation for losses from power revenues. This fund would serve to assist the financing of water developments in the Northwestern States. There would also be benefits accruing to these states from flood control, recreation, and fish and wildlife enhancement. Arizona, Nevada, California, New Mexico, Utah, Colorado and Wyoming would all receive water either directly or indirectly from the Modified Snake-Colorado Project. A substantial quantity of water for Mexico can also be provided from the Project. The serious water quality problem in the Lower Colorado River will be substantially improved by the importation.

The estimated construction cost of the first stage of the main stem of the Modified Snake-Colorado Project is \$3,612,000,000. It would cost \$37.60 per acre-foot to deliver 5 million acre-feet of water through this first stage of the main stem of the Project into the Colorado River.

A comparison of the subject Project with the Pirkey Plan and other plans which include a diversion from the mouth of the Columbia River shows annual power saving of 22.4 million dollars in the first stage, 40.8 million dollars in the second stage, and 48.8 million dollars in the third stage. There also would be a minimum of 500 million dollars in savings in initial cost. The North American Water and Power Alliance Plan is a very long range plan that is really not comparable to the Snake-Colorado Project. Other plans do not involve enough water to qualify them for a reasonable comparison.

RECOMMENDATIONS

It is recommended that the Modified Snake-Colorado Project be thoroughly studied by the Secretary of Interior and reported at the same time as the other alternatives for Regional Water Importations. This study or report should make a thoroughly analyzed comparison of this Project with all the others.

MODIFIED

SNAKE - COLORADO PROJECT

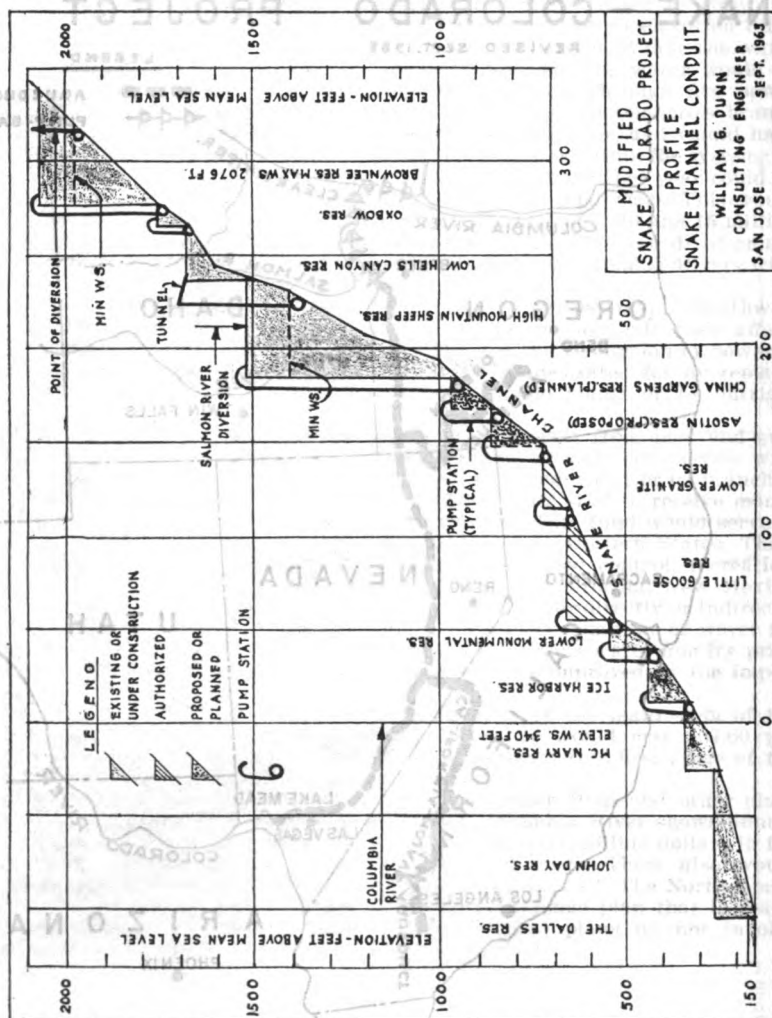
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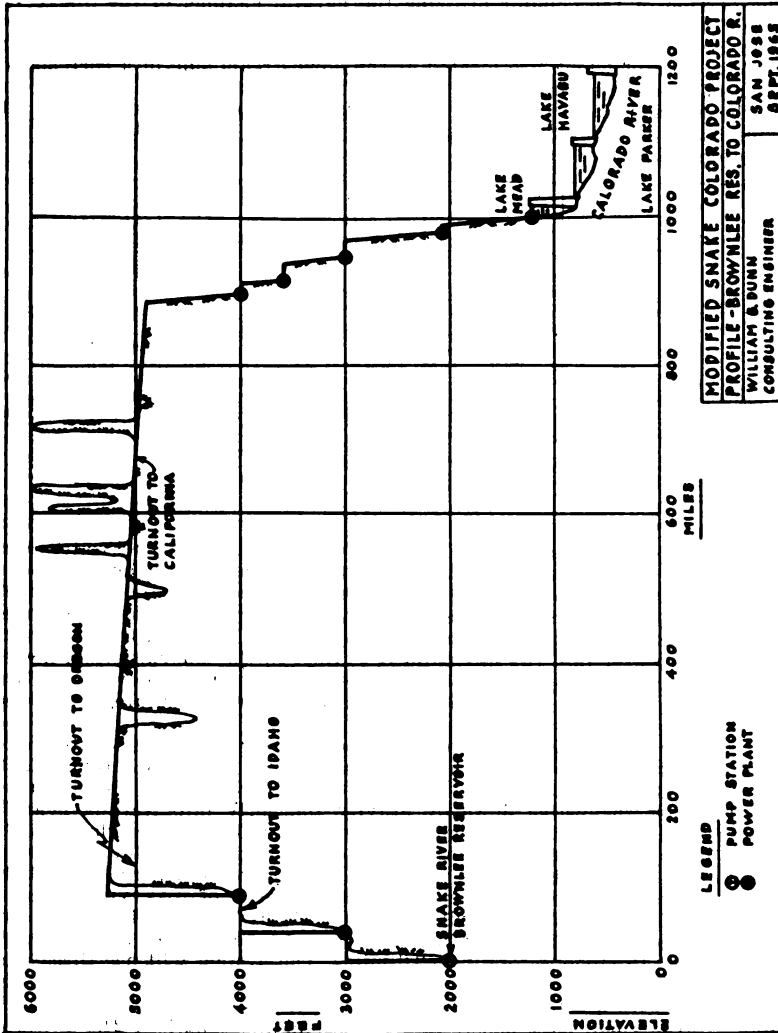
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==== AQUEDUCT
 --- PUMP-BACK



William S. Dunn, Consulting Engineer
 San Jose, Calif.





DESCRIPTION OF PROJECT

The Modified Snake-Colorado project would divert water from the Columbia River at the mouth of the Snake and various points along the lower Snake River, and convey it up the natural channel of the Snake to Brownlee Reservoir near Weiser, Idaho. The water surface of this reservoir is at an elevation of 2,077 feet above sea level. From this reservoir the water would be lifted to an elevation of 5,150 feet and conveyed southward through Eastern Oregon and Western Nevada to the Colorado River near Las Vegas. Branch aqueducts would convey water into Southern Idaho, Southeast Oregon and Southern California.

The portion of the conduit utilizing the natural channel of the Snake River between the Columbia River at the mouth of the Snake and Brownlee Reservoir, a distance of 287 miles, consists of 10 pumping plants with a total net lift of 1,737 feet, each of which are located at the downstream side of a corresponding number of dams, and an 11-mile tunnel with a diversion dam diverting water from the Salmon River into the Snake River. The dams required are all in varying stages of planning, construction, or have been completed. The status and description of these are as follows :

Name	Location distance above mouth	Height	Elevation	Status	Ownership
	Miles	Feet	Feet		
Brownlee.....	287	280	2,077	Existing.....	Idaho Power Co.
Oxbow.....	274	120	1,805	do.....	Do.
Low Hells Canyon.....	247	180	1,685	Under construction.....	Do.
High Mountain Sheep.....	193	620	1,510	do.....	Idaho Power Co., et al.
China Gardens.....	176	80	900	Proposed.....	Corps of Engineers.
Asotin.....	151	120	842	do.....	Do.
Lower Granite.....	113	110	735	Authorized.....	Do.
Little Goose.....	73	110	638	do.....	Do.
Lower Monumental.....	42	110	540	Under construction.....	Do.
Ice Harbor.....	8	110	440	Existing.....	Do.

The diversion from the Columbia River will be from the backwater pool of McNary Dam which is at an elevation of 340 feet above sea level. All of the pumping stations except one can be at the base of the upstream dams since the water surface elevation in all except this one will vary only a few feet. In each of these first cases a tunnel less than a thousand feet in length will be adequate to convey the water into the upstream reservoir. In the one exception, however, the station pumping from High Mountain Sheep Reservoir into Low Hells Canyon Reservoir will require a tunnel about 10 miles long to compensate for the receding backwater at low reservoir levels.

From the point of diversion from the Snake River at the backwater pool of the existing Brownlee Reservoir the water is conveyed southerly through Eastern Oregon over Blue Mountain Pass at an elevation of 5,150 feet above sea level. From this pass the water flows by gravity southerly into Nevada near Fort McDermitt thence passing Winnemucca, Nevada, and crossing Highway U.S. 50 about 25 miles southeast of Fallon and on to Soda Springs Valley 20 miles east of Hawthorne, Nevada. From this valley the conduit would generally parallel the California-Nevada border passing immediately north of Las Vegas and discharging into Lake Mead at Callville Bay east of Las Vegas. This conduit would have a total length of 1,016 miles including three tunnels having a total length of 33.9 miles and 19 siphons totaling 43.6 miles. The system will use three pumps with total lifts of 3,220 feet and have five power plants in the section northwest of Las Vegas with a total gross power drop of 3,660 feet. The powerhouses and pumping stations will have penstocks with a combined length of 24.0 miles.

A branch aqueduct 40 miles long would deliver water to Southern Idaho utilizing the proposed Duncan Ferry Reservoir on the Owyhee River. This reservoir would have a capacity of 2,000,000 acre-feet.

A branch aqueduct to serve Southeastern Oregon would take off from Blue Mountain Pass at an elevation of 5,150 feet and extend westerly 400 miles to Northern Lake County in Central Oregon. This aqueduct would include two tunnels 10 miles and 7 miles long, respectively, and several low-head siphons totaling 20 miles in length. The entire system would be a gravity facility.

The California-Mojave Branch would take off from the main aqueduct at a point about 30 miles west of Tonopah, Nevada, at an elevation of 5,000 feet above

sea level and go westward to the Owens Valley 15 miles north of Bishop, California, thence southerly along the Owens Valley, past Owens Lake and the towns of Inyokern and Mojave to connect with the Feather River Project aqueduct at a point 30 miles west of Rosamond, California. The entire conduit would be 318 miles long which includes two tunnels, one 4.6 miles and the other 14.6 miles in length. There will be three powerhouses with total heads of 1,860 feet which include penstocks that have a total length of 2.3 miles. From the terminus of the California-Mojave aqueduct a conduit would parallel the present Feather River Project aqueduct to Perris Reservoir which is 135 miles long and which includes one tunnel 5 miles long, a siphon 25 miles long, a pumping plant lifting the water 545 feet and two power drops with a total head of 1,669 feet.

Stage Development

A review of many estimates on water needs in the west by knowledgeable individuals during the past year indicates a future demand of 15 million acre-feet per year. It would probably take 50 to 60 years to develop such demand. A reasonable program for a project such as the Snake-Colorado Project would consist of three stages developing 5, 10 and 15 million acre-feet respectively at 15-year intervals. The canals and flumes would be designed for 10-million acre-feet per year with provisions for expansion to the full 15-million acre-feet per year level. The pumping stations and power plants would be constructed in three stages with the foundations, excavation and building areas built for a two-stage development.

Siphons, tunnels and penstocks would be planned for a three-stage construction program. Reservoirs would be scheduled at the various stages of development depending on the particular function of the storage. The large Hells Canyon Reservoir would be scheduled for construction during the last stage of development. Other source regulatory reservoirs would be built during the second and third stages. The forebays and afterbays for each power plant would be constructed to full capacity under the initial program.

Storage Requirements

Considerable storage will be required at various locations and at different stages of the development of this project as follows: First, to regulate the sources; second, to serve as a forebay for the primary pumping stations and the main stem of the project; third, as a primary forebay for the string of powerhouses; fourth, as secondary forebays and afterbays for each power plant; and, fifth, as a terminal storage for the project to regulate the water supply before it is distributed for irrigation or municipal usages.

Storage for source regulation is very important because of the highly seasonal nature of the runoff from the Salmon and Clearwater Rivers. This will not only serve the needs of the regional project but would be able to provide water service to adjacent local areas as well.

Major storage is needed to serve as a forebay to the main stem of the Project to permit the system to operate at a relatively constant rate throughout the year. This function would require nearly 3 million acre-feet of storage. It can be attained by building the oft proposed Large Hells Canyon Dam. Since this storage requirement will not be needed for 40 to 50 years the present dam in Hells Canyon would be depreciated by then.

A storage facility with 3,000,000 acre-feet capacity would be built near Goldfield, Nevada. This would provide backup for the power drops west of Las Vegas in the event of maintenance or major outage on the main stem of the project. It appears that a large valley about 20 miles south of Goldfield would provide a site for this very valuable facility.

Each power plant should have its own forebay and afterbay in order to operate at the most economical load factors. These storage units should have at least 10,000 to 20,000 acre-feet of capacity. Some of these may be simply long extra-wide channels.

Terminal storage will be required in varying quantities at the end of the various aqueducts and at major delivery points. The amount required for this function will depend on the quantity of water delivered at the particular point and the variation between the pattern of usage and the constant flow delivery schedule of the aqueduct. There is a large amount of storage capacity available in Lake Mead and Lake Powell. At the present time this totals more than 40-million acre-feet. This will serve not only as terminal storage for the Snake-Colorado Project, but will permit storage of deliveries that are surplus to demands for the first few years of operation.

WATER SUPPLY

The primary source of water for the Snake-Colorado project is the Columbia River at the mouth of the Snake River which point is within the backwater pool of McNary Dam.

The runoff of the Columbia River at McNary Dam ranges between 92 and 94 percent of the runoff at Bonneville Dam, while the Snake River produces from 22 to 26 percent of the runoff of the Columbia River at Bonneville. The major tributaries to the Snake River below Brownlee Reservoir, the point at which the water is diverted from the natural channel, are the Salmon River and the Clearwater River. The amount of water during the critical dry years in the Snake River at points above and below these primary tributaries, and on the Columbia River, after estimated depletions for local use for the year 2010, is as follows:

[Runoff in millions of acre-feet] ¹

	1928-29	1929-30	1930-31	1931-32	1932-33	5-year average
Snake River at Brownlee.....	8.3	7.6	7.2	8.6	8.7	8.1
Snake River below Salmon.....	14.7	14.0	11.5	17.0	16.7	14.8
Snake River below Clearwater.....	28.9	22.7	19.6	31.5	30.9	25.7
Columbia River at McNary Dam.....	82.7	84.8	77.8	119.0	130.1	98.8
Columbia River at Bonneville.....	89.2	89.5	83.5	129.0	140.1	103.3

¹ Based on flows and depletions estimated by Water Management Subcommittee, Columbia Basin Inter-agency Committee, 1959.

With the natural channel of the Snake River being used as a conduit it appears unnecessary to take all the water from the Columbia River at McNary Dam (elevation 340 feet above sea level) and transport it back the way it came. It should first be established to everybody's satisfaction what minimum flows are necessary to maintain the needs of the local establishments. Then whatever is left may be pumped back upstream and transported through the Snake-Colorado aqueduct. These minimum flows may vary from year to year depending on how adverse or good the runoff conditions may be. They may be varied at individual dams for one reason or another; or the amounts may even be varied according to the time of day to help support power values. These minimum flow requirements could also be varied as time goes on and conditions change.

To indicate the amount of water available at different levels, certain assumptions will be made. It will be assumed that minimum flows of 1,000 cubic feet per second are necessary in the Snake and Salmon Rivers down to the mouth of the Salmon River. Below the Salmon River it will be assumed that a flow of 2,000 cubic feet per second will be necessary in the Snake River. The quantities of water that can be diverted at various levels with these assumptions during the driest period of record (1928-1933) are as follows:

Modified Snake-Colorado project

[Amount of water available (1,000 acre-feet per year)]

Point of diversion	Elevation (feet)	5,000,000 acre-feet ¹	10,000,000 acre-feet ¹	15,000,000 acre-feet ¹
Brownlee Reservoir.....	2,077	5,000	7,229	7,253.0
High Mountain Sheep Reservoir.....	1,510	0	2,576	2,796.6
China Gardens Reservoir.....	950	0	195	1,530.4
Lower Granite Reservoir.....	735	0	0	3,003.0
McNary Reservoir.....	340	0	0	417.0
Total.....		5,000	10,000	15,000.0

¹ Minimum rates of diversion: 5,000,000 acre-feet, 8,650 cubic feet per second; 10,000,000 acre-feet, 17,120 cubic feet per second; 15,000,000 acre-feet, 25,680 cubic feet per second.

² Assuming a rate of diversion of 7,000 cubic feet per second from Salmon River with no storage.

On the basis of the foregoing assumptions the average lift for the water diverted at the various stages of development would be as follows:

5 million acre-feet per year—3,170 feet average lift
 10 million acre-feet per year—3,340 feet average lift
 15 million acre-feet per year—3,700 feet average lift

EFFECT OF WATER PROJECT OPERATION ON OTHER USES ON THE SNAKE AND COLUMBIA RIVERS

The effect of the above-described project on irrigation, municipal and domestic uses of water will be nil because it proposes to make the major diversion from the Snake at the head of the Snake River Canyon which is downstream from the most important agricultural areas in Idaho. As the supply to the upper Snake River is depleted by increasing usage, a larger quantity of water would be pumped back up the channel from lower levels of the system. Minimum releases would be gauged to meet the needs of the lower Snake River below Clarkson.

The regional importation system proposed herein will not adversely affect the fish and wildlife program. Actually, it will enhance the accessibility of these remote areas to the general public because of the access roads that will be needed for the project.

In evaluating the effect of this project on the power potential of the Snake and Columbia River it must be noted that the relationship between the hydro power and the power market in the Northwest is changing. In the past there has been hydro power sufficient to serve all the demands but by the time the first phase of this proposed regional project goes into operation (1985 to 1990) only 50 to 55 percent of the power market can be served by hydro electric plants, and by the time of the second stage, nuclear and conventional steam plants will be serving 66 percent of the power market. Since conventional steam and nuclear power plants operate best at plant factors approaching 100 percent, there will be a great need for peaking power. The Snake River power plants under the impact of the herein proposed regional water program will become peaking plants and help fulfill this need. As a result, it can be categorically stated that no present hydro power facilities will be rendered useless by the Project.

Since the water that is taken out of the Snake or Columbia River would have passed through a series of powerhouses downstream the energy lost by virtue of this diversion must be charged to the Project and either paid for or replaced. The amount of energy involved is as follows:

Energy losses and requirements

[In billions of kilowatt hours]

State of development	Project energy requirements	Hydro energy loss	Total energy requirements
5 MAF.....	20.3	7.5	27.8
10 MAF.....	42.9	13.6	56.5
15 MAF.....	71.4	16.7	88.1

The project will have no direct effect on flood control although where storage facilities are constructed for Project purposes within the Snake River or its tributaries, flood control features could be readily incorporated to help ease this problem.

Navigation would be unaffected since most navigation is restricted to the Lower Snake River where the various dams back up water to the adjacent upstream dams.

PROJECT BENEFITS

The benefits for the foregoing project are widespread and very great. An analysis of the benefits by state is as follows:

Washington will benefit from flood control facilities incorporated in Project reservoirs on the Salmon River, Clearwater River and Snake River. It is a possibility that Washington could join with Oregon, Idaho and Montana as recipients of a Basin Development Fund, similar to that furnished by California's Davis-

Grunsky Act, that would receive money from the Regional Project for power losses and perhaps even some compensation for each acre-foot of water exported. This fund would be used to assist local water projects and to provide grants for recreation, and fish and wildlife enhancement. If the energy lost through upstream diversions were to be paid for at the rate of 2 mills per kilowatt hour the income would be \$15 million per year in Stage 1, \$27 million per year in Stage 2 and \$33 million per year in Stage 3.

Oregon by this project will have a new water supply available to many hundreds of thousands of acres of arable lands in the high plateau areas of the southeast and central parts of the state. Some of the local storage needed for advanced stages of the Project may be located on the Burnt River, Power River or Grande Ronde. These reservoirs will serve needs of local areas in supplying water for irrigation and municipal purposes. In addition the large storage units needed for the project on the Clearwater and Salmon Rivers will provide flood control benefits on the lower Columbia River. The Duncan Ferry Reservoir will provide additional water supplies and great recreation benefits for Eastern Oregon. Oregon would also receive benefits for local projects from the Basin Development Fund described earlier.

Idaho will be the recipient of a new water supply for thousands of acres in the high, arid plains areas in the Owyhee River Basin. This supply may be feasibly extended easterly to serve other lands which have no other source of water. Here, as in Oregon, storage units serving Project needs on the Salmon River, Clearwater River and upper Snake River can be adapted to care for local needs for irrigation, municipal and industrial water and provide flood control and recreational benefits. Idaho would also receive benefits for local projects from the Basin Development Fund described earlier.

Montana would benefit from the construction of large storage reservoirs for Project purposes on the Clearwater River and Salmon River which could readily be designed to provide water supplies for irrigation, municipal and industrial purposes in the local areas and provide flood control and recreation benefits. Montana would also receive benefits for local projects from the Basin Development Fund described earlier.

Arizona would be one of the major recipients of benefits from the Snake-Colorado Project in that 4 million or more acre-feet could be delivered to more than a million acres of highly productive soils. In addition, the quality of water in the lower Colorado River would be greatly improved.

Nevada would receive benefits from the water supplies made available to thousands of acres of lands that have never before had any hope for water. Also, the terminal storage reservoirs and forebays and afterbays for each of the power plants would provide excellent recreation facilities.

California can be the recipient of at least five million acre-feet of water either directly or indirectly from the Project. Water for irrigation, municipal and industrial purposes can be delivered through the California Mojave Aqueduct for direct use on lands in the Owens Valley, Indian Wells Valley, Mojave Desert and the South Coastal Area. Water released into the Colorado River will enhance supplies in the Imperial and Coachella Valleys, Palm Springs Area and the Colorado River Area. The San Joaquin Valley can receive up to 2 million acre-feet of water indirectly by exchange with Feather River Project water now scheduled for delivery to Southern California. In addition, the San Joaquin Valley can receive water directly through a diversion from the California-Mojave Aqueduct through a 13.5 mile tunnel into the South Fork Kern River. The Tahoe Lake Area can also receive a substantial enhancement of its water supply through an exchange with the Carson Project in Nevada.

The Upper Basin States of *Utah, Colorado, New Mexico and Wyoming* can receive several million acre-feet of water from the Project indirectly through an exchange of Colorado River water. These states would divert additional water that is presently required for the use of the Lower Basin States and the Snake-Colorado Project would replace this water. In addition, New Mexico can exchange Gila River water in a similar manner with Arizona to supplement its present supply.

Mexico can be given a substantial supply of water from this project via the lower stem of the Colorado River as a gesture of international goodwill. The improvement of the quality of the water in the lower Colorado River will relieve a very bad situation for Mexico.

The Snake-Colorado Project is also, in effect, a power transmission system in that it consumes power in a power-rich area and produces power in plants located in an area of heavy power demand. The power production for these plants at various stages of development is as follows:

Stage	Capacity (megawatts)	Energy (million kilowatt- hours)	Project energy deficiency (million kilowatt- hours)
5,000,000 acre-feet.....	3,000	18,400	1,600
10,000,000 acre-feet.....	5,500	33,000	8,900
15,000,000 acre-feet.....	7,000	49,000	22,400

In addition to the above the importation of water into the Colorado River will permit the storage levels in Lake Powell and Lake Mead to be raised resulting in greater power output.

COST OF PROJECT

The estimated cost of the first stage project by units is as follows:

Main stem, Snake-Colorado Aqueduct.....	\$3,612,000,000
Idaho Aqueduct.....	58,000,000
Oregon Aqueduct.....	482,000,000
California-Mojave Aqueduct.....	1,570,000,000
Total	5,722,000,000

The cost of the Snake River system is estimated to be about \$715,000,000 but is not shown in the above-listed costs because it is doubtful if this portion of the facility will be needed during the first stage of development. Even under the second stage it appears that only a part of it may be needed to supply the 10 million acre-feet per year.

The estimated annual cost of the main stem project is as follows:

Capitalization: \$3,612,000,000, at 0.03165.....	\$114,000,000
Pumping power: 20.3 billion KWH, at 4 mills.....	81,000,000
Power reparations.....	29,000,000
Operation and maintenance.....	16,000,000
Subtotal	240,000,000
Power revenues:	
15.9 billion KWH, at 3 mills.....	48,000,000
2.5 billion KWH, at 1.4 mills.....	4,000,000
Subtotal	52,000,000
Total net annual cost	188,000,000

The average cost of delivering 5 million acre-feet per year from the Snake River to the Colorado River is then \$37.60 per acre-foot.

COMPARISON WITH OTHER PLANS

The primary alternative to the Modified Snake-Colorado Plan is a diversion from the mouth of the Columbia River such as envisioned by Frank F. Pirkey of Sacramento, California.

The Pirkey project is obviously considerably greater in length than the herein-described proposal. There seems to be little doubt that the Pirkey Plan would cost at least 500 million dollars more than the Modified Snake-Colorado Project. One of the major differences is in project pumping cost. Where the Pirkey

Plan would require a pumping lift of at least 5,200 feet for all water, the average lift ranges from 3,200 to 3,700 feet for the Modified Snake River Plan. The differential in annual energy requirements is as follows:

Energy requirements

[In billion kilowatt-hours]

Stage	Pump energy	Energy loss	Total	Pirkey plan	Difference
5 MAF-----	20.3	7.5	27.8	33.4	5.6
10 MAF-----	42.9	13.6	56.5	66.7	10.2
15 MAF-----	71.4	16.7	88.1	100.3	12.2

The annual cost of this extra energy based on a cost of 4 mills per kilowatt hour is 22.4, 40.8 and 48.8 million dollars per year respectively, for the three stages of development.

The North American Water and Power Plan (NAWAPA) as conceived by Mr. Hilleman Hansen and promoted by the Parsons Company is not comparable to the Snake-Colorado Project. The NAWAPA Project is a very long range concept requiring more than a century to develop. It is quite possible that the Modified Snake-Colorado Project could be considered as a first stage of the NAWAPA Plan.

There have been no other projects proposed that are capable of delivering the quantities of water obviously needed in the fulfillment of a Regional Water Project.

RESOLUTION

UPPER SNAKE RIVER (IDAHO) WATER USERS PROTECTIVE UNION ANNUAL MEETING,
FEBRUARY 27, 1967, IDAHO FALLS, IDAHO

Whereas planning programs are currently being carried on by agencies of the Federal Government to determine the availability of water for exportation from either or both the Snake River Basin or the Columbia River into the Colorado River Basin, and

Whereas the water resources of the State of Idaho are essential not only to the state's existing economy, but also to the state's future development and growth, and any exportation of the waters of this state either from within the state or from the Columbia River Basin which would require a contribution of water from Idaho rivers, prior to the maximum utilization of the water in Idaho, could stunt and stifle the future development and growth of our state: Now, therefore, be it

Resolved, by the Upper Snake River Waters Users Protective Union at its annual meeting held on the 27th day of February, 1967, in the City of Idaho Falls, Idaho, That it is opposed with all of its force and energy to the exportation or to the planning by Federal agencies for exportation into the Colorado River System of any of the waters of the State of Idaho, or of the Columbia River Basin of which Idaho is a part, until the area or areas seeking importation of water shall first conclusively establish that it or they have put all potable water within their own area to highest feasible use and until such time and such time only as the State of Idaho and the other states of origin of the waters in question have:

1. Completed their water inventory;
2. Determined what their future water needs and requirements for all purposes will be;
3. Then only after adequate provision is enacted into Federal law guaranteeing existing water rights, and reserving to such states of origin their full future water needs and requirements.

STATEMENT OF DR. MORAS L. SHUBERT, PRESIDENT-ELECT, COLORADO-WYOMING
ACADEMY OF SCIENCE

The Colorado-Wyoming Academy of Science, composed of about 400 members, most of them being school and university faculty, approved the following state-

ment in opposition to Grand Canyon dams and requesting extension of Grand Canyon National Park, at its Annual Meeting, April 28, 1967, in Boulder, Colorado.

Two of the bills before this Subcommittee were presented by Senators Gordon Allott and Peter Dominick of Colorado as "a package plan for the development and use of the Colorado River Basin and Grand Canyon National Park." (*Congressional Record*, 3/9/67, S3411-3412) S. 1242 would authorize construction on Hualapai Dam in Grand Canyon as part of the Colorado River Basin Project. S. 1243 would extend Grand Canyon National Park upstream to include Marble Gorge, but would at the same time remove 13 river miles of Grand Canyon from the National Park, and would abolish the National Monument altogether. The National Monument contains 41 miles of Grand Canyon. Therefore S. 1243 would downgrade a total of 54 miles of the Grand Canyon to the status of national recreation area.

The purpose of this bill is not to create new recreational opportunity, but to revise the Park and Monument boundaries to accommodate the Hualapai Dam. Our National Parks and Monuments have been created in recognition of the vast enjoyment they offer to people when maintained in their natural or very nearly natural condition. They are not lands simply held by the public until they can be engineered for utility—whether the engineering is termed improvement, development, or exploitation. We feel that Congress would be most unwise to tolerate a process of picking at our National Parks. It is a process that could have only one tragic conclusion.

There are compelling reasons to table S. 1243, and to act favorably on a bill which would extend Grand Canyon National Park both upstream and downstream, to give protection to the entire geographical Grand Canyon from Lee's Ferry to Lake Mead.

The Grand Canyon is a geologic unit extending uninterrupted for approximately 280 miles. A dam anywhere in its length would drastically change the hydrologic nature of the Canyon and its ecological characteristics. A high dam with pump-back storage features would be even more disturbing, for it would increase the daily fluctuation of water levels in the reservoir and the scouring of the Canyon below the dam.

The reservoir which would be created by Hualapai Dam would completely obstruct any future access to the bottom of the Canyon—which is the life zone of the inner gorge, as well as the location of the oldest geologic features—for approximately 80 miles.

The proponents of a dam in Grand Canyon must bear the burden of proof that it is essential, and that its purposes could not be served by any other means. The dam proponents have never demonstrated this. To the contrary, it is clear that Hualapai Dam is not essential to the solution of any part of the problem of water shortage in the Southwest. It is planned as a payback feature only. Alternative methods of financing exist for feasible development projects.

The Grand Canyon is a resource possessing such important and unusual qualities of scientific, recreational and spiritual value that the American people have a special privilege and obligation to hold it in trust for the enjoyment of all our people, for the world, and for the future. It has no proper place in the scramble for water projects, and must be removed from the bargaining block, quickly and permanently.

For all these reasons, we urge this Subcommittee to support legislation that will place the entire Grand Canyon within the protection of a National Park, and do so in this session of Congress.

STATE OF NEW MEXICO,
HOUSE OF REPRESENTATIVES,
TWENTY-EIGHTH LEGISLATURE,
Redrock, N. Mex., April 24, 1967.

HON. CLINTON P. ANDERSON,
U.S. Senate, Washington, D.C.

DEAR SENATOR ANDERSON: I understand that hearings will be held in the next week or so in Washington on the proposed construction of Hooker Dam on the Gila river.

We in Grant County and Southwestern New Mexico appreciate your and the rest of our Congressional Delegation's efforts in behalf of this project.

The people of Grant, Hidalgo, Catron and Luna counties are enthusiastically supporting Hooker Dam. There is no question but that this dam on the Gila would be of great recreational value to all of New Mexico as well as permanent economic boost to Southwestern New Mexico and Grant County. The benefits derived from flood protection below Hooker site and on into the Virden valley and Arizona would be of great importance as floods in the past have done great damage to the farm lands in the Gila, Cliff, Redrock, Virden and on into the Duncan, Arizona area.

Again, thanks for your interest in this proposed project and I assure you that the vast majority of the people in Southwest New Mexico are enthusiastically supporting the construction of Hooker Dam.

Sincerely,

ROBERT C. MARTIN,

STATE OF NEW MEXICO,
HOUSE OF REPRESENTATIVES,
TWENTY-EIGHTH LEGISLATURE,
Santa Fe, April 25, 1967.

HON. CLINTON P. ANDERSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR ANDERSON: I, and the people of Southwest New Mexico, earnestly solicit your support on the Central Arizona Project which is supposed to include the Hooker Dam. Grant County and the Southwest have waited many years for a project like the Hooker Dam to be constructed.

We are close enough to several large cities that such a recreation outlet would means many dollars to us and the state of New Mexico. As it is now, the people from El Paso and Las Cruces go right on through to lakes galore in Arizona.

This section of New Mexico feel that we certainly need a large body of water that can be made into a real recreation area. There are such areas in the central and northern parts of the state but we do not have access to such a luxury down here.

Beside the recreation standpoint it would also prevent a large amount of flood damage that we sometimes have. We all feel that if we do not get this dam this time we will be finished forever.

Your sincere support and help will be very much appreciated by about ninety-five percent of the people down here.

Thank you.

Sincerely,

FRED W. FOSTER.

NEW MEXICO STATE SENATE,
Santa Fe, April 24, 1967.

SENATOR CLINTON P. ANDERSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR ANDERSON: As Senator from the County of Grant, I am writing you concerning the Hooker Dam Project to be heard before the Senate Committees the first week in May. I would like to urge you and the entire New Mexico Delegation to give this project your support both in committee and on the floor of the Congress.

The Hooker Dam is a part of the Central Arizona Project and we would like to have the project passed and put into action this year. The Hooker Dam is proposed to be built in Grant County and from the standpoint of agriculture, water conservation, recreation and economics, it will be very beneficial to this county and, as a result, beneficial to the state of New Mexico as a whole. The benefits to be derived from such a project are of such size that the full impact cannot be expressed. Your support toward the passage of this project will be invaluable and, from my personal standpoint and that of my constituents, greatly appreciated.

Due to the benefits that can be derived from this project both for Grant County and for the state of New Mexico, I respectfully urge your sincere and strongest support for the passage of the bill proposing this matter. If I can be of any service to you in obtaining information about the feelings in this area or the facts surrounding Hooker Dam, I will be more than happy to supply them to you at your request or the request of any of the New Mexico Congressional Delegation. The people in Grant County are strongly behind this project and we hope we can depend on your support in this matter.

Very truly yours,

EDITH H. VESELY,
Senator, Grant County.

BAYARD CHAMBER OF COMMERCE,
Bayard, N. Mex., May 2, 1967.

HON. CLINTON P. ANDERSON,
*Senate Building,
Washington, D.C.*

DEAR SENATOR ANDERSON: Our representative from our area, Mr. Alvin Franks, who will be at the hearing in Washington regarding Hooker Dam and the Central Arizona project, is acting as courier to take a mile of signatures to you which were collected by the Bayard Chamber of Commerce.

We hope that this shows our whole hearted support of the projects.

Respectfully yours,

CHARLES W. ROGERS, *President.*

DEMING ROTARY CLUB,
Deming, N. Mex., April 28, 1967.

MR. ALVIN FRANKS,
Silver City, New Mexico.

DEAR MR. FRANKS: The Deming Rotary Club, upon action taken at a regular meeting April 27, 1967, endorsed the construction of Hooker Dam, to be located on the Gila River near the mouth of Turkey Creek.

The membership, through a majority vote, has instructed me to express this endorsement through a letter to you.

Very truly yours,

CLAUDE E. LEYENDECKER, *President.*

BAYARD, N. MEX., *April 22, 1967.*

HON. SENATOR CLINTON P. ANDERSON,
*Senate Office Building,
Washington, D.C.*

DEAR SENATOR: As the present commander of VFW post number 3347, and after a meeting of our members who total 106 we earnestly ask all the aid you may give to expedite the legislation necessary to build Hooker Dam.

It will be a great economic aid to this section of the state; ranking on a par with our mining industry and would be far ahead of the livestock industry.

In respect to the charge made that it would be an intrusion on the Gila wilderness Area it would be less than one-tenth of one percent of the Wilderness Area involved. The wildlife will all be benefitted by its construction; as the flood control alone will help equalize water over a large area.

Very Sincerely Yours,

JOHN T. CADE,
Commander, Post 3347, VFW.

TOWN OF HURLEY,
Hurley, N. Mex., April 24, 1967.

THE DAMSITERS,
Silver City, N. Mex.

GENTLEMEN: The Board of Trustees and the Mayor of the Town of Hurley have passed a resolution supporting your efforts toward the Hooker Dam legislation. Letters have been forwarded to Senator Clinton P. Anderson, Senator

Joseph M. Montoya, Governor David F. Cargo, E. S. Johnny Walker, representative, and Thomas G. Morris, representative, along with a copy of the resolution asking their support. We sincerely hope the entire southwest will join you in your efforts toward a successful conclusion of this legislation.

Yours very truly,

HAROLD F. TRAPP, *Mayor.*

RESOLUTION

Whereas, the Council of the Town of Hurley has for many years been fully aware of the vital importance of water to any community and especially to those in the semi-arid Southwest, and is very pleased that our Congress is considering legislation which would insure the construction of the proposed Hooker Dam and Reservoir on the Gila River, and

Whereas, we sincerely believe that the passage of said legislation would be a tremendous stride forward in providing the additional water required for the population growth and industrial expansion now in progress in Southwest New Mexico, and

Whereas, such a Dam and Reservoir would also be a tremendous addition to the recreation facilities which are becoming more and more a requisite for the well-balanced growth of any community, and would also provide for much needed flood control in the Gila Valley, and

Whereas, we do not for a moment believe that such a project would to any noticeable extent whatever detract from the favorable benefits of any Wilderness or Primitive areas now extant because of the very small acreage the Dam and Reservoir would require from those areas: Be it therefore

Resolved, That the Congress of the United States is asked to consider, approve and pass in this present Session whatever legislation may be required to authorize not only the presently titled Central Arizona Project but the inclusion therein of Hooker Dam and Reservoir on the Gila River in New Mexico, and; be it further

Resolved, That the Governor of and the Congressional Delegation from our State of New Mexico be requested to lend their timely and sustained efforts for the passage of the subject legislation by our Congress.

Accepted, Passed, Adopted and Approved by the Town Council of the Town of Hurley, New Mexico this 24th day of April, 1967.

HAROLD F. TRAPP, *Mayor.*

Attest:

ALBERTA BATES, *Clerk.*

STATE OF THE NEW MEXICO COUNTY OF LUNA,
Deming, N.Mex., April 25, 1967.

ALVIN E. FRANKS,
1002 Santa Rita, Silver City, N. Mex.

DEAR MR. FRANKS: The following is a Resolution prepared by the Board of County Commissioners after due consideration of the great advantages that would come to our area from the construction of Hooker Dam on the Gila River:

Whereas: The entire Southwestern portion of New Mexico is dependent to a great extent on business brought in by tourists; and:

Whereas: We are severely lacking in recreational facilities to offer said tourists; and:

Whereas: The storage of waters behind Hooker Dam would be of great benefit to farmers along the Gila River, particularly from the standpoint of flood control;

Therefore, we members of the Board of County Commissioners, Luna County, New Mexico do hereby unanimously resolve that we endorse the Hooker Dam Project and, hereby respectfully request your support in the passage of the project and the expending of the project in its construction.

Respectfully submitted.

WILLIAM T. ANDERSON,
Chairman, Luna County Board of County Commissioners.

APRIL 24, 1967.

HON. THOMAS G. MORRIS,
*Member of Congress,
House Office Building,
Washington, D.C.*

DEAR REPRESENTATIVE MORRIS: The following is a Resolution prepared by the Board of Directors after due consideration of the great advantages that would come to our area from the construction of Hooker Dam on the Gila River:

Whereas: The entire Southwestern portion of New Mexico is dependent to a great extent on business brought in by tourists; and

Whereas: We are severely lacking in recreational facilities to offer said tourists; and

Whereas: The storage of waters behind Hooker Dam would be of great benefit to farmers along the Gila River, particularly from the standpoint of flood control;

Therefore, we members of the Board of Directors of the Deming-Luna County Chamber of Commerce do hereby unanimously resolve that we endorse the Hooker Dam Project and, hereby respectfully request your support in the passage of the project and the expediting of the project in its construction.

Respectfully submitted,

CARL SHORES,
President for the Board of Directors.

ATTEST:

PAULINE MORGAN, *Secretary.*

(This letter also sent to the following: Governor David F. Cargo, Senator Clinton P. Anderson, Representative E. S. Walker, Senator Joseph M. Montoya.)

RESOLUTION

Whereas, the Council of the Town of Silver City by reason of its continuing interest in the proposed Hooker Dam and Reservoir on the Gila River is encouraged by pending legislation before the Congress, and

Whereas, municipal and industrial water needs of this rapidly growing area of Southwestern New Mexico can be met in part by passage of pending legislation to authorize the Central Arizona Project including Hooker Dam and Reservoir, and

Whereas, the construction of Hooker Dam will greatly enhance recreational facilities without adversely effecting established wilderness and primitive areas, and

Whereas, flood control protection, the need for which has been so clearly demonstrated in recent years, will be finally realized by construction of Hooker Dam.

Now, therefore, be it resolved by the Council of the Town of Silver City that:

1. The Governor of New Mexico and the Congressional Delegation from this State are asked to support and urge the passage of legislation designed to meet the growing needs for water in the area to be supplied by the proposed Central Arizona Project.

2. The Congress of the United States is asked to favorably consider and pass in this session legislation authorizing the Central Arizona Project including Hooker Dam and Reservoir on the Gila River in New Mexico.

Passed, Adopted and Approved this 17th day of April, 1967.

BEN D. ATTAMIRANO,
Mayor Pro Tem.

RESOLUTION

Whereas, the Board of County Commissioners of Grant County, New Mexico, have been proponents of the proposed Hooker Dam and Reservoir on the Gila River since inception of the proposal, and

Whereas, enabling legislation for such project is now pending before the Congress of the United States, and

Whereas, municipal and industrial water needs of this rapidly growing area of Southwestern New Mexico can be met in part by passage of pending legislation to authorize the Central Arizona Project including Hooker Dam and Reservoir, and

Whereas, the construction of Hooker Dam will greatly enhance recreational facilities without adversely affecting established wilderness and primitive areas, and

Whereas, flood and water damage is one of the major area problems and can be virtually eliminated by the flood control possibilities of the proposed Hooker Dam.

Now, therefore, be it resolved by the Board of County Commissioners that:

1. The Governor of New Mexico and the Congressional Delegation from this State are asked to support and urge the passage of legislation designed to meet the growing needs for water in the area to be supplied by the proposed Central Arizona Project.

2. The Congress of the United States is asked to favorably consider and pass in this session legislation authorizing the Central Arizona Project including Hooker Dam and Reservoir on the Gila River in New Mexico.

Passed, adopted and approved this day of April, 1967.

BOARD OF COUNTY COMMISSIONERS OF
GRANT COUNTY, NEW MEXICO.

APRIL 22, 1967.

Senator CLINTON P. ANDERSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR ANDERSON: Please accept this as my personal recommendation and that of my organization, New Mexico, Grant County Farm & Livestock, for favorable action on the construction of Hooker Dam near Silver City, New Mexico.

I am convinced that this reservoir is badly needed and will be an asset to the entire South-West.

Sincerely yours,

NOEL RANKIN,
President, Grant Co. Farm & Livestock.

APRIL 22, 1967.

Senator CLINTON P. ANDERSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR ANDERSON: Please accept this as my personal endorsement of favorable action with reference to Hooker Dam near Silver City, New Mexico.

As an individual citizen I sincerely feel that this reservoir would be a great asset to Southwestern New Mexico.

In my occupation, I deal with the public a great deal and popular opinion is in favor of this project.

I strongly urge your support in the passing of this legislation.

Thank you for usual good cooperation.

Sincerely yours,

JOSEPH B. HAYCOCK,
Salesman, Clifton Chevrolet, Silver City, N. Mex.

SILVER CITY, N. MEX., April 20, 1967.

Senator CLINTON P. ANDERSON,
Senate Building,
Washington, D.C.

DEAR SENATOR ANDERSON: We as a business firm and I as an individual respectfully urge you to do all possible to bring about the building of Hooker Dam on the Gila River.

I am sure you are as aware as we are of the incalculable benefits to be derived from water conservation, flood control, land conservation, and recreation revenues.

We feel it is not only important to the future development of southwest New Mexico but will be of importance to the State as a whole.

Please let us thank you now for your support of this most important project.

Very truly yours,

WILLIAM G. WORD, Jr.

APRIL 21, 1967.

Senator CLINTON P. ANDERSON,
*Senate Building,
Washington, D.C.*

DEAR SENATOR ANDERSON: We as a business firm and I as an individual urge you to do all possible to bring about the building of the Hooker Dam on the Gila River.

I am sure you are just as aware as we all are of the benefits to be derived from water conservation, flood control, land conservation and revenues from recreation.

We feel that this project is of utmost importance to the future growth and development of southwest New Mexico and our state as a whole.

We wish to thank you now for your support of this project which is most important to us all.

Very truly yours,

DON G. WERNER.

APRIL 20, 1967.

Senator CLINTON P. ANDERSON,
*U.S. Senate,
Washington, D.C.*

DEAR SENATOR ANDERSON: In view of the fact that Mr. Hilton Dickson and Mr. Alvin Franks have been called to Washington on or about May 1st, for a hearing on the proposed Hooker Dam on the Gila river north of Silver City, this letter is written for the following purpose:

The Chamber of Commerce of Lordsburg-Hidalgo County wishes to go on record that this project is very much favored and needed by the entire area of Southwest New Mexico and also believe we are safe in saying, it is favored by the entire population of Hidalgo County.

Respectfully,

HOWARD PHILLIPS, *President.*

APRIL 20, 1967.

Hon. JOSEPH M. MONTOYA,
*U.S. Senate,
Washington, D.C.*

MY DEAR SENATOR MONTOYA: The intent of this letter is to reaffirm the position taken by the Board of Directors of our Chamber of Commerce some months back in regard to the Hooker Dam Project. It is our understanding that there will be a congressional committee hearing on this proposal on May 1, 1967. We would urge you to take whatever action you deem appropriate to lend assistance to the approval of the project.

It is our considered opinion that this project will greatly benefit Southern New Mexico in the following three areas:

1. Flood control on the Gila River
2. Water conservation for Southwestern New Mexico
3. Creation of a new area that would provide more recreation to serve the people of this region and another tourist attraction to this area.

We earnestly urge your support of the Hooker Dam Project.

Sincerely yours,

CHAD A. WYMER,
Executive Vice President.

GRANT COUNTY ASSOCIATION OF INDEPENDENT INSURANCE AGENTS,
Silver City, N. Mex., April 19, 1967.

HON. CLINTON P. ANDERSON,
*United States Senator,
 Washington, D.C.*

DEAR SENATOR ANDERSON: We, individually and as an association, believe New Mexico deserves favorable action towards the construction of Hooker Dam during this session of Congress.

We know the reservoir will provide needed flood control, water conservation and a fine recreation area and we also know it will enhance the Gila National Forest and the Gila Wilderness Area.

We urge your strong and active support towards the realization in the near future of this long-planned and long dreamed of asset.

Yours very truly,

JOHN E. BARBON, *President.*

GRANT COUNTY BANK,
 SILVER CITY OFFICE,
Silver City, N. Mex., May 1, 1967.

HON. SENATOR CLINTON P. ANDERSON,
*Senate Building,
 Washington, D.C.*

DEAR SENATOR ANDERSON: I am writing this letter to be sent via our courier, Mr. Alvin Franks who plans to appear at a hearing in Washington regarding the proposed Hooker Dam and Central Arizona Project. I am anxious that a certain viewpoint be expressed at the hearing.

The viewpoint which I refer to above, has to do with the fact that our community is not considering this as local "porkbarrel". Many of the citizens of the rapidly growing Southwest are looking to the probability of serious water shortages as the population inevitably pushes toward a high figure. This anticipated population figure is definitely going to face water shortages unless further water conservation and development is devised. This creates a condition which necessarily becomes of national interest since the Southwest is becoming such an important part of the nation.

All consideration and help that can be afforded by your office will be appreciated by fellow citizens in New Mexico, Arizona, and West Texas.

Sincerely,

LEWIS C. VENCILL.

SILVER CITY, N. MEX., *April 27, 1967.*

SENATOR CLINTON P. ANDERSON,
*United States Senate,
 Washington, D.C.*

DEAR SENATOR ANDERSON: I am pleased that your committee will be hearing our local representatives, Hilton Dickson and Al Franks, this Thursday, May 4th, relative to proposed legislation involving the Central Arizona project and, in particular, the Hooker Dam project.

As Chairman of the Grant County Development Committee, I would be remiss if I did not urge you and your committee to propose and adopt favorable legislation in support of the Hooker Dam project.

Very truly yours,

THOMAS E. WALKER.

SILVER CITY, NEW MEX., *April 30, 1967.*

HON. CLINTON P. ANDERSON,
*Senate Office Building,
 Washington, D.C.*

DEAR SENATOR ANDERSON: At the annual meeting of Grant County Republicans held on April 30, 1967, a motion was made and passed endorsing construction of Hooker Dam on the Gila River.

Very truly yours,

THOMAS W. MCCABE,
Republican County Chairman.

RESOLUTION

To : The Congress of the United States.

Subject : Opposition to Marble Canyon and Bridge Canyon (or Hualapai) Dams.

We the undersigned oppose the aforementioned dams since the dams would serve no necessary function, since they would do a considerable amount of aesthetic damage, and since they would set a precedent for exploitation of national parks and monuments.

The dams provide no needed water storage capacity because existing dams can store several years of runoff. In fact they cause a decrease in the amount of available water through increased evaporation and absorption surfaces.

The dams are not required for power generation because alternate means are available. For example, steam or nuclear-generated electricity is no more expensive, and nuclear generation will be much less expensive in a few years.

The dams will submerge beautiful sections of canyon, depriving future generations from being able to see some of the most spectacular scenery in the United States. While access to these areas is currently limited to boats, it is possible to develop other means of access.

The dams would also deleteriously affect the Grand Canyon National Park and National Monument. Marble Dam, which is above the park, would remove silt from the river, causing the river to readily absorb particles, and thus eroding sand bars and silt banks in the park. Also, Marble Dam would prevent the spring flood from cleaning out debris that washes down side canyons. Bridge Canyon, which is below the park, would produce slack water through the Grand Canyon National Monument and into the park. Such slack water causes a build-up of silt and debris which would be exceedingly ugly when exposed at a low water level.

To protect the canyon from such encroachments in the future, we urge that the Grand Canyon National Park be extended to encompass the Marble and Bridge Canyon damsites.

MARGUERITE S. DEARBORN,
And 87 other signatures.

ALTUS, OKLA., May 13, 1967.

CHAIRMAN,
Water and Power Resources Subcommittee,
Senate Interior Committee,
Washington, D.C.

DEAR SIR: Please include in the record of hearings on the Grand Canyon the following statement:

I support the Administration proposals contained in S1004 and S1013.

I understand that these bills contain alternatives to the building of dams in the Grand Canyon. I am opposed to the building of any more dams in the Grand Canyon and support the Administration's substitute plan.

Cordially yours,

DONALD R. MORRISON.

VENICE, CALIF., May 6, 1967.

U.S. SENATE INTERIOR COMMITTEE,
Washington, D.C.

GENTLEMEN: My wife and I are opposed to the dams which are planned for Grand Canyon. This is a national monument for our country and should not be exploited for commercial interest. Energy demands in the near future will probably be able to be competitively met by atomic power generating stations, as opposed to hydroelectricity.

We therefore favor passage of the bill HR 1305. Please make this letter part of the official record.

Cordially yours,

RAYMOND F. ORLOSKI, Ph. D.
GLORIA ORLOSKI.

BERKELEY, CALIF., May 3, 1967.

HON. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D.C.

Dear SENATOR JACKSON: Please enter my statement, as follows, in the official hearing record concerning the Central Arizona Project and Colorado River Basin Project Act which were held on May 2, 3, 4 and 5, 1967.

I strongly urge that the proposal to construct the Marble Canyon Dam and the Hualapai Dam on the Colorado River be defeated permanently during the current session of Congress.

My opposition to such two dams stems from the very basic observation that such dams will destroy for all time the world's most unique and outstanding river canyon—a national and international scenic and geologic treasure.

I also oppose the proposed Hooker Dam, as this dam will inundate portions of the Gila primitive and wilderness areas. These two areas must retain their primitive-wilderness aspects—such areas now protected under Federal law.

Power for water transportation in the Southwest should be obtained from steam, oil and nuclear sources. Water for the Southwest should be obtained from the Gulf of Mexico; desalted via nuclear power and transported by some means, all under simple agreement with Mexico.

The Southwest's and eventually much of America's water needs will be met by obtaining water from the sea; proper desalting of same all via nuclear power. Also, much hope for weather and rain control, as well.

I propose legislation to be enacted during this session of Congress to establish:

A permanent free-flowing Colorado River from Lees Ferry, Arizona, to head waters of Lake Mead in Arizona, some 280 miles of free-flowing river.

An extension of Grand Canyon National Park from Lees Ferry to Lake Mead to include portions of Lake Mead National Recreation area, Grand Canyon National Monument, Havasupai Indian Reservation, portions of Kaibab National Forest, and other public and state lands.

Desalting and transportation of fresh water from the Gulf of Mexico to meet all current and future water needs of Southwestern United States.

Sincerely,

JOHN R. SWANSON.

A RESOLUTION OF THE BOARD OF WATER COMMISSIONERS OF THE CITY OF LONG BEACH, CALIFORNIA

Whereas, legislation to authorize a Colorado River Basin Project is being considered by the 90th Congress; and

Whereas, the Board of Water Commissioners of the City of Long Beach, California, believes that the best solution to the problem of dwindling water supplies of the Colorado River is a regional solution and that new projects to divert more water within the Lower Basin of the Colorado River should be authorized only within a regional framework; and

Whereas, any sound regional development for the Colorado River Basin should have the following basic features:

1. Agreement regarding the need to augment the inadequate flows of the Colorado River with supplemental waters.
2. Authorization of the Central Arizona Project.
3. Establishment of a Lower Basin Development Fund to assist in financing and the authorization of Hualapai Dam to provide revenues for the Fund.
4. Protection of existing uses in Arizona, Nevada, and in California to the extent of 4.4 million acre feet annually, against the uses of the Central Arizona Project; and

Whereas, these principles are included in proposed legislation introduced by Senator Thomas Kuchel as S. 861 and by Congressman Craig Hosmer as H.R. 6271;

Now, therefore, be it resolved, that the Board of Water Commissioners of the City of Long Beach, California, does hereby support in principle S. 861 and H.R. 6271 and companion bills and urges their passage.

I hereby certify that the foregoing resolution was adopted by the Board of Water Commissioners of the City of Long Beach, at its meeting of May 18, 1967, by the following vote:

Ayes : Commissioners : McNulty, Speraw, Willingham, Mulvey and Gerken.

Noes : Commissioners : None.

Absent : Commissioners : None.

HELEN L. PENLAND, *Secretary.*

WEST COVINA, CALIF., May 4, 1967.

HON. HENRY M. JACKSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR JACKSON : Please include my comments in the record of hearings held relative to the bills and plans concerning the C.A.P. and construction of dams at Marble Canyon and Bridge Canyon (Hualapai).

The need for power and water for civil and industrial needs of the southwest in increasing amounts is not contested. However the means of furnishing this growing need is a matter of deep concern.

Surely it is within our nation's grasp to supply the growing needs of the southwest (really the nation at large) without further ruin of our great natural monuments such as the Grand Canyon.

Mans needs are real but let us devise a real approach to satisfaction of these needs that considers the necessity for avoiding the unnecessary destruction of priceless natural treasures such as the Grand Canyon of the Colorado.

Sincerely,

JAMES A. ALLEN.

MINNEAPOLIS, MINN., May 3, 1967.

HON. SENATOR HENRY M. JACKSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR JACKSON : Would you please enter this letter in the record of the Water and Power Resources Subcommittee's hearings on the Central Arizona Project?

We strongly object to the construction of Hualapai or any other dam in the Grand Canyon. We feel that every part of the Grand Canyon is too unique, and far too valuable aesthetically, to permit inundation by reservoirs. Also, as a purely practical matter, we believe it would be an incredible blunder to permit the intolerable seepage and evaporation losses of Colorado River water that would result if it were impounded by any more dams, when the Colorado cannot supply all the water needs of the southwestern states now. Finally, we question the economic value of Hualapai Dam as a "cash register", in the face of present-day low cost of fossil fuel-generated electricity, and the steadily decreasing cost of electric power from nuclear-fueled generating stations.

Thank you for giving these views your consideration.

Sincerely,

Mr. and Mrs. CARL W. EHRLMAN.

PRINCETON, N.J., April 6, 1967.

HON. HENRY JACKSON,
Chairman, Senate Interior Committee,
U.S. Senate,
Washington, D.C.

DEAR SENATOR JACKSON : I protest the proposal to construct dams within the Grand Canyon, below and/or above Grand Canyon National Park and Monument. If there were no alternatives to these dams, there would be no controversy. I hope that there will be a Senate bill to enlarge the Grand Canyon NP so as to include the total remaining area of the Grand Canyon. Meanwhile, I protest S 861 sponsored by Senator Thomas Kuchel.

Thank you.

Sincerely yours,

Mrs. JAMES F. GRAVES.

WEST COVINA, CALIF., May 6, 1967.

HON. HENRY M. JACKSON,
Senate Office Building,
Washington, D.C.

DEAR SIR: Please include the following comments in the hearing record as maintained for hearings relative to plans for supplying water to the Southwestern United States including plans that propose the construction of dams in the Grand Canyon of the Colorado.

Certainly with the passage of time it is reasonable to predict a population growth in the Southwest and corresponding to this population growth an increasing requirement for water is most probable.

How this increasing water need is satisfied is a matter of deep concern to many.

Though strong evidence has been submitted to show that if there is a need for new power sources to pump water the proposed dams in the Grand Canyon are not the optimum choice from economic considerations these economic factors though of merit are not the strongest reason for not considering the dams a proper approach to power generation.

If the Grand Canyon was ever worth saving and I think the National opinion is that it was as evidenced by the Grand Canyon National Park and Grand Canyon National Monument it is still worth saving for the very same natural values that led to the establishment of the monument and park.

If these natural values are to be saved the dams can not be built.

Returning to the means of satisfying the present and future water needs I respectfully suggest that this need can and should be satisfied from our expanding technological capability with all plans carefully formulated to preclude unnecessary sacrifice of priceless natural values.

Very truly yours,

LYLE A. TAYLOR.

WEST COVINA, CALIF., May 6, 1967.

HON. HENRY M. JACKSON,
Senate Office Building,
Washington, D.C.

DEAR SENATOR JACKSON: As a resident of California and specifically in a region of perennial water shortage I am sensibly aware of the need for development of new sources of supply and though with some misgivings supported the plan that California is in process of developing to transport Feather River water to the dry lands.

In regard to some of the current plans under consideration for supplying water to the southwestern dry lands I most staunchly oppose those plans calling for the placement of dams in the Grand Canyon at Hualapai and Marble Canyon. I would also oppose them at any other point.

My opposition is based on an understanding that the Colorado River in this region is for all practical purposes totally controlled and the dams will not really contribute to solution of the water shortage. Indeed not only will they not contribute to solving the problem at hand they may well worsen it by increasing waste. With the waste being increased we would also lose beneath the waters certain natural values that need not be so ruinously treated.

If as I understand the basic purpose of the dams is power generation there are superior methods of power generation and perhaps indeed the whole approach to supplying the water needs should be examined relative to the advancements in various fields of technology.

Please include these comments in the hearing record.

Sincerely,

Mrs. RUTH M. TAYLOR.

OCEANSIDE, CALIF., May 7, 1967.

HON. HENRY M. JACKSON,
United States Senate,
Washington, D.C.

DEAR SENATOR JACKSON: I have studied the literature, pro and con, re the proposed dams on the Colorado River. I am convinced that the Sierra Club knows

what it is talking about. They have clearly pointed out why these dams are not necessary. Not only would they add greatly to our escalating taxes but destroy one of our natural beauty areas. I strongly adhere to the Sierra Club plan.

Sincerely,

Mrs. A. W. SHAW and Family.

WIGWAM,
Scottsdale, Ariz., April 27, 1967.

HON. HENRY M. JACKSON,
*United States Senate,
Committee on Interior and Insular Affairs,
Washington, D.C.*

DEAR SENATOR JACKSON: As a continuing matter of information on the central Arizona Project (CAP), I am enclosing copies of recent articles that have appeared in the Arizona Republic and the Scottsdale Daily Progress.

Cordially,

LELAND M. JENKINS.

[From the Arizona Republic, Apr. 25, 1967]

SUGGESTIONS OFFERED FOR ECONOMIZING WATER

Editor, The Arizona Republic: I have been 40 years in this Valley and for 40 years I have listened to and read about the Central Arizona Project. What we hear today is about the same as what we heard 40 years ago, and we are just as close to getting Colorado River water as we were when I came here.

I think it is high time to start saving the water we have. Many times since I came here I have seen these floods come down the river through Phoenix and I have often wondered why there was no effort made to control and use these floodwaters.

There is a way to harness those floods and use the water here in this dry Valley with very little cost. There could be several earth-fill dams made in the box canyons up above the existing dams to catch and hold any run-off from the high country.

There are a dozen or more locations where an earth-fill dam could be made with dynamite at very little cost. One of the best locations on the Salt River is just above the crossing on Highway 60; to form a big lake at this place the high canyon walls could be blasted off and it would fall in place.

On the Verde there are several places where small lakes could be made with very little cost, and when they were made the storage lakes below could be operated at capacity, instead of releasing water to make flood protection.

The groundwater situation in the Valley is fast becoming a serious thing; with the water table going down so fast, pumping water will soon be a thing of the past.

These flood waters if controlled could be used to replenish the groundwater by releasing it gradually in the river below Granite Reef Dam and let it enter the water sands that underly this Valley.

It is well known that it takes a big flow of water coming over Granite Reef, to cause water to run as far down as 24th St., which indicates to me that there is an unusual situation in the river channel that makes it the ideal place to recharge our groundwater sands.

ED MATTESON.

[From the Scottsdale Daily Progress, Mar. 29, 1967]

RETHINK THE CAP

Once again Arizona is making little headway in Congress with the Central Arizona Project. Between California, Upper Basin states and conservation groups, opposition is formidable. Arizona leaders, however, appear incapable of changing positions and creating new proposals.

Yet this is precisely what is required if we are ever to get Colorado River water to the Valley.

Each year our leaders dust off the same plans with a few changes. They were created years ago when conditions were different and before the Supreme Court ruled in Arizona's favor.

The chances of getting two big dams, or even one, appear slim. With the advent of nuclear power, however, the need for dams no longer exists. Add to this recent engineering and water studies and we have the basis for new ideas.

Politicians and farmers may not like our suggestion, but we think Arizona would have a chance of getting a CAP with the following proposal:

An enclosed canal or pipe could be run to the Verde River from around Lake Powell. Water would come largely by gravity. This would eliminate most of the need for pumping power, so no dams would be required. Instead a small nuclear plant could provide necessary power for starting the flow.

Such a pipe would save thousands of acre feet of water yearly by eliminating surface evaporation. One reputable engineer suggested it might save 500,000 acre feet a year. If studies show this is nearly accurate, we could reduce the amount of water for delivery to 700,000-acre feet and let California have the other half million-acre feet in return for its support.

The net amount of water arriving in Central Arizona would be roughly the same. Any deficit could be made up by reducing allocations to cotton farming, which is an uneconomical use anyway.

This plan is far less costly than previous suggestions. In fact, it would cost only about 25 per cent of the Legislature's proposal. It would save water. It would not threaten the Grand Canyon. And, most important, it might have a chance of winning enough support to become reality.

We will await the reaction of Arizona leaders. We hope that they are open-minded enough to consider new alternatives.

[From the Scottsdale Daily Progress, Apr. 15, 1967]

GRAVITY FLOW TUNNEL IS FAVORED

Sir: It is interesting to know that your paper is sincerely interested in the newer engineering concept in the building of the Central Arizona Project (CAP).

However, it is noted that you mentioned the need of a small atomic power plant. This is the point that I find conflicts with the plan which is the only one that will work in bringing water to the Salt River Valley and on to Tucson. A gravity flow tunnel with covered conduits and generators in the Valley and on to Tucson will allow for the production of hundreds of thousands of kilowatt power just as the water falls in New England do. . . .

In addition to the great cost savings it is such a compelling argument that it is ridiculous to consider all of the propositions that are being thrown into the wind, mostly to confuse and subvert the issue. Even more ridiculous is the fact that we have embarked upon a plan costing \$1.8 billion when we can do it for so much less.

It is obvious that the Hosmer proposition was thrown into the fan to further the fragmentation of the people's thinking on CAP.

The above plan in itself, generating electricity as the water drops, will pay for itself (cost of \$300 million) by the utilization of the water from Lake Powell and will itself pay for the building of the whole water system in approximately 20 years. Also the tunnel plan will not involve extra costs of 17 to 18 million dollars per year for power payments such as the Lake Havasu plan will entail.

As you undoubtedly know, hearings have been scheduled on the Colorado River and Central Arizona Project proposals before the Senate Interior and Insular Affairs Committee for May 1, 1967, with Sen. Henry M. Jackson of Washington as chairman.

I hope that all citizens of Arizona can start thinking about this plan, talking about it and very soon doing something about it, because in their life time there is no more important civic work they have to do than to get water from the Colorado in the most efficient, inexpensive and practical way. And this is the way.

LELAND M. JENKINS,
4 Old Scottsdale Rd.

[From the Arizona Republic, Mar. 20, 1967]

NEED FOR COST EXAMINATION IN TUNNEL PROJECT CAUTIONED

Editor, The Arizona Republic: I have reread with interest Don Deder's column of Jan. 22 regarding the Central Arizona Project as outlined by Fred C. Ramsing.

I, too, am a mining man although not a graduate engineer like Mr. Ramsing. However, I have either been actively engaged in mining or very much interested in it for some 35 years.

Some 10 or 15 years ago I wondered why someone had not pursued the idea of tunneling to bring water from the Colorado River to the Salt River Valley. Although I had not read about it I was convinced the idea had been explored. It seems the exploration was very perfunctory.

About the same time I wrote an article regarding the feasibility of desalting water by atomic energy, placing the plant near the mouth of the Colorado, supplying fresh water to the Yuma and Imperial Valleys and thus releasing river water for use further upstream. This was presented to Gov. Howard Pyle and Senator O'Mahoney, but nothing ever came of it.

As you know, this is now being seriously considered by the federal governments of both the U.S.A. and Mexico. Since nothing came of this idea I figured nothing would happen if I put in my two cents' worth on the Central Arizona Project.

In spite of the fact some people think it would delay the Central Arizona Project a number of years if the tunnel idea were presented at this time I sincerely believe it should be. Under the present plans two large dams, pumping stations and long canals and viaducts would have to be constructed.

After the construction was completed the project would be saddled with an enormous pumping expense for as long as water is used in the Valley. It is claimed electricity generated at the two dams would pay for the project and pumping the water. Perhaps so, but forever is a long time.

As Mr. Ramsing suggests, the two new reservoirs would add an enormous evaporative surface area to the lakes already in existence on the river. By taking the water out at Glen Canyon evaporation would be drastically reduced. This could amount to the total used by the Central Arizona Project when present evaporation and the additional reservoir surface area is considered.

In this connection it has been said taking the water out at Glen Canyon would reduce that amount of water now being used at the lower power plants for generating electricity. Assuming the savings in evaporation, it knocks this idea into a cocked hat.

As Mr. Ramsing suggests, the advances made in mining in general and tunneling in particular the past 15 years makes it imperative a new look be taken at the tunnel idea. There is no doubt whatever in my mind the cost would be no more, and probably less, than the \$600 million Mr. Ramsing suggests. If Arizona has to go it alone all angles should be thoroughly examined. The possible difference in cost could mean getting the job done or having the idea voted down by the people of Arizona.

In drilling such a long tunnel a number of working shafts would have to be drilled down to the tunnel level. Mr. Ramsing states the tunnel should not be more than 5,000 feet deep at any point.

I could be mistaken but my contour map indicates 4,000 feet would be about the deepest if the San Francisco peaks are avoided and the tunnel driven to the east of them. Most shafts would be a lot less than that.

A. A. BARR.

[From the Scottsdale Progress, Feb. 15, 1967]

UNDERGROUND CAP ROUTE PROPOSED

By Stu Robertson, Progress Staff Writer

Probably the biggest—certainly the longest—underground movement in the State of Arizona is being proposed by a mining engineer, F. C. Ramsing.

While everyone else is discussing whether Central Arizona Project should be financed by federal or state funds or whether it should have two dams or 12 or none, Ramsing poses the interesting question of whether it should be above or below ground.

Ramsing says so much time is being used up planning power stations and electrical expansion that everyone's losing sight of one important aspect; compared to distribution of water, production of power doesn't amount to a tinker's dam.

There are plenty of alternate ways to produce power, the engineer went on, but how does one replace the priceless water being lost each year through ground surface transportation and storage of water?

According to figures he presented, loss of surface water at Lake Mead alone amounts to almost 2 million acre feet per year.

When one reflects on the fact that the lower basin of the Colorado, Arizona's natural water source, produces only 7.5 million acre feet per year, that loss looms mighty large.

Most telling arguments against surface movement and storage, Ramsing goes on, are the tremendous water losses, which can be measured, due to evaporation and natural seepage.

The answer, he contends, lies in construction of a 159-plus-mile tunnel from the Glen Canyon damsite, terminating at the Granite Reef Dam east of Phoenix.

Intermediate areas drawing water from the project would be part of an 80-mile complex of smaller conduits leading from the main tunnel.

The tunnel would be concrete-lined for its full length.

Thus, with the water supply underground and concrete preventing leakage, water loss would be negligible.

Transporting force to deliver the water would be gravity. Glen Canyon elevation is about 3,700 feet and at Granite Reef it is approximately 1,300 feet, plenty of slope for a properly-aligned tunnel to deliver the water with no power boosts, he says.

According to Ramsing's estimates, cost of the project would be about \$600 million and he is firm in his belief the state should go it alone.

Justification for expending that amount, he feels, lies in water-loss figures.

At Lake Mead alone, he points out, the loss of almost 2 million acre feet per year means, at the going rate in this area for delivered water, \$100 million per year saved, and when a \$600 million debt can be technically paid off in six years, that would seem to be justification.

"In these arguments about power and water," Ramsing said, "it boils down to the power companies versus the people, and I think the people should come first."

Ramsing doesn't short-sell the importance of power, but he does feel development of hydro-electric power in this area is strictly second fiddle when stacked up against the importance of water.

He argues there are several ways as cheap and cheaper to produce the needed power without the sacrifice of water.

"Arizona is closest to the source of Colorado River water and so should have preference in making use of it," he said, adding that California has almost unlimited water sources in the northern part of the state, many of which are completely untapped.

Ramsing's current campaign for underground water delivery is the culmination of 30 years of study and discussion on his part of the water problems of Central Arizona.

His education and experience as a mining engineer, plus this 30 years of interest in the water problem has, he says, firmly convinced him his tunnel project is not only workable, but would be cheaper to construct and would be more efficient in its operation.

"Water is the one great resource necessary on the desert," he said. "Without it, this land and its people must give up. Only Colorado River water is close by for the salvation of this civilization."

[From the Arizona Republic, Jan. 22, 1967]

MORE THAN ONE WAY TO SKIN THAT CAT—ENGINEER SAYS CAP THINKING IS FROZEN IN 1947 MOLD

(By Don Dederá)

Obstructionist be warned: Arizona has not one, but at least two ways of bringing its fair share of Colorado River water to the central valleys.

Such is the reminder-nay, the threat—of Fred C. Ramsing of 325 W. Cypress, private citizen, retired.

Ramsing is agitating for a fresh consideration of an old, old scheme to take Arizona's water from high on the Colorado—from the vicinity of Lake Powell far to the north.

The plan differs from the Central Arizona Project. In simplest terms, the CAP would draw its water from Lake Havasu, on Arizona's western border. Enormous dams would be needed to make electricity to power the pumps to lift the water, which then would run by gravity in open canals to the Salt River Valley.

TUNNEL WOULD BE WONDER OF THE WORLD

Ramsing wants to fetch the water by tunnel—a tunnel which surely would be one of the manmade Wonders of the World.

First some notes about Ramsing. He is not, as some whippersnappers have suggested lately, a nut. His university degree and career were in mining engineering. Among his accomplishments in four decades of Arizona living is a refrigeration system, installed in 1934, which efficiently cools his 1,800 square-foot home with a 1½-horsepower motor.

Yet, when Ramsing talks of his tunnel, often he is judged to be "just a nice old guy with a discredited idea."

Ramsing persists, saying, "Look. At 78 years of age I don't have anything to gain. Maybe I won't live much longer. I'm not a political engineer. There's nothing in the pork barrel for me. I'm only interested in the truth."

WATER PRICELESS IN ARID REGIONS

It is not surprising, then, that Ramsing prefaces his plan with a bit of philosophy:

"In arid regions, water is the priceless, limiting resource. Water should be used for the people, and for the sustenance of the people. It should not be used to make electricity, or wasted in any way. To waste water in the desert is a sin against humanity."

Dams, Ramsing contends, are water wasters as well as water storers. For example, evaporation losses off Roosevelt Lake average 8 feet a year. One recent year at Lake Havasu a layer of water 14 feet deep wafted off into the hot, dry desert air.

Dams and canals also lose water to seepage. Comparing the run of the Colorado before and after the construction of Hoover Dam, Ramsing suspects that the losses of Lake Mead to evaporation and seepage may be as much as 2 million acre feet per year.

TUNNEL WOULD COST LESS THAN DAMS

The Central Arizona Project, as presently conceived, would call for more high dams on the Colorado. The cost of the project would be as much as \$1.7 billion (with federal funding) or as little as \$700 million (if Arizona must go it alone.)

Ramsing thinks his tunnel system would cost less. And no water would be lost in evaporation and seepage.

The tunnel would have its intake in Glen Canyon and drive in a straight line 160 miles to discharge under the Mogollon Rim near the little town of Cornville.

Preposterous? Not at all. The tunnel concept was among the earliest in the long history of Arizona's quest for Colorado River water. The Interior Department seriously considered tunnels in a comparison study reported in 1945. As late as 1957, the tunnel plans were reviewed, and were rejected as being too costly.

"But this is 1967," Ramsing insists. "New techniques have greatly reduced the costs of tunneling. Experiments with the laser beam indicate revolutionary improvements in tunneling."

WATER WOULD FLOW UNDER THE PEAKS

The laser aside, by today's standard costs of conventional mining of hard rock in place, Ramsing estimates that a tunnel with a 16-foot bore, lined with reinforced concrete, would cost only \$130 million.

Because Lake Powell is much higher than the Central valleys, the water would flow by gravity through the tunnel, under the plateau country, under the San Francisco peaks. At the tunnel mouth at Cornville, the water would flow into a series of covered flumes, through a series of hydroelectric generators, generally following the basin of the Verde River. Eventually the water would discharge behind Granite Reef diversion dam on the Salt River.

"Conservatively, I believe the tunnel project with the power plants, would cost \$300 million," Ramsing says. "I can't see it costing more than \$400 million. The capital expenditure is especially important if the project is to be financed without federal help."

RAMSING CLAIMS OTHER ADVANTAGES

Ramsing claims other advantages:

—Water taken from Powell by tunnel would by-pass the evaporation and seepage penalties at Lake Mead, Lake Mohave, and Lake Havasu (and at the other lakes required by the CAP).

—Arizona's water further would not be reduced in its passage across the hot desert by open canal from Lake Havasu.

—By the Interior Department's own reports, a tunnel system, once built, would be substantially cheaper to maintain.

—As for the tunnel construction, never would the depth exceed 5,000 feet, not as deep as existing Arizona mines. The aqueducts delivering Colorado River water to Los Angeles include 90 miles of tunnels, all dug before the development of carbide-steel drills.

Perhaps the strongest argument against Ramsing's plan does not question his engineering. There is a fear that to reopen the tunnel vs. canal debate is to afford Arizona enemies yet another way to delay the CAP, ad infinitum.

DECISION A MUST IN ANY STUDY

"In any engineering study," says one prominent Arizona water engineer, "you reach a point when with all available facts, you must come to a decision.

"Our decision was made, back in 1945. All of our time since, all of our momentum, all of the expensive surveys have gone into a project of high dams, a pumping installation, and a delivery system of gravity canals. Sure, technology has changed. But to go back to a tunnel plan now could mean another 10 or 20 year delay."

Conversely, Ramsing thinks CAP opponents might be more cooperative if they knew Arizona could do the job, without help, for \$400,000.

CRESTVIEW GARDEN CLUB,
Durango, Colo., May 9, 1967.

Re Article, May 5, 1967, from the Durango Daily Herald, Washington Bureau
HON. HENRY M. JACKSON,
Chairman, Senate Interior Committee,
U.S. Senate, Washington 25, D.C.

DEAR SIR: Dr. Ruth Weiner of Denver presented testimony to the Senate Interior Committee stating, "Relative to opposition to dams on the Colorado River she said she spoke for the Colorado Federation of Women's Clubs and Garden Clubs also."

The Crestview Garden Club of Durango, Colorado, as a member of the Colorado Federation of Garden Clubs, Inc., wishes to inform you that it was not aware of the Federation's opposition to the five Upper Basin projects in the Colorado River Bill, and further that as an individual club it does not support Dr. Weiner's position on the Colorado River Bill.

Sincerely yours,

Mrs. Wm. W. HOLLIS,
Corresponding Secretary.

SAN FRANCISCO, CALIF., May 10, 1967.

HON. HENRY M. JACKSON,
Chairman, Senate Committee on Interior and Insular Affairs,
Washington, D.C.

DEAR SENATOR JACKSON: This letter is to urge the passage of legislation which will preserve the entire length of the Grand Canyon in its present natural state as an enlarged National Park, and to oppose any authorization (Federal or

State) of construction of Hualapai (Bridge Canyon) Dam or Marble Canyon Dam. These proposed dams would actually defeat the major purposes of their construction; instead of storing water they would diminish the present volume and quality of water by excess evaporation and the accumulation of salts; their potential production of hydroelectric power can better be replaced by modern fuel-burning plants now known to be more economical. Preservation of Grand Canyon in its natural wild state without dams or other development will enhance its recreational value by imparting a sense of awe and aesthetics, both of which are gained from a true wilderness experience in majestic scenery. Contrarily, lakes created by impounding water behind dams will only add another site for water sports which we already have at Lake Mead, Lake Powell, and many other places, as well as despoiling beauty with fluctuating reservoir shorelines. A dam at Marble Canyon would forever end the natural flow of the Colorado River which has carved and is carving the major geological exhibit of the earth for unknown ages. Furthermore, the dam at Bridge Canyon would impound water both in a National Park and a National Monument, which is in violation of current law, and such impoundage would set a most abhorrent precedent; and it would breach the integrity of the National Park System.

In closing, I would like to ask that this letter be made a part of the record and its contents brought forth at all appropriate hearings, and particularly that this letter be considered as part of the hearings of the Water and Power Resources Subcommittee of the Senate Interior and Insular Affairs Committee, held on or about May 2. Again, for the reasons stated above, I urge you to enact legislation now to preserve Grand Canyon in its present natural state as an enlarged National Park, and to oppose authorization of the construction of Hualapai-Bridge Canyon Dam and Marble Canyon Dam.

Sincerely,

Miss NINA H. ELOESSER.

THE NATIONAL CONFERENCE ON STATE PARKS,
Washington, D.C., March 30, 1967.

Senator HENRY M. JACKSON,
137 Old Senate Office Building,
Washington, D.C.

DEAR SGOOP: The enclosed Resolution 8, urging that power dams not be built in the Grand Canyon between the head of Lake Mead and Glen Canyon Dam and that suitable other means of financing needed water development projects for the arid Southwest be used, was adopted by the Board of Directors of the National Conference on State Parks at its March 17 meeting.

The Board hopes that this resolution will be helpful to the Congress in considering pending legislation to provide water for the Southwestern states.

Sincerely,

CONRAD L. WIRTH,
Chairman of the Board.

[Enclosure]

RESOLUTION 8

Whereas, there is widely recognized need for additional water for the burgeoning communities in the arid Southwest, and

Whereas, there have been proposals to finance needed water development projects by earmarking revenue from the sale of hydroelectric power to be generated by building dams in the Grand Canyon of the Colorado River that would flood significant portions of Grand Canyon National Monument, Grand Canyon National Park and Marble Canyon, comprising the finest remaining unspoiled portion of the Grand Canyon and possessing scenic and inspirational qualities of great and irreplaceable value.

Now, therefore, be it resolved that the National Conference on State Parks at the meeting of its Board of Directors at Washington, D.C., March 17, 1967, urges that dams not be constructed in the Grand Canyon between Lake Mead and Glen Canyon Dam and that suitable other means of financing needed water development projects for the arid Southwest be used.

(The inserts previously referred to by Senator Fannin follow:)

STATEMENT OF POSITION OF THE SOUTHERN ARIZONA BRANCH, ARIZONA SECTION,
AMERICAN SOCIETY OF CIVIL ENGINEERS

The Southern Arizona Branch of the Arizona Section, American Society of Civil Engineers, recognizes that natural resources of considerable extent and variety exist in the Southwest as a result of the presence of the Colorado River, a significant portion of which runs through or borders the State of Arizona. To date, the benefits derived from dams on the Colorado are accruing primarily to the upper-basin states and the State of California; the State of Arizona is not realizing its fair share of this natural resource of the state—either in the form of power revenues or of water.

Under current extensive popular and legislative debate are proposals to construct one or more sizable dams in Arizona, multipurpose to be sure but essentially to produce hydroelectric power alongside the Colorado. The benefits from this use of the Colorado, wholly within the borders of our State, would be considerable in any one year and infinite in time. Such use would indeed decrease the length of quasi-wild river, but approximately 100 miles would remain unchanged through Grand Canyon National Park. (The modifier "quasi" is used advisedly because, since the construction of Glen Canyon Dam, the river is no longer in its wild state—it has been improved.)

The argument that a steam-powered electricity-generating plant can be substituted for the proposed hydroelectric plants and dams is fallacious: hydro power is peaking power, and firm base steam power cannot be substituted for it. In the next decade or two all hydro power obtainable will probably be used as peaking (high value) power; electric systems without natural hydro power will have to create peak power by relatively inefficient pumped-storage schemes.

Thus, the Southern Arizona Branch takes the view that the resources of the State of Arizona must be developed optimally, that sufficient "wild" river would be left in Grand Canyon National Park for those to whom it is important, and that these dams and the power generated should be used to "build" Arizona—especially to develop its water resources and someday to help import water to the basin.

THE UNIVERSITY OF ARIZONA,
OFFICE OF THE PRESIDENT
TUCSON, ARIZ., April 27, 1967.

HON. CARL HAYDEN,
HON. PAUL J. FANNIN,
United States Senate, Washington, D.C.

DEAR SENATORS HAYDEN AND FANNIN: I share the deep concern being expressed in this state regarding the growing scarcity of water and the realization that this condition of scarcity is the most compelling problem that Arizona faces. I have studied the many plans and proposals for securing additional water supply. It is apparent that Arizona must secure the water to which the Supreme Court of the United States has ruled the state is entitled.

I have lived in this State and been associated with the University of Arizona since 1934. Throughout these years I have observed the tremendous development and the great changes that have occurred in Arizona. My study and knowledge of the Central Arizona Project have caused me to support fully the proposal that the Congress of the United States enact legislation to provide for the implementation of the Central Arizona Project in order that Arizona may receive the benefit of the portion of the Colorado River water to which it is legally entitled.

I endorse the efforts of you and many other officials and other citizens of this state in support of measures now before the Congress that would achieve these results.

With kindest regards,
Sincerely yours,

RIHARD A. HARVILL.

ARIZONA STATE UNIVERSITY,
Tempe, Ariz., April 27, 1967.

SENATOR CARL HAYDEN,
SENATOR PAUL J. FANNIN,
United States Senate, Washington, D.C.

DEAR SENATORS HAYDEN AND FANNIN: I strongly urge prompt action on the current initiating the Central Arizona Project.

Any sense of history, and awareness of noteworthy trends in American development and the future of this part of the country, make this project an absolute necessity, in my judgment. I say this from the background of residence in Massachusetts, California, Pennsylvania, and Utah in my lifetime. The presence in this Valley within the past few weeks of the Board of Directors of such firms as the General Electric Company, Phelps Dodge Corporation, Motorola, and other prominent national enterprises argues in the most convincing economic terms for the development of this project, not only for Arizona, but as a necessary complement to strategic and desirable trends in the development of the American economy.

The hearings before the Congress in recent months on urban redevelopment, and the plight of the older urban community, argue in even stronger, louder terms for the project. The American people and the American population are increasing. A number of years ago, considerable skepticism existed outside Arizona with respect to the economic feasibility of the project. The willingness of the state to "go it alone" should demonstrate to the nation that such doubts are no longer justified. We may visualize a new type of urban-open country-industrial life in the broad valleys and areas stretching between the Phoenix metropolitan area, Tucson and intermediate points.

I sincerely trust that the members of the Congress, in both houses, in an age that has seen the development of the Aswan Dam on the Upper Nile, world-wide interest in development of arid lands through USAID, UNESCO, and other programs, will include this significant phase of American development in their thinking.

Sincerely yours,

G. HOMER DURHAM, *President.*

ARIZONA FARM BUREAU FEDERATION,
Phoenix, Ariz., May 14, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
1124 Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: The voting delegates of the Arizona Farm Bureau Federation, comprised of over 4100 voluntary, dues paying members, at their delegate session on November 18, 1966 in Willcox, Arizona, passed the following resolution in reference to the Central Arizona Project:

"We affirm and support Farm Bureau policy seeking federal enactment of Central Arizona Project legislation. However, because of continuing delays in passage of the Central Arizona Project by the Congress, we favor the study of state financing of the project."

We sincerely hope that a satisfactory federal plan can be passed.

With best regards,

Very truly yours,

R. E. PILGRIM,
Executive Secretary.

THE LEAGUE OF ARIZONA CITIES AND TOWNS,
Phoenix, Ariz., April 25, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
1124 Arizona Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: This letter is written in support of the Central Arizona Project Bill, which is currently before the Congress of the United States.

As you know, every year the delegates at the League Conference adopt a policy statement in support of legislation which they feel would be of benefit to the incorporated cities and towns throughout the State of Arizona. As a part of the 1967 Municipal Policy Statement, the following excerpt relating to the Central Arizona Project was adopted unanimously by the delegates in attendance at our 1966 Annual Conference:

CENTRAL ARIZONA PROJECT

14-1. For some 20 years, the people of the State of Arizona have been desirous of establishing the Central Arizona Project. Such an undertaking is urgently needed to provide supplemental water for the preservation of the economy of the whole state through the importation of water from the mainstream of the Colorado River. Since authorization of the project was first sought in Congress in 1947, the water needs for both municipal and agricultural purposes have multiplied exponentially. Therefore, we endorse and support all efforts to secure this most needed legislation. Especially, we request that the U.S. Congress enact a bill providing for the Central Arizona Project, and we most urgently request that the President of the United States, the Secretary of the Interior, the Director of the Bureau of the Budget, the Commissioner of Reclamation and all other appropriate officials of the Executive Branch of the Federal Government lend their prestige and support to this endeavor for the benefit of all the people living in the State of Arizona.

We respectfully request that you inform our Congressional delegation and members of the Congress that the official position of all the incorporated cities and towns of the State of Arizona is one of complete support of the Central Arizona Project.

Cordially,

JOHN J. DEBOLSKE,
Executive Director.

ARIZONA FOREST INDUSTRIES COMMITTEE,
Phoenix, Ariz., April 28, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association,
1124 Arizona Title Building, Phoenix, Ariz.*

DEAR MR. RAYMOND: The Arizona Forest Industries Committee has watched with increased interest the developments in Washington in connection with the Central Arizona Project.

Noting the hearing scheduled by a subcommittee of the Senate Interior and Insular Affairs Committee on May 2nd I wanted to reaffirm our position on the Project.

The Arizona Forest Industries Committee believes that water from the Colorado River is the most important factor in the future economic growth of the state and we are vitally concerned with the efforts of our congressional delegation in this important legislation. Needless to say we pledge to them our fullest support.

Sincerely yours,

JAMES M. BOYD, *Chairman.*

ARIZONA CONSERVATION COUNCIL,
Phoenix, Ariz., April 28, 1967.

Mr. H.S. RAYMOND,
*Central Arizona Project,
Phoenix, Ariz.*

DEAR MR. RAYMOND: It is the unanimous wish of the Arizona Conservation Council that your organization, the Central Arizona Project Association, express the Conservation Council's support of the Hayden-Jackson-Fannin Bill, S.B. 1004, which we understand is scheduled for hearing before the Senate Interior Committee on May 2nd.

The Arizona Conservation Council is a statewide, incorporated affiliation of fourteen conservation organizations. Its membership includes:

The Federated Garden Clubs of Arizona.
 The Federated Women's Clubs of Arizona.
 The Arizona Horsemen's Association.
 The Arizona Game Protective Association.
 The Audubon Society.
 The Sierra Club.
 The Arizona Education Association.
 The Arizona State Bowhunters Association.
 The Arizona State Rifle and Pistol Association.
 The American Camping Association, Arizona Division.
 The Arizona Outdoors Architects Association.
 The Arizona State Guides Association.
 The Arizona State Varmint Callers Association.
 The Arizona Outdoor Writers Association.

Thank you for assisting our interests on Senate Bill 1004, and good luck to you in your great efforts.

Sincerely,

Mrs. SCOTT SPAW, *President.*

ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS,
April 26, 1967.

H. S. RAYMOND,
*President, Central Arizona Project Association,
 1124 Arizona Title Building,
 Phoenix, Ariz.*

DEAR MR. RAYMOND: It has come to my attention that hearings will be held beginning May 2, 1967 before the Senate Subcommittee on Water and Power Resources concerning the "Central Arizona Project", and as President of the Arizona Society of Professional Engineers I would like to reaffirm the Society's endorsement of the Central Arizona Project and its immediate authorization by the Congress of the United States.

The Arizona Society of Professional Engineers has supported this Central Arizona Project because Water Resources in Arizona are fast being depleted and must be supplemented or replenished before the economy of Arizona is seriously affected and retards our future growth.

As the Colorado River is the last major source of water available to the State of Arizona, and as the Supreme Court of the United States has upheld Arizona's claim to its fair share of the water in the Colorado River, the Arizona Society of Professional Engineers is hopeful that this year of 1967 is the one that will see this dream come true for the vital economy of Arizona's Future.

Sincerely,

ALLISON C. DOW, P.E.,
President ASPE.

ARIZONA SUPERVISORS AND CLERKS ASSOCIATION,
St. Johns, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association,
 1124 Arizona Title Building, Phoenix, Ariz.*

DEAR MR. RAYMOND: We have been advised that the Senate will commence hearings on the Central Arizona Project on May 2, 1967.

The Arizona County Supervisors and Clerks Association recognizes the fact that a sufficient water supply is essential to the growth of the State, and that Arizona's right to its fair share of the water from the Colorado River has been upheld by the United States Supreme Court.

We therefore endorse this Project and urge that the Congress of the United States take immediate steps to enact legislation creating the Central Arizona Project.

Sincerely yours,

ARLO B. LEE, *President.*

OFFICE OF THE MARICOPA COUNTY BOARD OF SUPERVISORS,
April 26, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project,
1124 Arizona Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: In view of the fact that hearings will be held before the Senate Subcommittee on Water and Power Resources starting May 2, 1967 concerning Central Arizona Project legislation, the Maricopa County Board of Supervisors endorses the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States for the following reasons:

1. New sources of water are essential to the economy of the State of Arizona and its future growth.
2. The Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River.
3. The Colorado River is the last major source of water to the State.

The Maricopa County Board of Supervisors is extremely hopeful that 1967 will be a successful year for the Central Arizona Project, for each year of delay poses a vital threat to Arizona's economy.

Sincerely,

BOARD OF SUPERVISORS, MARICOPA
COUNTY, ARIZ.,
WILLIAM S. ANDREWS, *Chairman.*

PHOENIX, ARIZ., April 26, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project,
1124 Arizona Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: In view of the fact that hearings will be held before the Senate Subcommittee on Water and Power Resources starting May 2, 1967, concerning Central Arizona Project legislation, the Arizona Association of Manufacturers endorses the proposed Central Arizona Project and urges its immediate enactment by the congress of the United States for the following reasons:

1. New sources of water are essential to the economy of the state of Arizona and its future growth.
2. The Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado river.
3. The Colorado river is the last major source of water available to the state.

Our association is extremely hopeful that 1967 will be a successful year for the Central Arizona Project, for each year of delay poses a vital threat to the economy of Arizona.

Sincerely yours,

ARIZONA ASSOCIATION OF MANUFACTURERS,
WALTER S. GRAY, *President.*

ARIZONA RETAILERS ASSOCIATION,
Phoenix, Ariz., April 26, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
Phoenix, Ariz.

DEAR MR. RAYMOND: In view of the upcoming hearings on the Central Arizona Project to be held in Washington, D.C., the Arizona Retailers Association wishes to go on record as supporting the C.A.P. wholeheartedly.

Our reasons for this overwhelming support are as follows:

1. The water shortage in Arizona is acute now and will become even more so in the years ahead. Therefore, if Arizona is to continue to progress, it is imperative new sources of water be found.
2. Since the U.S. Supreme Court has upheld Arizona's claim to our share of the Colorado River waters, we feel the time has long since passed for action to be taken by Congress to assure us this water.
3. Unlike so many other states, Arizona has no other source of water except the Colorado. If we are not allowed to utilize this last source of additional water, then the economy and growth of Arizona will wither and die.

We hope our wishes on this matter will be conveyed to those holding these hearings and that a favorable decision will be forthcoming.

Sincerely,

H. C. "MAC" DOSSEY,
Executive Vice President.

ARIZONA BUILDING CONTRACTORS,
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA,
Phoenix, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
Phoenix, Ariz.

DEAR MR. RAYMOND: The Arizona Building Contractors Association, Building Chapter, AGC, has been keeping a constant vigil on the progress of the Central Arizona Project now before Congress. In view of the fact that hearings will be held before the Senate Subcommittee on Water and Power Resources starting May 2, 1967, our organization would like to reaffirm its endorsement of the proposed Central Arizona Project.

Arizona's continuing prosperity and future growth are dependent on the water from the Colorado River to which the Supreme Court of the United States says we are entitled. We hope, as you do, for immediate enactment of the project in this first session of the 90th Congress, for each year of delay poses a vital threat to the existing and future economy.

Sincerely,

GEORGE G. CODD, *President.*
J. SNEAD PARKER, *Executive Manager.*

VALLEY NATIONAL BANK,
Phoenix, Ariz., April 27, 1967.

HON. CARL HAYDEN,
HON. PAUL FANNIN,
U.S. Senate Office Building, Washington, D.C.

DEAR PAUL: The Valley Bank fully endorses Senate Bill 1004 introduced by Senators Fannin, Hayden, Cannon and Jackson on February 16, 1967.

Arizona has waited a long time for the water allotment from the Colorado River which the United States Supreme Court had decreed the state is entitled to receive.

We trust this will be the year Congress will enact the necessary legislation to provide this water allotment.

All Arizona is certainly indebted to you, Senator Hayden, and Congressmen Rhodes, Udall and Steiger for everything you are doing to prevail upon Congress to arrange the means whereby our state will at long last receive this water from the Colorado River.

Sincerely,

JIM PATRICK.

ARIZONA EDUCATION ASSOCIATION,
Phoenix, Ariz., April 26, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
Arizona Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: In view of the May hearings in the U.S. Senate on the Central Arizona Project legislation, we would like to be on record supporting this vitally-needed bill for our state. Education and water may be at first glance somewhat removed from each other but we sense an important relationship.

We have excellent schools and the education profession is advancing rapidly in our state. Our 16,000 teacher and administrative members are most concerned that Arizona's growth be constant and that we have good schools to match the increase. Arizona needs water in its central section and all parts of the state will benefit. We need constantly to attract teachers to our state to meet the needs of growth districts. People will come from all areas, among them keen and capable teachers, if water development authorized by the U.S. Supreme Court can take place in the central section of the state.

CENTRAL ARIZONA PROJECT

We join our Senators, Governor, Congressmen, business leaders, and many other professions in an urgent appeal to the Congress that this legislation be enacted.

Yours sincerely,

DIX W. PRICE,
Executive Secretary and General Counsel.

ARIZONA HOTEL AND MOTEL ASSOCIATION, INCORPORATED,
Phoenix, Ariz., April 26, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association,
1124 Arizona Title Building,
Phoenix, Ariz.*

DEAR MR. RAYMOND: Whereas, as the only source, and essential to the economy of the State of Arizona and its future growth; and

Whereas, the Supreme Court of the United States upheld Arizona's claim to its fair share of water from the Colorado River as the last major source of water available to the State;

Now, therefore, be it resolved that the Arizona Hotel and Motel Association endorses the proposed Central Arizona Project and urges its enactment by the Congress of the United States.

Very truly yours,

E. R. SEIFER, *President.*

ARIZONA BANKERS ASSOCIATION,
Phoenix, Ariz., April 28, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association,
1124 Arizona Title Building, Phoenix, Ariz.*

DEAR MR. RAYMOND: The Arizona Bankers Association has been keeping a constant vigil on the progress of the Central Arizona Project now before Congress. In view of the fact that hearings will be held before the Senate Sub-Committee on water and power resources starting May 2, 1967, our Association would like to re-affirm the banking industry's endorsement of the proposed Central Arizona Project.

Arizona's continuing prosperity and future growth are dependent on the water from the Colorado River to which the Supreme Court says we are entitled. We hope as you do for immediate enactment of the project in this first session of the 90th Congress—for each year of delay poses a vital threat to Arizona's existing and future economy.

Sincerely yours,

G. CLARKE BEAN, *President.*

HOME BUILDERS ASSOCIATION OF CENTRAL ARIZONA,
Phoenix, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
*Central Arizona Project,
1124 Arizona Title Building,
Phoenix, Ariz.*

DEAR MR. RAYMOND: The Home Builders Association of Central Arizona enthusiastically endorse passage of the Central Arizona Project Bill.

Our reason for endorsing is very simple, this project would provide the water which Arizona will need in the future to insure growth.

Respectfully yours,

ELIIS SUGGS, *President.*

DOWNTOWN MERCHANTS ASSOCIATION OF PHOENIX,
Phoenix, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association, 1124 Arizona Title Building,
Phoenix, Ariz.*

DEAR MR. RAYMOND: The Downtown Merchants Association of Phoenix en-

dorsed the Central Arizona Project in May of 1964 by letters to their congressmen in Washington D.C. Your office received copies of these letters.

We again, today, reaffirm our endorsement of the Central Arizona Project.

Sincerely yours,

J. A. SALE, *President.*

ARIZONA AGGREGATE ASSOCIATION,
Phoenix, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association, 1124 Arizona Title Building,
Phoenix, Ariz.*

DEAR MR. RAYMOND: In view of the forthcoming hearing concerning the Central Arizona Project, which I understand will commence on May 2, 1967 before a Senate Sub-Committee on Water and Power Resources, please be advised that the Arizona Aggregate Association stands completely united in support of the necessity of securing water from the Colorado River.

Without doubt, the membership of this Association believe that it is a necessity to secure our rightful share of Colorado River water. We support the effort being made in the Congress to favorably pass legislation to this end.

Very truly yours,

DON ROZEMA, *Executive Director.*

ARIZONA BROADCASTERS ASSOCIATION,
Phoenix, Ariz., April 26, 1967.

Mr. H. S. RAYMOND,
*President, Central Arizona Project Association,
1124 Arizona Title Building,
Phoenix, Ariz.*

DEAR HANK: In view of the fact that hearings will be held before the Senate Subcommittee on Water and Power Resources, starting May 2, 1967, concerning Central Arizona Project legislation, the Arizona Broadcasters Association endorses the proposed Central Arizona Project Legislation, and urges its immediate enactment by the Congress of the United States for the following reasons:

1. New sources of water are essential to the economy of Arizona and its future growth.

2. The Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River.

3. The Colorado River is the last major source of water available to the State.

Our Association is extremely hopeful that 1967 will be a successful year for the Central Arizona Project—for, each year of delay poses a vital threat to Arizona's economy.

Sincerely,

JAMES W. ROSS, *President.*

THE UNIVERSITY OF ARIZONA,
Tucson, March 28, 1967.

Mr. EVO DECONCINI,
*Arizona Interstate Streams Commission,
510 Valley National Bank Building,
Tucson, Ariz.*

DEAR MR. DECONCINI: It was good to discuss with you this morning, even though briefly, some of the problems involved in the proposal regarding the Central Arizona Project that is now before the Congress.

I have received a number of phone calls and other comments about the position that Professors Young and Martin have expressed in their recently published material. These faculty members of course, as you so well recognize, have the same rights and privileges as those of any other individuals to express their views and to present the analysis on which they base their conclusions.

As an institution, the University of Arizona does not have any position on this or any other public issue (the expression of any member of the faculty, therefore, is not to be taken as a stand by the University on any particular issue). Made up of many faculty members engaged in a great number and variety of areas of teaching and research, it would be both impossible and undesirable for all of these people as a group to express a common view. Indeed, I happen to know that

there are economists in the same department who do not share conclusions reached by Professors Young and Martin. Their premises and analyses and conclusions differ greatly from those of their two colleagues.

While I personally have been and still am a strong supporter of the Central Arizona Project and believe that the enactment of Federal legislation providing for the financing of the project is in the interest not only of the Southwest but of the country at large, I state this view as an individual and not as an official representative who expresses the views of the University of Arizona.

It is my earnest hope that the great company of individuals who are working diligently in favor of the legislation before the Congress will be successful in their endeavors, and if not, that the state will consider a "go it alone" project.

Sincerely yours,

RICHARD A. HARVILL.

STATE OF ARIZONA DEVELOPMENT BOARD,
Phoenix, Ariz., April 26, 1967.

H. S. RAYMOND,
President, Central Arizona Project Association,
1124 Arizona Title Building, Phoenix, Ariz.

DEAR MR. RAYMOND: It is my understanding that hearings will be held on water and power resources starting May 2, 1967 concerning the Central Arizona Project legislation. The Arizona Development Board endorses the proposed Central Arizona Project and urges its immediate enactment by Congress for the following reasons:

1. New sources of water are essential to the economy of Arizona and its future growth.

2. The Supreme Court of the United States has upheld Arizona's claim to its fair share of the Colorado River.

3. The Colorado River is the last major source of water supply for our state.

The Development Board is extremely hopeful that 1967 will be a successful year for the Central Arizona Project, for each year of delay poses a vital threat to Arizona's economy.

Cordially,

ROBERT B. LANDRY.

ARIZONA MINING ASSOCIATION,
Phoenix, Ariz., April 27, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
Arizona Title Building,
Phoenix, Ariz.

DEAR MR. RAYMOND: In as much as new sources of water are essential to the economy of the state of Arizona and its future growth, and in as much as the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River, and since the Colorado River is the only major source of water presently available to Arizona, the Arizona Mining Association strongly endorses the creation of the proposed Central Arizona Project.

We are sending copies of this letter to all of Arizona's Congressional Delegation as a means of urging the Congress to pass in this session legislation creating and funding a Central Arizona Project.

Along with all other responsible Arizonans we join you in hoping this goal can finally be attained.

Sincerely yours,

EDWARD H. PELOW, Jr.,
Executive Secretary.

ARIZONA COTTON GROWERS ASSOCIATION,
Phoenix, Ariz., April 25, 1967.

Mr. H. S. RAYMOND,
President, Central Arizona Project Association,
Phoenix, Ariz.

DEAR HANK: It has been called to my attention that we have overlooked sending you a statement assuring you that this association continues to support the Central Arizona Project.

At our annual membership meeting on February 21, 1967, just two months ago, the members adopted the following resolution :

"That we as cotton farmers recognize that an extremely critical water situation limits long range agricultural development in most areas of Arizona. Thru research much progress has been made in the more efficient use of existing supplies. However, the problem can be alleviated only through a supplemental supply of water ; therefore, we express our full support of the Central Arizona Project, provided all prior existing water rights are protected."

Very truly yours,

E. S. MCSWEENEY,
Executive Vice President.

TUCSON, ARIZ., April 27, 1967.

LEWIS E. HAAS,
*Executive Vice President, Central Arizona Project Association,
Phoenix, Ariz.:*

The Mayor and Council of the City of Tucson heartily endorse the proposed Central Arizona Project and urge its immediate enactment by the Congress of the United States. Formal resolution to this effect ordered for submittal at the City Council meeting of May 1, 1967.

ROGER O'MARA, *City Manager.*

ARIZONA CHAPTER,
PUBLIC RELATIONS SOCIETY OF AMERICA,
Phoenix, Ariz.

LEWIS E. HAAS,
*Executive Vice President, Central Arizona Project Association,
Phoenix, Ariz.:*

DEAR MR. RAYMOND: The Arizona Chapter, Public Relations Society of America, has been keeping a constant vigil on the progress of the Central Arizona Project bill now before Congress.

In view of the fact that hearings will be held before the Senate sub-committee on Water and Power Resources starting May 2, 1967, our organization wants to affirm its endorsement of the proposed Central Arizona Project.

Arizona's continuing prosperity and future growth are dependent on water from the Colorado River, to which the Supreme Court of the United States says we are entitled. We hope, as you do, for immediate enactment of the project in this first session of the 90th Congress. Each year of delay is a vital threat to Arizona's existing and future economy.

Cordially,

BERTHA R. PINE, *President.*

ARIZONA ASSOCIATION OF
SOIL AND WATER CONSERVATION DISTRICTS,
Tolleson, Ariz., April 26, 1967.

MR. H. S. RAYMOND, *President,
Central Arizona Project Association,
Phoenix, Ariz.*

DEAR HANK: This is to reconfirm our Association's long-standing and unqualified support of the Central Arizona Project Association and associated groups to secure the Central Arizona Project in its entirety, to include the dams on the Colorado River. We deeply appreciate the efforts made by the C.A.P.A. in our behalf in this project absolutely necessary to the orderly development of all areas of the State and the State in its entirety.

To document that our Association's representation is significantly state-wide, "grass-roots", and effectively natural-resource oriented, we re-state the following:

"The Arizona Association of Soil and Water Conservation Districts is an Association of 34 Soil Conservation Districts and their elected Boards of Supervisors. The Association is an independent, non-profit, non-partisan organization whose primary concern is the conservation and orderly development of Arizona's land and water resources through means of local self-government. Arizona's 34 Soil Conservation Districts embrace over 78% of the land area of the State of Arizona. Arizona's Soil Conservation Districts legally embrace essentially all of the irrigated land in the State.

"All SCD Supervisors are unpaid public state officials charged with the responsibility of conservation and orderly development of the renewable natural resources of Arizona. All Association officers and directors are locally-elected Soil

Conservation District Supervisors of their Districts, and represent both irrigation and grazing land conservation interests in Arizona."

The latest official statement of policy of our Association was recently approved unanimously. In part the statement reads:

"Just so it is abundantly clear to everyone, at a time when certain "conservation" (preservationist'?) organizations are in the news opposing the C.A.P. dams on the Colorado River, this statement is in order:

"This Association of Soil and Water Conservation Districts has, since its organization in 1944, resolved and repeatedly reconfirmed its stand in favor of the Central Arizona Project, including both Colorado River dams—Bridge Canyon (Hualapai) and Marble Canyon. Much testimony and other concrete evidences of Association policy on conservation, development and self-government are a matter of record in Association files."

We are optimistic for the early authorization of the Central Arizona Project.

Cordially yours,

KARL F. ABEL, *President.*

ARIZONA CATTLE GROWERS ASSOCIATION,
Phoenix, Ariz., April 25, 1967.

Mr. H. S. RAYMOND, *President,*
Central Arizona Project Association,
Phoenix, Arizona.

DEAR HANK: The Arizona Cattle Growers' Association continues to hope for a successful effort to obtain Congressional authorization for the Central Arizona Project.

At our last Annual Meeting, held December 3, 1967 the members adopted the following resolution:

"Whereas, the Arizona Congressional delegation, in an effort to obtain Federal authorization for a bill authorizing Federal construction of facilities to bring Arizona's entitlement to the waters in the Colorado River as defined by the Supreme Court of the United States of America in the case of Arizona v. California into Central Arizona, consented to the insertion in H.R. 4671 of language guaranteeing 4,400,000 acre-feet of water to the State of California; and

"Whereas, in spite of this concession, as well as others, it was found to be impossible to get this Bill on the floor of the House of Representatives for a vote in the last session; and

"Whereas, the Governor of the State of Arizona, has directed the Arizona Power authority and the Arizona Interstate Stream Commission to combine all of the engineering abilities, their knowledge of project finance and their legal resources in order to develop a state plan of water and power development; and

"Whereas, the Arizona Cattle Growers' Association is of the opinion that a state-financed water and power project would be more advantageous to Arizona than a federally constructed project containing the concessions to California which were written into H.R. 4671; now therefore be it

"Resolved, that the ACGA does hereby go on record as supporting the construction of a State-owned Central Arizona Project if proposed federal legislation contains any concessions or guarantees to California over and above the rights of California as spelled out in the case of Arizona v. California; and further, the ACGA recommends that the State of Arizona take all possible steps to obtain licenses from the Federal Power Commission for the construction of hydro electric projects at the Bridge Canyon and Marble Canyon dam sites on the Colorado River."

We believe that a Federal project is much to be preferred, if Arizona is assured of receiving her full entitlement of Colorado River water. We urge that all possible steps be taken to bring this about.

Sincerely,

BILL DAVIS,
Executive Secretary.

PIONEER BANK OF ARIZONA.
Phoenix, Ariz., May 1, 1967.

HON. CARL HAYDEN,
HON. PAUL FANNIN,
United States Senate, Washington, D.C.

MY DEAR SENATORS: Little more than a century ago, an expeditionist, venturing into the land now called Arizona, nearly sealed a fate of doom upon our now

great State by referring to it as being "uninhabitable for a civilized population," because of the lack of water.

Men of vision ignored this premature epitaph, however, and brought water to the dry lands. Because of this vision, there are now more than 1.8 million inhabitants of Arizona. Some 75 percent live in the once arid locales we call metropolitan Phoenix and Tucson.

Phophets claim that history repeats itself. Arizona may very well become "uninhabitable" for an expanded "civilized population," again because of the lack of water. Statisticians project that in less than 20 years, our State will more than double its population.

This means water for an additional half-million homes . . . water for industry which must provide jobs; more than three-quarters of a million new jobs. By the turn of the century, only a generation away, our population will be more than three times its present size. These figures are not part of a faraway dream; they are staring us in the face now.

The fate of Arizona's future is controllable—through the Central Arizona Project. As a member of the banking profession, it is my responsibility to help control that fate.

I urge you, with all of your energy and resources, to appeal to all great men of vision for immediate passage of the Central Arizona Project bill.

Sincerely,

ALLEN L. ROSENBERG, *President.*

ARIZONA CATTLE FEEDERS' ASSOCIATION,
Phoenix, Ariz., April 26, 1967.

MR. H. S. RAYMOND,
*President, Central Arizona Project Association,
Phoenix, Arizona.*

DEAR MR. RAYMOND: The Arizona Cattle Feeders' Association wishes to reiterate its long standing endorsement and support of the Central Arizona Project.

The records of this Association show a resolution of full endorsement and firm support of the Project was passed by the membership at the 30th Annual Meeting, February 15, 1964, in Phoenix.

Enclosed herewith is a copy of that resolution.

The policy of this Association is unchanged and we strongly recommend earliest approval of the Central Arizona Project.

Sincerely,

WADE LACY, *Executive Secretary.*

[Enclosure]

RESOLUTION OF THE ARIZONA CATTLE FEEDERS' ASSOCIATION

CENTRAL ARIZONA PROJECT

Whereas, The Central Arizona Project is a plan to preserve an economy and prevent the crippling of a thriving economy; and

Whereas, The Central Arizona Project is strictly a rescue operation, since the Project will not bring into production any new land; and

Whereas, The Central Arizona Project will repay its cost of one (1) billion dollars in a period of 50 years out of revenues from the sale of water and electric power; and

Whereas, The U.S. Bureau of Reclamation as long ago as 1947 reported to the Congress that the Central Arizona Project was completely feasible; and

Whereas, Action is needed at once by the Congress to make the Central Arizona Project a reality; therefore

Be it resolved, That the Arizona Cattle Feeders' Association in convention at their 30th Annual Meeting in Phoenix, Arizona, February 15, 1964, fully endorses the Central Arizona Project and urges the Congress of the United States to take immediate action in approving the Central Arizona Project; and be it further

Resolved, That copies of this resolution be sent to all Arizona Congressional delegates in Washington, D.C. and to the Governor of Arizona.

Certified to be a true copy of resolution passed by the membership of the Arizona Cattle Feeders' Association at the 30th annual meeting, February 15, 1964, in Phoenix, Arizona.

WADE LACY, *Executive Secretary.*

RESOLUTION OF THE ARIZONA ACADEMY

Whereas, Arizona has substantial rights to Colorado River water; and
Whereas, the United States Supreme Court has confirmed that claim; and
Whereas, this supplementary supply of Colorado River water is necessary to firm up the declining water supply in Arizona; and

Whereas, the 28th Arizona Legislature enacted a measure providing for state construction of a Central Arizona Project in the event Congress should fail to act promptly;

Now, therefore, be it resolved that we, the participants in the Tenth Arizona Town Hall, recommend the prompt enactment of the Central Arizona Project legislation by the 90th Congress, or, in the event of the failure of the 90th Congress to act, construction of the Project by the State of Arizona.

RESOLUTION OF THE ARIZONA GAME PROTECTIVE ASSOCIATION CONVENTION

Whereas, The Arizona Game Protective Association is firmly based on principles of a reasonable balance between fish and wildlife management and the development of natural resources for several purposes, including outdoor recreation; and,

Whereas, this Association has long advocated construction of a Central Arizona Project, most recently by Resolutions adopted in 1963 and 1965, consistent with these principles; and,

Whereas, The National Wildlife Federation has proposed to this Association's President that the Federation's position is favorable to the construction of Bridge Canyon Dam, providing the integrity of the Grand Canyon National Park be protected; and,

Whereas, this Association compliments the National Wildlife Federation for its forthright and equitable stand on this Project so vital to Arizona; and,

Whereas, Arizona's Congressional delegation has this week submitted to Congress a Colorado River Basin Project bill embodying these principles, including Bridge Canyon Dam and excluding Marble Canyon Dam; and,

Now, therefore, be it resolved, that, the Arizona Game Protective Association continues to support the Arizona Congressional delegation in its efforts in behalf of a Federally-authorized Colorado River Basin Project, now before Congress, including construction of Bridge Canyon Dam; and,

Be it further resolved that copies of this approved Resolution be forwarded to the Secretary of the Interior, members of the Arizona Congressional delegation and the Governor of Arizona.

(Adopted by the Arizona Game Protective Association, 44th Annual Convention, Phoenix, Arizona, January 15, 1966.)

RESOLUTION OF THE PHOENIX CHAMBER OF COMMERCE

The Executive Committee of the Board of Directors on this date unanimously approved the following Resolution:

"Whereas new sources of water are essential to the economy of the State of Arizona and its future growth; and whereas the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River; and whereas the Colorado River is the last major source of water available to the State; now therefore be it resolved that the Executive Committee of the Board of Directors of the Phoenix Chamber of Commerce endorse the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States."

OZELL M. TRASK, *President.*

RESOLUTION OF THE NORTHERN ARIZONA UNIVERSITY

Whereas new sources of water are essential to the economy of the State of Arizona and its future growth; and

Whereas, the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River; and

Whereas, the Colorado River is the last major source of water available to the State; now, therefore, be it

Resolved that Northern Arizona University endorses the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States.

J. LAWRENCE WALKUP, *President.*

RESOLUTION OF THE CITY OF TUCSON

Whereas, new sources of water are essential to the economy of the State of Arizona and its future growth; and

Whereas, the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River; and

Whereas, the Colorado River is the last major source of water available to the State; and

Whereas, this city and the entire state are in dire need of the supplemental water supply to be received from the Colorado River under the plan of the Central Arizona Project Association;

Now, therefore, be it resolved by the Mayor and Council of the City of Tucson, Arizona, as follows:

Section 1. That the Mayor and Council of the City of Tucson, acting in the best interest of the citizens of Tucson and of the State of Arizona, hereby endorses the proposed Central Arizona Project and strongly urges the immediate enactment of the proposed legislation by the Congress of the United States.

Section 2. Whereas, it is necessary for the preservation of the peace, health and safety of the City of Tucson that this resolution become immediately effective, an emergency is hereby declared to exist, and this resolution shall be effective immediately upon its passage and adoption.

Passed, adopted and approved by the Mayor and Council of the City of Tucson, Arizona, May 1, 1967.

[SEAL]

Attest:

LEW DAVIS, *Mayor.*

MARY FIELDS, *City Clerk.*

RESOLUTION OF THE BOARD OF SUPERVISORS OF PIMA COUNTY, ARIZONA

Whereas, New sources of water are essential to the economy of the State of Arizona and its future growth; and,

Whereas, The Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River; and,

Whereas, The Colorado River is the last major source of water available to the State of Arizona;

Now, therefore, be it resolved, That the Pima County Board of Supervisors endorses the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States.

Passed this 28th day of April, 1967.

PIMA COUNTY BOARD OF SUPERVISORS.

THOMAS S. JAY, *Chairman.*

PETE RUBI, *Member.*

DENNIS WEAVER, *Member.*

Attest:

ELSA B. HANNA, *Clerk.*

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF PHOENIX

Whereas, new sources of water are essential to the economy of the State of Arizona and its future growth; and

Whereas, the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River; and

Whereas, the Colorado River is the last major source of water available to the State;

Now, therefore, be it resolved by the Council of the City of Phoenix as follows:
Section 1: That the City Council of the City of Phoenix hereby endorses the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States.

Section 2: Whereas, the immediate operation of the provisions of this resolution is necessary for the preservation of the public peace, health and safety, an EMERGENCY is hereby declared to exist, and this resolution shall be in full force and effect from and after its passage by the Council, approval by the Mayor and publication and posting as required by law, and is hereby exempted from the referendum clause of the City Charter.

Passed by the Council of the City of Phoenix this 3 day of May, 1967.

Approved by the Mayor this 3 day of May, 1967.

MILTON H. GRAHAM, *Mayor.*

RESOLUTION OF THE TUCSON CHAMBER OF COMMERCE

Whereas, new sources of water are essential to the economy of the State of Arizona and its future growth;

Whereas, the Supreme Court of the United States has upheld Arizona's claim to its fair share of water from the Colorado River;

And, Whereas, the Colorado River is the last major source of water available to the state;

Now therefore be it resolved, that the Tucson Chamber of Commerce endorse the proposed Central Arizona Project and urge its immediate enactment by the Congress of the United States.

Approved by the Board of Directors of the Tucson Chamber of Commerce.

DON B. TOSTENRUD,
President.

TUCSON, ARIZ., April 30, 1967.

Senator CARL HAYDEN and PAUL FANNIN (Care Morley Fox)

Central Arizona Project Assoc.,

Rm. 402, Hotel Congressional, 300 New Jersey Ave. Southeast, Wash., D.C.

GENTLEMEN: The Board of Directors of the Arizona Section of American Society of Civil Engineers endorses the proposed Central Arizona Project and urges its immediate enactment by the Congress of the United States.

KENNETH FLORIAN,
President, Arizona Section ASCE.

