REPORT OF SAN JUAN RIVER ENGINEERING COMMITTEE

January, 1959

REPORT OF SAN JUAN RIVER ENGINEERING COMMITTEE

January, 1959

- - - - -

INTRODUCTION

A report on the San Juan-Chama, a transmountain diversion project prepared by the Bureau of Reclamation was completed in November 1955. A supplement to this report was issued in May, 1957.

The supplemental report recommends the construction of an initial unit of the project providing for a diversion in Colorado and use in the State of New Mexico of an average of 110,000 acre feet of water from the headwater tributaries (Navajo River, Little Navajo River and Rio Blanco) of the San Juan River. This initial unit is to be so designed and constructed that ultimately an additional 125,000 acre feet of water could be diverted from other tributaries (West and East Forks) of the San Juan River in Colorado. The water is to be used in the Rio Grande Basin in New Mexico.

Coordinated with the time of issuance of the San Juan-Chama reports, a report on the Navajo Project for use of San Juan River water in New Mexico, was prepared by the Bureau of Indian Affairs. The report was completed in January, 1955. A supplement to this report was issued in March, 1957

The supplemental report recommends the construction of canals and pumping facilities for the irrigation of 110,630 acres of new land in New Mexico. The water required for the irrigation

of the land is reported to be 508,130 acre feet. The water is to be diverted from the San Juan River at the Navajo Dam.

San Juan River Committee.

On April 11, 1958, a joint Legal and Engineering Committee was appointed by the State of Colorado for the purpose of study of the effects the two New Mexico projects may have on the future development of water resources in the San Juan River basin in the State of Colorado. The Committee members consist of the following:

Coordinator:

John B. Barnard, Jr., Denver

Legal Committee:

William S. Eakes, Durango (Chairman)
Raphael J. Moses, Alamosa
Felix L. Sparks, Denver

Engineering Committee:

R. M. Gildersleeve, Denver (Chairman)
Ray Williams, Durango
C. H. Jex, Grand Junction
P. P. Smith, Glenwood Springs

This is a preliminary report of the Engineering Committee on findings to date. The report is prepared as a guide to the Legal Committee and as a reference for a joint Legal and Engineering Committee determination of the effects the San Juan-Chama and the Navajo Projects will have on future water development in the State of Colorado.

New Mexico Present and Planned Use of Water.

Under date of June 10, 1958, State Engineer S. E. Reynolds of New Mexico advised Colorado of New Mexico's present tentative plans for the use of Colorado River water in the State of New Mexico. This letter with attached tables summarizes that State's current data

on present use and plans for additional use of Colorado River water in the State of New Mexico. In order to further clarify the reported plans of the State of New Mexico regarding the use of San Juan River water, a letter under date of December 23, 1957, of New Mexico State Engineer S. E. Reynolds is also made a part of this report.

The letters above referred to, with attached tables, are reproduced in this report for information purposes only. The time schedule for submitting this report would not permit a detailed study of the above data by the committee. From study of the letters the committee concludes that plans of the State of New Mexico include three additional new water use demands on the flow of the San Juan River at the Navajo Dam and upstream tributaries. These three new water use demands include the Navajo Irrigation Project as reported, the initial unit of the San Juan-Chama Project as reported and a use demand identified as "Municipal and Industrial (M and I) Water" of 224,000 acre feet. Such demands are in addition to present water use and the water requirements of the authorized Hammond Project, the authorized Fruitland Project and the authorized Hogback Project. Testimony in support of the three new water use demands was given in the Senate Committee hearing on legislation for the authorization of the Navajo and San Juan-Chama Projects.

Division of Basin.

For purposes of analysis of the water supply and water demand on the San Juan River, the Basin naturally divides itself into two separate study divisions. The stream runoff and water demand on the Navajo Reservoir and upstream tributaries are considered as one division. The second division includes the Animas River and that section of the San Juan River downstream from the Navajo Reservoir.

COPY

STATE OF NEW MEXICO

State Engineer Office
Santa Fe

S. E. Reynolds
State Engineer

June 10, 1958

Mr. John Barnard
First Assistant Attorney General
Office of the Attorney General
Denver, Colorado

Dear John:

Your letter of April 24, 1958 requested certain data concerning present and future uses of water in the San Juan River Basin, New Mexico. I regret the delay in furnishing you this information, but as I advised you during our conversation in Santa Fe on April 29, the office has been preoccupied with a heavy work load in connection with the presentation of New Mexico's case in the Arizona v California litigation; also, the compilation of these data in the form requested has required more effort than I had anticipated.

Much of the data requested in your letter is not available in precise form and it has been necessary to make a number of approximations in the preparation of the attached tables. With minor corrections, the data contained in the report entitled "A Review of the San Juan River Problem in New Mexico," dated March 4, 1953 are considered to adequately reflect usage in New Mexico as of 1950. The minor corrections required are the addition of 1462 acres of Indian irrigation in the headwaters of La Jara Creek, 717 acres of decreed irrigation rights in the headwaters of Chaco Wash, and 423 acres of Indian irrigation on the Navajo River. These acreages were apparently inadvertently omitted from the 1953 report.

Usage as of 1958 is arrived at by adding to the 1950 estimate, the estimate of usage under permits issued by the State Engineer Office and usage on Indian acreage reported by the Bureau of Indian Affairs to have been placed under irrigation since 1950. Crop consumptive use rates used for the 1953 report have been used to estimate depletions by irrigation usage developed since 1950.

It is assumed that new municipal and industrial developments cause a depletion equal to 50% of the permitted diversion.

It is assumed that incidental usage remains unchanged from that shown in the 1953 report.

Diversion amounts for irrigation uses are approximated at 5 acre feet per acre of irrigated land.

The attached tables are copiously footnoted, and I hope, therefore, self-explanatory. However, I would specifically invite your attention to the fact that the ultimate stages of the San Juan-Chama Project (125,000 acre feet per year) and the municipal and industrial diversion from Navajo Dam (224,000 acre feet per year) as set forth under "other potential uses" are possible alternative developments under U. S. Government filings and are a part of our long-range plans and not contemplated for completion in the near future. As you know New Mexico is currently seeking authorization of only an initial stage of the San Juan-Chama Project for the diversion of an average of 110,000 acre feet per year.

Since the Utah Construction Company filings were discussed in considerable detail at our meeting on January 30, 1958, and in my letter to Dean Crawford of the same date, I take this opportunity to advise you concerning the present status of those filings. The Utah Construction Company's Notice of Intention No. 2838 has ripened into an application for the diversion of 55,000 acre feet from the San Juan River below the confluence of the Animas River. The estimated depletion of 39,000 acre feet under that application as set forth in the attached table is derived from the application. The Utah Construction Company has assigned the balance of 84,000 acre feet per year covered by their Notice of Intention to the Secretary of the Interior for the Secretary's control and use in connection with possible alternative developments mentioned above.

Present indications from correspondence on file in this office are that the Utah Construction Company contemplates taking the 55,000 acre feet of water for which it has applied from Navajo Dam when the Navajo Canal is completed. Thus, that 55,000 acre feet would become a part of the 224,000 acre feet available for diversion from Navajo Reservoir. Also it is likely that some of the other potential uses listed, for example the Town of Farmington, will draw water from Navajo Reservoir under contract with the Secretary of the Interior.

I would also point out that the estimates of possible potential usage under pending applications and notices of intention on file were made by Mr. Phil Mutz, who prepared the attached tables, without regard to the merit of the projects contemplated or the water supply available for those projects.

You will note that the total of present uses and all possible potential uses in New Mexico as listed in the two attached tables, exceeds

838,000 acre feet per year. For planning purposes both New Mexico and the Bureau of Reclamation assume that the Colorado River Compacts and the available water supply will permit ultimate depletions at sites of use in New Mexico amounting to 838,000 acre feet per year.

I whole-heartedly agree with you as to the importance of having the facts before us, and I sincerely hope that you will feel free to request whatever other information or clarification may be helpful in your considerations.

Yours truly,

/s/ STEVE
S. E. Reynolds
State Engineer

SER:c

FUTURE USES

Works Authorized or in Advanced Planning Stage

Location	Project	Total Depletion Average A. F.	Total Diversions Average A. F.	Indian Depletion Avg.-A.F.
Tribs. in Colorado	San Juan-Chama**	110,000	110,000	Not evaluated
Pine River	Pine River Ext. *	1,400#	3,800	Not evaluated
San Juan-Animas				
San Juan above Pine R.		-0-	-0-	-0-
San Juan Pine River to Animas	Navajo Reservoir**	39,000 Y		Not evaluated
" "	Navajo Project**	252,300	508,000	252,300
" "	Hammond*	6,800 ¢	23,000	-0-
San Juan below Animas	Fruitland*	2,100	4,500	2,100
" "	Hogback Ext.*	22,600	49,000	22,600
Animas-LaPlata	Animas-LaPlata**	33,400	66,800	Not evaluated
From San Juan System	C.R.S.P. Evaporation Authorized units	73,300Y	-0-	
Total		540,900	765,100	- -

Other Potential Uses

San Juan-Animas	Town of Farmington $	5,000	10,000	-0-
San Juan below Animas	Utah Construction Co.$	39,000	55,000	- -
Above Navajo Dam	San Juan-Chama [a]	125,000	125,000	- -
Below Navajo Dam	M & I [a]	112,000	224,000	- -
" " "	El Paso Natural [z]	500	1,000	- -
" " "	Bloomfield Irrig. [z]	3,000	6,000	- -
" " "	C. H. Hallet [z]	1,700	3,400	- -
Animas River ≠	Ranchito Mutual [z]	1,300	3,400	- -
" " ≠	Frank Manzori [z]	400	1,000	- -
" " ≠	Wm. Kottke [z]	200	500	- -
" " ≠	M. H. Englebreacht [z]	100	250	- -
San Juan bel. Animas ≠	Utah Construction Co. [z]	8,800	17,500	- -
" " " ≠	R. G. Ray [z]	1,800	3,600	- -

** Feasible projects as reported from present status of planning.
* Authorized projects, excluding main reservoirs.
# May not all be used due to inundation of project lands by Navajo Reservoir.
¢ Part of Hammond Project Area included in Present Uses.
$ Possible usage under applications on file in good standing which have not received action.
a Possible alternative uses under U.S. Gov't filings; portions of both may be developed.
z Notices of Intention to Appropriate Water in good standing.
≠ Priority date later than N. M. filing for Animas-LaPlata Project.
Y U.S.D.I. Report "Financial and Economic Analysis, C.R.S.P.," dated February 1958.

PRESENT USES

Location	Total Depletion at or near sites of use - Ac.Ft.	Total Diversions Ac.Ft. *	Indian Depletion** at or near sites of use - Ac. Ft.
Navajo	800	3,500	620
Pine River	1,290	5,200	-0-
San Juan-Animas Rivers			
San Juan above Pine River	2,170	9,100	1,460[z]
Pine to Animas River	14,230	33,400	-0-
Animas River	36,500	87,100	-0-
Below Animas[ø]	24,260	57,400	14,700
Subtotal	78,160[x]	187,000	16,160
LaPlata River	6,240	25,000	-0-
Chaco Drainage	5,840	34,000	4,920
TOTAL	92,330	254,700	21,700

** Included in total
* Diversions approximated at 5 A.F. per acre of irrigated land
z On headwaters of LaJara Creek, tributary to San Juan River
ø Does not include LaPlata and Chaco drainage
x Includes 1000 A.F. domestic and miscellaneous uses not distributed to subdivisions of San Juan-Animas Rivers

001992

COPY

STATE OF NEW MEXICO

State Engineer Office

Santa Fe

S. E. Reynolds
State Engineer

P. O. Box 1079
Santa Fe, N. M.

December 23, 1957

Dean Ivan C. Crawford
Colorado Water Conservation Board
212 State Office Building
Denver 2, Colorado

Dear Dean:

In response to your letter of December 6 and subsequent inquiries I am pleased to provide information relative to contemplated uses of San Juan River water in New Mexico as follows:

Use	Depletion-Ac.Ft.
Present and Authorized [1]	127,000
Navajo Indian Irrigation Project	254,000
San Juan-Chama Diversion Project	110,000
Storage Project Reservoir Evap.Losses [2]	69,000
Navajo Reservoir Evap. Losses	34,000
	594,000

1) Includes Fruitland Hogback Extension and the authorized Hammond Project
2) Glen Canyon, Curecanti and Flaming Gorge

For planning purposes the State of New Mexico assumes that a depletion of 838,000 acre feet per year (11-1/4% of 7,450,000) at sites of use in New Mexico will be possible under the terms of the Upper Colorado River Compact. The assumption is supported by the 1951 Report of the Technical Committee on the San Juan River in New Mexico, and by recent data which show that the virgin flow of the Colorado River at Lee Ferry amounted to an average of about 15,300,000 acre feet per annum in the period from 1896 through 1957. As you will

remember these data were furnished at the Upper Colorado River Commission Engineering Committee meeting in Cheyenne on December 19. The assumption of an allowable depletion of 838,000 acre feet per year is conservative in that it makes no allowance for salvage that will occur between sites of use and Lee Ferry as a result of the usage.

Assuming an allowable depletion of 838,000 acre feet per year, present uses and projects for which New Mexico is seeking early authorization will utilize 71% of New Mexico's share of the waters of the Upper Colorado River System. With the completion of the Animas-LaPlata Project, which will result in a depletion of 33,400 acre feet per year in New Mexico, 75% of New Mexico's development will be accomplished.

We have estimated that additional diversion requirements in New Mexico amounting to 224,000 acre feet per year can be served from the San Juan River and its tributaries above Navajo Dam. We contemplate that most of this water will be used for municipal and industrial purposes. If such usage is made in the San Juan Basin the consumptive use resulting from a diversion of 224,000 acre feet will amount to about 112,000 acre feet. This additional amount of consumptive use would bring New Mexico's depletion to 91% of the assumed allowable. It appears unlikely that this stage of development will be reached before 50 years have passed.

It should be pointed out that, under the State's plan of development, up to 125,000 acre feet per year of the additional 224,000 acre feet available for diversion as noted above may be transported to the Rio Grande Basin. In the event such a diversion is made the return flow to the San Juan Basin would be less than the 112,000 acre feet per year estimated above, but the State's allowable depletion still would not be exceeded.

The foregoing data show that present and authorized uses, and the projects for which New Mexico is seeking early authorization, will deplete only 71% of the water allocated to New Mexico, and, therefore, it appears clear that there is ample water to meet New Mexico's share of the requirements of the Animas-LaPlata Project. New Mexico people in the project area evidence continuing and active interest in the Project, and the State of New Mexico is anxious to cooperate with Colorado toward its early, full development.

001994

Dean Crawford
3d
December 23, 1957

I am sure you appreciate that the information presently available does not permit a reliable statement as to whether power revenue credits available to New Mexico at the time the Animas-LaPlata Project may be authorized will be adequate to finance New Mexico's share of the project construction costs. I feel that the possibility that the credits will be adequate is not ruled out at this time, but it must be assumed that it will be the State's policy not to delay the construction of authorized participating projects by reserving credits for projects which are in the preliminary planning stage.

Please feel free to write or call me if some further information concerning New Mexico's present and proposed uses of the waters of the San Juan River would be useful to you.

Yours truly,

/s/ S. E. REYNOLDS
S. E. Reynolds
State Engineer

SER:c

NAVAJO RESERVOIR AND UPSTREAM TRIBUTARIES

Water Supply.

For purposes of water supply analysis, the historic runoff of the San Juan River at the U. S. Geological Survey Blanco gaging station located downstream from the dam site of the proposed Navajo Reservoir has been taken as the supply of water available for additional upstream use and regulation by the Navajo Reservoir. The period of study covers the years 1928-1956, inclusive. The committee recognizes that during this same period some increase in stream depletion has occurred from expanded use of water on the upstream tributaries and therefore the records of runoff for the earlier years of the period show more water than would be available under present development. This is not considered serious as the years of acute water supply have occurred in the more recent period of 1946-1956.

The following table gives the annual runoff of the San Juan River at the Blanco gaging station. The records make allowance for use by the Citizens Ditch which diverts from the river a short distance below the dam site of the proposed Navajo Reservoir and above the Blanco gaging station through December 6, 1954. On December 7, 1954, the gage was relocated above the point of diversion of the Citizens Ditch. The recorded river flow at the new location for the years 1955 and 1956 has been adjusted to reflect the diversions by the Citizens Ditch.

RUNOFF SAN JUAN RIVER NEAR BLANCO, NEW MEXICO

Runoff Year Nov. 1-Oct.31	Runoff in 1000 ac. ft.	Runoff Year Nov.1-Oct.31	Runoff in 1000 ac.ft.
1928	835	1942	1412
29	1571	43	749
1930	828	44	1243
31	595	45	857
32	1815	46	397
33	711	47	709
34	337	48	1216
35	1527	49	1394
36	931	1950	524
37	1402	51	326
38	1472	52	1496
39	685	53	512
1940	550	54	532
41	2551	55	466
		56	484
29 year average 1928-1956 inclusive			969.9

Water Operation Study of the Navajo Reservoir.

Construction plans of the Bureau of Reclamation call for a total capacity for the Navajo Reservoir of 1,700,000 acre feet. Of this amount 740,000 acre feet is to be dead capacity for the accumulation of silt and for the purpose of providing necessary canal elevation for the irrigation of lands under the Navajo Project. The net active capacity of the Navajo Reservoir for this study was considered to be 960,000 acre feet.

Using the data in the preceding table as the available water supply, annual water operation studies were prepared reflecting use on upstream tributaries, and the inflow to and the release of water from the Navajo Reservoir for the years 1928-1956. Two water use demand criteria were used in the water operation studies as follows:

Demand Criteria No. 1 (in thousands of acre feet):

	Demand from Trib. Streams	Demand from Navajo Reservoir	Total Demand
Pine River Depletion - New Mexico (authorized)	1.4		
Pine River Depletion - Colorado (authorized)	60.5*		
Weminuche Pass Depletion - Colorado (authorized)	16.3*		
Initial Unit San Juan-Chama - New Mexico	103.9*		
Sub Total	182.1		182.1
Navajo Project - New Mexico		508.0	
Hammond Project - New Mexico		23.0	
Navajo Reservoir Evaporation - New Mexico		39.0	
El Paso Natural Gas - New Mexico		1.0	
Bloomfield Irrigation - New Mexico		6.0	
C. H.Hallett - New Mexico		3.4	
Town of Farmington - New Mexico		10.0	
Utah Construction Co. - New Mexico		55.0	
Sub Total		645.4	645.4
		Total	827.5

*29-year average (1928-1956). Water operation study reflected annual availability of water.

If demand on the available water supply tributary to the Navajo Reservoir is limited in Colorado to the two authorized projects (Pine River Project of 69,000 acres and Weminuche Pass), and if the new water demands in New Mexico do not exceed the uses as listed in the above schedule, the only shortage of supply would have occurred

in 1956 of the 1928-1956 period. This shortage would have amounted to 150,000 acre feet or 23 per cent of normal reservoir demands.

The above analysis relates only to a condition of no new use in Colorado over and above the two authorized uses mentioned above. With any additional use in Colorado the resultant shortage would be increased.

It is not practicable at this time to determine the probable extent of possible new uses in Colorado without a field study. For the purpose of evaluating the effects of such new uses, annual new depletions ranging between 20,000 acre feet and 100,000 acre feet were imposed on the water supply. The resulting shortages in reservoir supply are indicated in the following table. In the case of the higher figure for new use in Colorado, it is possible that some natural shortage in water supply might be experienced in years of low runoff.

CRITERIA NO. 1

Shortages in New Mexico Normal Demand on Navajo Reservoir

New Uses in Colorado

Year	20,000 Ac.Ft.		50,000 Ac.Ft.		100,000 Ac.Ft.	
	Shortage Ac.Ft.	Percent	Shortage Ac.Ft.	Percent	Shortage Ac.Ft.	Percent
1954					144,000	22
1955			174,000	27	397,000	62
1956	290,000	45	326,000	51	376,000	58

Under the condition of existing uses only in Colorado, and with New Mexico demands as shown in Criteria No. 1, one shortage in Navajo Reservoir supply would occur in a year such as 1956, amounting to 102,000 acre feet or 16 percent.

Demand Criteria No. 2 (in thousands of acre feet):

	Demand from Trib. Streams	Demand from Navajo Reservoir	Total Demand
Pine River Depletion - New Mexico (authorized)	1.4		
Pine River Depletion - Colorado (authorized)	60.5*		
Weminuche Pass Depletion - Colorado (authorized)	16.3*		
Initial Unit San Juan-Chama - New Mex.	103.9*		
Sub Total	182.1		182.1
Navajo Project - New Mexico		508.0	
Hammond Project - New Mexico		23.0	
Navajo Reservoir Evaporation - New Mexico		39.0	
M & I Water - New Mexico		224.0	
Sub Total		794.0	794.0
		Total	976.1

*29-year average. Water operation study reflected annual availability of water.

The above schedule of demand (Criteria No. 2) represents the new water requirement of the presently reported plans of the State of New Mexico for use of the water tributary to the Navajo Reservoir. This schedule also provides for no new water use in the State of Colorado over and above the two authorized projects in Colorado. The M & I water demand in New Mexico, amounting to 224,000 acre feet, includes 75,400 acre feet for the last five new uses in New Mexico shown in the tabulation for Demand Criteria No. 1.

The total demand under Criteria No. 2 on the river runoff tributary to the Navajo Reservoir as envisioned by New Mexico thus exceeds the average river runoff for the 29-year period of study, 1928-1956. The Navajo Reservoir does not have sufficient capacity to fully equate the stream flow, and non-controllable spills would

occur in several years.

Water operation studies using the demand of Criteria No. 2 indicate shortages in reservoir supply in 4 years of the 29-year period. The following table shows such shortages with no new use in Colorado and indicates the range of shortages with assumed 20,000, 50,000 and 100,000 acre feet of new depletion in Colorado.

CRITERIA NO. 2

Shortages in New Mexico Normal Demand on Navajo Reservoir

Year	Authorized Projects in Colorado		New Colorado Uses					
			20,000 Ac.Ft.		50,000 Ac.Ft.		100,000 Ac.Ft.	
	Shortage 1000 AF	Percent	Shortage 1000 AF	Percent	Shortage 1000 AF	Percent	Shortage 1000 AF	Percent
1947			8	1	158	20	354	45
1950							121	15
1951	308	40	453	57	573	72	652	82
1953					57	7	157	20
1954	366	46	382	48	416	52	466	59
1955	445	56	465	59	495	62	545	69
1956	425	54	445	56	475	60	525	66

Considering only existing uses in Colorado, the demand schedule of Criteria No. 2 would result in shortages in reservoir supply in the years 1955 and 1956. These would each be in the amount of 375,000 acre feet or 47 percent.

It should be recognized that the water demand figures for New Mexico used in the above analyses were taken either from estimates in reports of Federal agencies or from estimates in letters of New Mexico State Engineer Reynolds. It is probable that the actual demands after development may exceed these estimates. In the case of the Navajo Project in particular, the diversion demand figure of 508,000 acre feet was estimated as the irrigation diversion requirement

for 105,099 acres of what is termed productive land or 110,360 acres of land for project development. It could well be that the land area may be increased or the estimated diversion requirement of approximately five acre feet per acre be inadequate.

In the case of the Town of Farmington the future demand is estimated as 10,000 acre feet. This would appear to be sufficient for an increase in population of 25,000 to 35,000 which is very little in excess of the growth of the town during the past ten-year period. It is not realistic to assume that the total water requirements will remain static and that 10,000 acre feet will be sufficient to serve all future growth.

The preceding analysis of the water supply tributary to the Navajo Reservoir under demand Criteria No. 1 and No. 2 provides no release or by-pass for supplying water requirements of the present San Juan River appropriators in New Mexico down stream from the junction of the Animas River with the San Juan. This matter will be discussed later in the report.

Sharings of Shortages under Upper Colorado River Basin Compact.

Article XIV (c) of this compact provides that uses of the waters of the San Juan River and any of its tributaries, not existing or authorized at the time of the signing of the compact, and which are dependent upon a common source of water, shall be reduced in times of water shortages. The amount of this reduction shall be such that the resulting consumptive use in each State shall bear the same proportionate relation to the consumptive use made in each State during times of average water supply. It also provides that any preferential uses of water to which Indians are entitled under Article XIX

shall be excluded in determining the amount of curtailment to be made.

With respect to the claimed preferred status of Indian rights, the following statement was made by Mr. Warner, one of the attorneys for the United States in the pending case of Arizona vs. California, in the United States Supreme Court, at San Francisco, on August 12, 1957:

> "The reservation (of water) is the act (of the United States) by which the unappropriated waters involved are set apart for the purposes of the reservation and insulated against subsequent appropriations by members of the public (under applicable state or territorial laws)."

The Navajo Indian Reservation was established by Treaty on June 1, 1868. If the above contention of the United States, in Arizona vs. California, is upheld by the Supreme Court as a part of the "Law of the River", the result would be this, among others:

(a) Rights of the Navajo Indians would be supplied as senior to and preferred over all rights to the use of the water of the affected streams which vested after June 1, 1868.

(b) In the low runoff period of years such as the one ending with water year 1956, all rights on the affected streams, either in New Mexico or Colorado, which became vested after June 1, 1868, would be involved to the extent necessary to make up any shortage which in that year, or any other similar year, would have been experienced by the Navajo Project.

An agreement with the Navajo Indian Tribal Council contemplates the sharing in New Mexico of streamflow and reservoir water between the Navajo Project and other new uses in years of low runoff.

It would appear on the surface that if this sharing principle should result in consumptive use by new projects in New Mexico other than the Navajo Project in such years, then under the compact new uses in Colorado also would be entitled to some consumptive use. In this case, curtailment of new Colorado uses would be such that their shortages would approach the same percentages as those indicated in the analyses under Criteria No. 1 and No. 2.

However, if the Navajo Project should be a preferential Indian use as against Colorado, regardless of the agreement in New Mexico, there could be no new use in Colorado in years when the Navajo Reservoir would be empty and inflows to the reservoir would be less than the diversion demand of the Navajo Project.

Use of Water from the Navajo and the Blanco Rivers.

The streams to be intercepted by the initial unit of the San Juan-Chama Project include the Navajo and Little Navajo Rivers and the Rio Blanco. The entire flow of the Little Navajo River is presently diverted during the summer months of each year for irrigation use in Colorado. A substantial base flow now remains in the Navajo and the Rio Blanco Rivers over and above diversions in Colorado, thus providing good fishery for the two streams.

Stream Fishery By-pass Water.

With regard to the effects of the San Juan-Chama Project on fishery values of these streams, under the heading of "Minimum Flows" the following statement appears on Page A-41 of the Bureau of Reclamation Report of 1955:

> "145. Aquatic habitat studies have been conducted on the Pagosa Division streams to determine the minimum flows that will be required to protect the existing fishery. Analysis of the operation study indicates that if the Pagosa Division is operated as shown in this study, with-the-project streamflows will be about equal to the minimums that are considered to be necessary to maintain the fishery. The schedule of minimum flows that has been developed is shown in table 11. The schedule is included for information and guidance, but is not presented as a recommendation."

On page A-14 of the same report, there appears Table 6, "Proposed average releases to project streams and estimated streamflows, San Juan Chama Project, Pagosa Division". This table contains

the following columns (values in second feet):

	AVERAGE RELEASE	
	From Rio Blanco Diversion Dam to Rio Blanco	From Oso Diversion Dam to Navajo River
October	18	49
November	19	34
December	13	29
January	13	31
February	14	34
March	19	56
April	20	165
May	39	227
June	20	200
July	19	117
August	19	76
September	19	56

The average releases indicated by these columns in Table 6 are generally equal to or greater than the recommended minimums shown in the attached Table 11 (page 14-A of this report). This is probably the basis for the statement quoted above from page A-41 of the report.

However, an analysis of the Bureau of Reclamation study for the 1955 report disclosed a segregation of the Navajo River average releases above shown, as follows:

	AVERAGE VALUES IN SECOND FEET		
	By-pass for prior rights	Available for Dulce Project	Total
October	32	16	48
November	32	2	34
December	27	1	28
January	26	2	28
February	28	5	33
March	35	21	56
April	37	127	164
May	85	140	225
June	55	150	205
July	50	66	116
August	48	27	75
September	42	13	55

Although the totals shown above are almost identical with

Table 11 - Minimum Streamflows Required to Preserve the Existing Fishery of the Pagosa Division Streams 1/

Month	West Fork of San Juan River at Lobo Dam site	East Fork of San Juan River at Tesoro Dam Site	San Juan River at Source	San Juan River at Pagosa Springs	Rio Blanco at Blanco Dam site	Navajo River at Oso Diversion Dam site
October	35	15	55	55	20	35
November	20	10	35	55	15	30
December	20	10	35	35	15	30
January	20	10	35	35	15	30
February	20	10	35	35	15	30
March	20	10	35	35	15	30
April	35	20	55	75	25	40
May	60	35	95	100	40	60
June	60	35	95	100	40	60
July	60	35	95	100	40	60
August	60	35	100	100	40	60
September	50	25	75	75	30	45

1/ Streamflows are shown in second-feet.

the Navajo River column of Table 6, actually it was not contemplated that the water designated "available for Dulce Project", in an average amount of 35,000 acre feet, would be released to the Navajo River in the event that the Dulce Project would be eventually constructed. In that case it would be stored in a proposed reservoir and released through a canal to Dulce Project lands. Under this operation study, for the period 1928-1951, an average of about 23,000 acre feet annually of Navajo River water would be available for diversion to the Rio Grande.

The Bureau of Reclamation operation study for the 1957 supplemental report indicates that the Dulce Project was no longer considered. The potential diversion from the Navajo River was estimated to average about 57,000 acre feet. This would leave average flows in the Navajo River amounting to only the prior right by-passes as shown above.

The monthly releases are somewhat less than the recommended minimums of Table 11. However, these minimums are in some cases higher than historic flows. It should be noted that water by-passed for prior irrigation rights is subject to diversion and re-diversion which could result in stream flows at critical points considerably below the recommended minimums for retaining the fishery values of the stream. This situation would tend to discount statements made by the Fish and Wildlife Service as to the general adequacy of the average by-passes to meet recommended minimums.

This conflict of reported data raises a serious question concerning the intent of the operation of the project after construction.

As the schedule of releases to the stream appears as a part of the discussion of fishery and wildlife aspects of the project, it is concluded that the same applies to stream requirement at points of minimum flow for the maintenance of the fishery values of the streams. If it is the intent that the Navajo and the Rio Blanco diversions of the San Juan-Chama Project are to be operated in accordance with the schedule of minimum stream releases, the data on the divertable water by the project should reflect such operation and the report confirm the same as a project operating principle. On the other hand, if the diversions are to be operated without full compliance with the schedule of minimum stream flow releases, as our analysis of the data discloses, it would appear that the same should be so reported and that an adjustment be made for the loss of fishery values of the two streams to the State of Colorado.

If there is to be no limit on diversion into the Rio Grande basin except the water required to be by-passed for vested rights in Colorado, this should clearly be understood as an operating principle of the project, and an evaluation of its effect on fishery values in Colorado should be reconciled therewith.

ANIMAS AND SAN JUAN RIVERS

DOWNSTREAM FROM THE NAVAJO RESERVOIR

Water Requirement.

Information supplied the committee by New Mexico indicates that the full water use requirement of that section of the San Juan River from the Navajo Reservoir downstream to the junction of the Animas River are provided for within the schedule of demands on the Navajo Reservoir previously discussed in this report. The information also indicates that all municipal and industrial requirements downstream from the junction of the Animas River are to be supplied from and are a part of the schedule of demand on the Navajo Reservoir.

Predicated on the above information the findings of the committee show that there are four ditches with diversions from the San Juan River below the junction of the Animas which, according to plans of New Mexico, will be dependent on water supply from sources other than water tributary to the Navajo Reservoir. The acreage of land to be irrigated by the four ditches and the water requirement of each as given in the 1955 Navajo Project report are summarized in the following table:

Ditch	Presently Served (Acres)	Potential New (Acres)	Total (Acres)	Water Required (Ac.Ft.)
Jewett Valley Ditch	1,200	0	1,200	6,000
Fruitland Project	2,500	900	3,400	17,000
Hogback Project	4,200	9,800	14,000	70,000
Cambridge Ditch	350	0	350	1,700
Total	8,250	10,700	18,950	94,750

The Fruitland and Hogback Projects serve Indian land. All four ditches were in operation and the extensions of the Fruitland and Hogback were authorized for construction at the time of the signing of the Upper Colorado River Basin Compact. The owners of the ditches thus have a first and prior right in accordance with provisions of Article XIV (a) of the compact.

Water Supply.

A comparison of the monthly diversion requirement of the four ditches with historic stream runoff data shows that the unregulated flow of the San Juan River at the several points of diversion has been adequate for the full irrigation of the lands. The construction of the proposed Florida and the Animas-La Plata Projects for use of Animas River water upstream in Colorado and New Mexico will result in some depletion in flow which under historic conditions has been available for use by the four prior right ditches. Run-off data show that the residual flow of the Animas with the Florida and the Animas-La Plata Projects in operation together with the runoff of the San Juan under historic conditions is adequate for the prior right ditches.

The regulation and uses of water upstream proposed by the State of New Mexico have been previously analyzed herein. These would result in major depletion of the water supply available to these four ditches. Even with the development of these uses, together with those mentioned on the Animas River in Colorado, there would still remain sufficient total residual annual streamflows, if regulated, to adequately meet the diversion requirements of the four ditches.

However, without regulation serious shortages could result in late season diversion requirements. The 1955 report on the Navajo Project contains estimates of return flows from the proposed new uses which indicate that the returns would occur in sufficient amounts and at times which would permit supplying the ideal diversion schedules of the four ditches.

The location, quantity and monthly distribution of these possible return flows are presently indeterminate to some degree in all cases. Data relative to those return flows which may result from diversions to the proposed Navajo Indian Project are the most highly conjectural.

A study was made by the committee based on estimates of amounts and monthly distribution of return flows contained in the letters of the New Mexico State Engineer and the Navajo Project report. The study disclosed that, even if these return flow estimates are reasonably accurate for uses other than the Navajo Project, material shortages would result if the expected return flows from that project fail to materialize. These shortages in the ideal monthly diversion requirements of the four ditches would occur in all except a few years of the study period having exceptionally high late season runoff. They would average about 11 percent and could be as much as 20 to 30 percent in the drier years of the period.

It is recognized that some return flow water will be available at the headgates of the four ditches on the San Juan below the mouth of the Animas. The committee feels, however, that some by-pass of water at the Navajo Dam will be required for these prior rights.

AVAILABILITY OF COLORADO RIVER WATER FOR SUPPLYING PRESENT AND PLANNED DEVELOPMENT IN NEW MEXICO

Under the heading "New Mexico Present and Planned Use of Water", previously presented in this report, reference is made to letters of June 10, 1958, and December 23, 1957, from New Mexico State Engineer, S. E. Reynolds.

With further reference to these attachments, Mr. Reynolds states in his letter of June 10, 1958, "For planning purposes both New Mexico and the Bureau of Reclamation assume that the Colorado River Compacts and the available water supply will permit ultimate depletions at the sites of use in New Mexico amounting to 838,000 acre feet per year". This assumption is obviously based on taking 11.25% of the full 1922 Compact allocation to the Upper Basin States of seven and one-half million acre feet per annum less the 1948 Upper Basin Compact allocation of a fixed 50,000 acre feet annually of the Upper Basin's share in the river to the State of Arizona. This assumption requires that the average annual virgin run-off at Lee Ferry is and will continue to be at least fifteen million acre feet and that there be sufficient surplus in the increments to the flow of the river between Lee Ferry and the International Boundary with the Republic of Mexico to fulfill the Treaty obligations of the United States to the Republic of Mexico with respect to Colorado River water.

Estimates made by the Bureau of Reclamation indicate that the average annual virgin runoff of the Colorado River at Lee Ferry, for the 48 year period 1909-1956, was 15.2 million acre feet. For the 29 year study period used in this report, 1928-1956, these estimates

show the average virgin runoff at the same point to be 13.5 million acre feet.

The attached table immediately following presents a summary of present and planned depletion of Colorado River water by the State of New Mexico, as specified in the two referenced letters from State Engineer Reynolds. The committee notes with concern that the sum of the depletions shown in the tabulation approaches and could well exceed the total apportionment due New Mexico by virtue of provisions of the two controlling Compacts. This concern is occasioned by the demand of New Mexico that virtually all of their planned development be immediately considered for approval and authorization.

002013

SUMMARY OF NEW MEXICO DEPLETION

Currently Planned Uses

	Acre Feet	Acre Feet	Acre Feet	Acre Feet
Present and Authorized Depletions				
Present Uses	92,300			
Main Stem Reservoir Evaporation	73,300			
Navajo Reservoir Evaporation	39,000			
Fruitland Extension	2,100			
Hogback Extension	22,600			
Hammond Project	6,800			
Pine River Extension	1,400			
Subtotal	237,500	237,500	237,500	
Animas-La Plata Project	33,400	33,400	33,400	
Schedule of Use - Criteria No. 1*				
Navajo Project	252,300			
Initial Unit San Juan-Chama	103,900			
El Paso Natural Gas	500			
Bloomfield Irrigation	3,000			
C. H. Hallett	1,700			
Town of Farmington	5,000			
Utah Construction Co.	39,000			
Subtotal	405,400	405,400		
Schedule of Use - Criteria No. 2*				
Navajo Project	252,300			
Initial Unit San Juan-Chama	103,900			
Ultimate San Juan-Chama	125,000			
M & I - Utah Construction Co.	39,000			
M & I - Remainder of 224,000 Diver.	22,000			
Subtotal	542,200		542,200	
Total (Criteria No. 1)		676,300		
Total (Criteria No. 2)			813,100	813,100
Other Potential Uses - Animas River	2,000			2,000
TOTAL CURRENTLY PLANNED USES				815,100

*In addition to present and authorized depletions and Animas-La Plata Project.