ASSESSMENT OF 1997-2001 WATER USE

by the

IMPERIAL IRRIGATION DISTRICT

SPECIAL REPORT

NOVEMBER 2002

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Prepared for the
U.S. Bureau of Reclamation
Boulder City, Nevada

by

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In Cooperation with the
Water Management and Conservation Team
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EXECUTIVE SUMMARY

The USBR requested an update of the August 1995 report by Jensen and the June 1997 report by Jensen and Walter using any new information and improved calculation procedures that have been obtained since the previous reports. This study incorporates recent data obtained from the Imperial Irrigation District (IID) and the USBR, it uses new calculation procedures for calculating reference evapotranspiration (ET), and uses a refined FORTRAN program for calculating daily crop ET and consumptive irrigation requirements using daily climate data from three California Irrigation Management Information System (CIMIS) stations. The study period for this report begins in 1989 and continues through 2001. Some results for 1987-1988 from Jensen and Walter (1997) are also presented.

The 1997 report by Jensen and Walter updated the assessment made in 1995. Calculations made in that report were based mainly on water balance data and crop acreage data provided by the IID. It incorporated updated draft water balance data for 1993 and 1994 (Boyle, 1993, updated) and water balance data for 1995 and 1996. The availability of these data enabled using IID water balance data directly for the period 1990-1996 along with crop acreage data for 1993-1995 and 1996. Analysis of trends in agricultural water deliveries from 1987 to 1996 was complicated because of the reduced deliveries mainly in 1992. Deliveries were also somewhat lower in 1991 and 1993. The 1992 calendar year was not a normal operational year for the IID because irrigation of many alfalfa fields was withheld for up to six weeks in an attempt to control whitefly. Except for the unusual years of 1992 and 1993, diversions of Colorado River by IID from 1994 to 1996 had increased from that in 1987-88.

Data analysis for this study began with downloading daily climate data for three CIMIS stations (No. 41, 68 and 87). These data were screened for missing and values that were not representative of climate data from a "reference ET" site. Missing data were filled in using standard procedures and non-representative data from one station were replaced with average values from the other two sites. Solar radiation data were compared with calculated clear-day values. When they appeared to be high or low because of problems with sensors, some periods of data were replaced with the average of the other two sites, or a single site in some cases. Review of summer dew point temperatures indicated that on many days, surrounding arid conditions influenced the data at the site. When calculated dew point temperatures were less than 5 °C below minimum daily temperature, daily water vapor pressures were calculated based on calculated minimum temperature minus 5 °C. Daily reference ET values were calculated using the recently standardized procedures for the Penman-Monteith equation.

The crop coefficients (K_c) used with reference crop ET used in this study were the single crop coefficients, linear segments, described in the recent FAO-56 publication (Allen et al., 1998). Base K_c values were mainly the time-averaged initial, mid-season and end season suggested in the publication FAO-56. The values for the initial, mid season and final periods were adjusted using procedures in FAO-56. Soils data for IID were obtained from SCS (1991). All adjustments were made using a comprehensive FORTRAN program called *CropET* developed by W.W. Wheeler & Associates, Inc. and Ivan's Engineering, Inc., Centennial, Colorado.

Field crop acreage generally increased from 1989 to 1998 and then decreased. The decrease in field crop acreage was primarily due to a reduction in wheat. As wheat acreage increased, the area of alfalfa decreased and vice versa. The acreage of Sudan grass and Sudan grass for seed reached maximum values in the mid 1990s then decreased in later years. The acreage of Bermuda grass and Bermuda grass seed steadily increased from 1989 to 2001.

Garden crop acreage decreased from a maximum in 1991 to 1992 and then remained relatively constant since then. Of the garden crops, the acreages of fall and spring lettuce and spring cantaloupes decreased the most from 1989 to 1991. The acreage of carrots and carrot seed generally increased during the 1989 to 1993 period and has remained relatively constant since then.

For this study, we used the same LR of 0.11 as was estimated by the TWG (1994). The volume of water required for leaching would be 0.11/(1 – 0.11) or 0.124 x the volume of irrigation water consumed by ET ($ET_{c(irr)}$). Since the NRCE (2002) report suggested that the change in Colorado River salinity was not considered, we adjusted the volume of LR by the relative salinity of the Colorado River water at Imperial Dam. The salinity at Imperial Dam is modulated by flow through reservoirs on the Colorado River. The relative salinity had decreased from a 10-year average, 1972-1982 value of near 1.0 following the high runoff in 1983-84, then increased back to the long-term trend by 1992-1993 and to near the 1972-82 average by 1994. The salinity level from 1998 through 2001 is significantly less than the 1972-82 average. Annual relative salinity values were used to calculate the leaching requirement volumes.

Because of the proximity of the three CIMIS sites, the average calculated reference ET values were very similar. Average ASCE reference ET estimates were 7.1% higher than CIMIS ET_o values. Total annual reference ET varies with precipitation in the valley. With increased precipitation, total annual reference ET is less because of lower solar radiation due to greater cloud cover and increased relative humidity. The year-to-year variation in annual reference ET from 1987 through 2001 is relatively small. The standard deviation of annual reference ET was 3.2 inches resulting in a coefficient of variation of 4.1%.

Diversions to IID as measured at Pilot Knob increased from 2,774,460 ac-ft in 1987 to a maximum of 3,171,875 ac-ft in 1997—an average increase of about 39,700 ac-ft per year. The years of 1992 and 1993 were exceptions to the general trend. Since 1997, Colorado River diversions to IID from 1998 to 2001 have remained relative constant at about 3,100,000 ac-ft/year, which is a decrease of about 2.4% from that in 1997. Deliveries to agricultural users, the main water user, followed similar trends.

Irrigation water supply at East Highland Canal increased from about 5.5 ac-ft per acre of harvested cropland in 1987 to a maximum of about 6.4 ac-ft/ac in 1997. The water supply relative to the flow at the AAC at Pilot Knob less deliveries to Coachella Canal is about 0.2 ac-ft/ac higher. When subtracting deliveries to non-agricultural uses, these values would be about 0.2 ac-ft/ac less. Calculated $ET_{c(irr)}$ clearly reflected the years of above normal precipitation in 1991-93 and 1997-98.

Total crop ET (ET_c) was estimated using the *CropET* model. The IID water balance appears to be unusually high in 1997 and 1998, which affected the calculated tailwater volume. The effect of increasing salinity of Colorado River water following high flows in 1983-84 on calculated leaching requirement is apparent, as was the decrease in salinity during the 1998-2001 period. The volume of tailwater expressed as a percentage of water delivered to agriculture also indicated an upward trend. The high IID water balance in 1997 and 1998 had a significant effect on the calculated percentage of tailwater.

Several important findings of the current investigation include:

- The major change in Colorado River water diverted to IID was increased diversions during the periods from 1987-88 to 1990 and from 1987-88 to 1994-2001. These increases resulted in a 16% increase in tailwater plus leach water from 1987-88 to 1989-90 and a 21% increase from 1987-88 to 1996-2001.

- Colorado River water diverted to IID per cropped acre increased from about 6.1 ac-ft/ac in 1987 to a maximum of 6.9 ac-ft/ac in 1997.

- Irrigation water supply at East Highland Canal per acre of cropped land increased from about 5.7 ac-ft/ac in 1987 to about 6.2 ac-ft/ac in 1989 and 1990, and to a maximum of about 6.5 ac-ft/ac in 1997. Beginning in 1998, it has been relative constant at 6.3 ac-ft per acre.

- Total harvested area has remained relatively constant at about 460,800 acres, varying from 453,200 to 467,900 acres.

- The volume of tailwater expressed as a percentage of agricultural water deliveries has an upward trend. The volume of leach water and tailwater increased significantly in 1997 and 1998 compared with 1994-96 and 1999-2001 average values.

- Net inflow to Salton Sea from IID increased from 1987 to 1990 and again to the 1994-2001 period. The 9% increase in flow to the EHL from 1987-88 to the 1996-2001 period resulted in a 20% increase in net flow to the Salton Sea.

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ACRONYMS

CIMIS	California Irrigation Management Information System
CU	Consumptive Use
EHL	East Highline Canal
ET	Evapotranspiration
ET_c	Crop Evapotranspiration
$ET_{c(irr)}$	Consumptive Irrigation Requirement
ET_o	Grass Reference Evapotranspiration
ET_{osz}	ASCE Standardized Penman-Monteith Grass Reference Evapotranspiration
IID	Imperial Irrigation District
K_c	Crop Coefficient
Kw	Coefficient for Evaporation from a Water Surface
LR	Leaching Requirement
TW	Tailwater
USBR	U.S. Bureau of Reclamation

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Marvin E. Jensen [1] and Ivan A. Walter [2]

1.0 INTRODUCTION

In August 1995, Jensen prepared a report titled *Water Use Assessment of the Imperial Irrigation District* in response to a request by the Boulder City office of the Bureau of Reclamation (USBR). A second report by Jensen and Walter was titled *Assessment of 1987-1996 Water Use by the Imperial Irrigation District Using Water Balance and Cropping Data.* The second report updated the first assessment and responded to comments by the Imperial Irrigation District IID. In March 1998, the IID prepared a report based on studies by a Work Study Team that included rebuttals to the USBR reports.

The purpose of this report is to update the August 1995 report by Jensen and the June 1997 report by Jensen and Walter. It incorporates new information and calculation procedures that have been obtained since the previous reports. The study period for this report begins in 1989 and continues through 2001. Some data for 1987 and 1998 from the Jensen and Walter (1997) report are included.

2.0 BACKGROUND

2.1 Review of Previous Reports

In the August 1995 report by Jensen, estimates had to be made of 1993 and 1994 water balance components based on a spreadsheet model pending receipt of 1993 and 1994 data and estimates of some crop acreages. The 1997 report by Jensen and Walter updates the first assessment released in 1995. More important, calculations were based mainly on water balance data and crop acreage data provided by the IID. Following receipt of the memo from the IID[3], draft water balance data for 1993 and 1994 became available (Boyle, 1993, updated). Water balance data for 1995 were provided on March 20, 1997, and 1996 data were provided April 25, 1997. Availability of these data enabled using IID water balance data directly for the period

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[2] Water Resources Engineer, Ivan's Engineering, Inc., Centennial, CO.

[3] Draft Memo to Mike Clinton, General Manager, IID, January 16, 1996, from Anisa Divine, p. 68-71.

1990-1996. Crop acreage data for 1993-1995 were provided in October 1996, and 1996 data were provided April 25, 1997.

The purpose of the original assessment was to evaluate water use by IID for the previous five years and to provide estimates of expected diversions for 1995 and 1996. The IID staff reviewed the assessment report and prepared a draft response in January 1996. A draft response to the IID comments was prepared by the USBR. Most of IID's comments required only clarification. The USBR delayed sending a formal response to IID's comments pending completion of a partnership agreement. A Partnership Agreement between the USBR and the IID is still pending.

An important part of the first assessment was to develop a spreadsheet model for use by the USBR in estimating monthly diversions for the coming one or two years. Such estimates of diversions depend mainly on expected changes in crops and acreages. The spreadsheet model could also be used as a tool in discussing water conservation measures as required by law (See Part 417, Appendix A, Jensen and Walter, 1997). It is one of many tools that the USBR may be using in carrying out its water resources management mandate knowing only current or expected crop acreages. Future studies were to also address the reasonable use of water.

2.2 Review, Water Use by IID, 1987-96

Analysis of trends in agricultural water deliveries from 1987 to 1996 was complicated because of the reduced deliveries mainly in 1992. Deliveries were also somewhat lower in 1991 and 1993. The 1992 calendar year was not a normal operational year for the IID because irrigation of many alfalfa fields was withheld for up to six weeks in an attempt to control whitefly. IID Board member Cox stated that "1992 was such a difficult year with 150,000 acres of alfalfa dried up because of the whitefly, it should be thrown out" (footnote 3, p 9).

Except for the unusual years of 1992 and 1993, diversions of Colorado River by IID have remained relatively constant, but gradually have increased over the previous 10 years. The trend of deliveries to the East Highline (EHL) Canal, based on regression analysis, increased about 19,600 acre-feet (ac-ft) per year from 1987 to 1996.

The trend of annual deliveries to agriculture increased about 17,800 acre-feet per year during the 1987-1996 period. Deliveries to agriculture decreased greatly in 1992. When excluding 1992, the trend of deliveries increased about 22,000 ac-ft per year. Lower deliveries to agriculture in 1993 may also have been due partly to reduced irrigation of alfalfa as a practice for controlling white fly infestation. In 1993, IID reported alfalfa average annual acreage was 10, 644 acres less than the 1992 acreage and 9,937 acres less than the 1994 acreage. Overall reported crop acreage in 1993 was 22,755 and 15,596 acres less than reported acres in 1992 and 1994, respectively. In January 1993, rainfall was much above normal with corresponding reduced water deliveries.

Annual water deliveries by IID to non-agricultural users increased linearly at about 2,100 acre-feet per year during 1987-1996. This increase has been consistent with little annual variations.

Consumptive use (CU) of Colorado River water for the years 1994-1996 was slightly less than for the years 1989-1990. From 1987 to 1996, there was essentially no change in total CU except for the years of 1992 and 1993. Consumptive use of water by non-agriculture increased about 18,000 acre-feet per year from 1987 to 1996 based on the data provided by IID.

Agricultural tailwater, computed as a closure or residual term instead of the leaching requirement, increased about 16,200 acre-feet per year, or 3.3% per year. This was the main trend in the 1987-1996 IID water balance components.

2.3 Review, Cropping Practices, 1987-1996

During the 1987-1996 period, the total crop acreage remained relatively constant except for a significant increase in 1996. There were distinct changes in some field and garden crops. The major changes were the decrease in garden crops from a maximum of about 113,000 acres in 1987 to 94,000 in 1996, a decrease of about 19,000 acres, and an increase in field crops from about 367,000 acres in 1987 to about 446,000 acres in 1996, an increase of about 79,000 acres. Permanent crop acreage increased about 3,000 acres. Total crop acreage, which includes double cropping, increased from about 498,500 acres in 1987 to about 560,000 acres in 1996, an increase of about 61,500 acres. The actual total land area irrigated remained relatively constant averaging about 461,400 acres. The acreage of alfalfa decreased while the acreage of Sudan grass and wheat increased. The acreages of cantaloupes, cauliflower, lettuce and tomatoes decreased, while the acreage of carrots increased slightly.

2.4 Review, IID Water Conservation, 1987-1996

A number of water conservation efforts were initiated by IID to reduce losses in the distribution system. However, diversions to IID were not decreased as a result of conservation efforts. With increasing water deliveries, as measured at the EHL Canal and relatively constant consumptive use (CU) of irrigation water, the net surface flows from IID to the Salton Sea were increasing. One of the factors affecting increasing surface flows to the Salton Sea was the increase in lateral spills through 1995. This increase has been partially offset by reduced seepage and reduced main canal spills. When operational losses that contribute to surface flow are combined (seepage and spills), the trend was upward through 1995.

In 1996, lateral spills decreased greatly. Lateral spills were computed as a water balance closure or residual term involving the annual volume at the EHL Canal minus system losses and deliveries. Other system losses remained relatively constant. Reported deliveries to users increased about 134,000 ac-ft from 1995 to 1996 (an increase of about 131,000 ac-ft was delivered to agriculture). Larger deliveries to users accounts for the large decreases in calculated lateral spills. Estimated evaporation losses remained relatively constant from 1987 to 1995. Estimated losses were higher in 1996 than in the previous nine years apparently due to a change in calculation procedures. Estimates in 1996 were essentially the same as those obtained with the procedures used by Jensen in 1995.

The IID is unique in that irrigation surface runoff and deep percolation do not return to the Colorado River—they flow to the Salton Sea. Therefore, in order for conservation measures and operating practices to impact water Colorado River water supplies, diversions must be reduced in proportion to the quantities of water conserved. The level of the Salton Sea, which is fed in part from surface and groundwater flows from the IID, decreased from January 1986 to January 1991. The level rose from 1992 to 1995 to a level higher than in 1986 flooding additional shoreline wetland habitat and adjacent farmland. The level decreased in 1996 due to increased evaporative demand that was about 6% above average, and decreased rainfall, which was 55% of the average. The 1996 level of the Salton Sea is about five feet higher than the target levels desired by IID. Part of the rise in the sea level was due to variations in climate and rainfall, but a significant part was due to surface flows from IID, Coachella Valley (CV) and surface flows from Mexico. Conservation measures and improvements in on-farm irrigation water management should enable reducing diversions of Colorado River water and reducing surface flows to the Salton Sea. The combination of these measures, therefore, is an important mechanism for managing the level of the Salton Sea toward the desired target level.

3.0 OBJECTIVE

The objective of this study as developed by the USBR was to update the August 1995 report by Jensen and the June 1997 report by Jensen and Walter. Where pertinent, new information and improved calculation procedures that have been obtained since the previous reports should be incorporated.

4.0 PROCEDURES

4.1 Climate Data

Climate data are the primary variables that were used in estimating unit area crop ET. The American Society of Civil Engineers (ASCE) standardized Penman-Monteith equation for reference ET was used to calculate reference ET for a short crop similar to grass using data from weather stations located in an environment defined as a reference surface (ET_{osz}). The other major variables are the crop coefficient curve that adjusts the ET_{osz} for the crop stage of growth, basically plant cover, and the acreage of each crop. Crop coefficient curves vary by length of season and climate-based adjustments to the initial stage, mid-season and end-season values used in the FAO linear segment crop curves. All initial calculations were made using metric units.

Climate data source. Climate data were downloaded from the following site:

http://www.ipm.ucdavis.edu/calludt.cgi/WXSTATIONLIST?COUNTY=IM

The same three sites as used in the previous reports were used. These are:

Station	Elev. (ft), m	Latitude	Longitude	Crop type
CIMIS #41, Calipatria/Mulberry)	-110, -34 (m)	33.044 °N	-115.415	Grass
CIMIS #68, Seeley,	40, 12 (m)	32.759 °N	-115.732	Grass
CIMIS #87, Meloland,	-50 -15 (m)	32.807°N	-115.446	Grass

Downloaded data were placed in a Microsoft Access database. After making some needed corrections, the Access database was updated before continuing with data screening and calculation of reference ET and crop ET calculations. CIMIS data are now becoming available at the following CIMIS Internet site:

http://www.cimis.water.ca.gov/

Screening solar radiation data. Initial data screening of solar radiation data was done using Excel spreadsheets. When 1-2 days of data were missing, they were replaced with the average of the day before and the day after the missing data.

Extraterrestrial and clear day solar radiation values were calculated for each site, though the difference in values between sites was very small. Solar radiation data, a major variable in the Penman-Monteith (P-M) equation, were screened by comparison with calculated clear-day values (Eq. 19, Walter et al., 2002). When solar radiation data were clearly high or low for a period, usually before or after July 1, but in a few cases for the whole year, the average daily solar radiation data from the other two CIMIS sites were substituted if the solar radiation from those stations appeared reasonable. In few cases, data from only one other station was substituted.

Table 4.1 *Time periods when solar radiation from another station was substituted.*

Year	CIMIS-41	CIMIS-68	CIMIS-87
1992			Replaced Aug-Dec R_s with CIMIS-68 R_s
1996			Replaced Jan-Jun R_s with average CIMIS 41 & 68 R_s
1997	Replaced Jul-Dec R_s with Average CIMIS 68 & 87 R_s		
1998	Replaced all year R_s with average CIMIS 68 & 87 R_s		
1999	Replaced all year R_s with average CIMIS 68 & 87 R_s		
2000		Replaced Aug-Dec R_s with CIMIS 87 R_s	
2001		Replaced Aug-Dec R_s with CIMIS 87 R_s	

Screening relative humidity data. Daily maximum and minimum relative humidity values (RH_{max} and RH_{min}) were reviewed graphically. For a reference evapotranspiration (ET) site, most of the daily RH_{max} values should be between 80 and 100% and most RH_{min} values should be above 20-30%. When midsummer RH_{max} values are less than about 80% most of the time and RH_{min} values are consistently in the range of 5-10%, this indicates that the weather station site may not be representative of a reference ET site as defined by Walter et al. (2000, 2002). Charts

of RH_{max} indicated that during summer months daily RH_{max} was often below 80% and charts of daily RH_{min} indicated that in some years, RH_{min} was often less than 10%. These data indicated that during summer months, the CIMIS weather stations were not representative of reference site conditions. Use of RH_{max} and RH_{min} directly with maximum and minimum air temperatures would result in low water vapor pressure estimates that affect estimated net radiation slightly, but mainly increase the daily estimates of reference ET because of higher vapor pressure deficits.

Dew point temperatures were calculated using daily maximum and minimum values for relative humidity and air temperature. Calculated dew point temperature (T_{dew}) for a reference ET site normally should not be less that 1-3 °C below minimum air temperature (T_{min}). During the summer months, it was not unusual to observe that calculated daily T_{dew} was 20-30 °C or more below T_{min}. This indicated that relative humidity measured at the site was being influenced by non-reference, or arid conditions, surrounding the site. Such data were considered to be from a "non-reference" site and their use in the P-M equation without adjustment would result in values of estimated reference ET that would be higher than that expected for a well-watered short crop reference ET site.

Average daily vapor pressure was also calculated using ($T_{dew} = T_{min} - 5$ °C). When average daily vapor pressure calculated using relative humidity data was less than that calculated using ($T_{dew} = T_{min} - 5$ °C), the latter value was substituted for the RH-based vapor pressure.

Processing climate data. After filling in missing data and substituting solar radiation data as explained above, reference ET (ET_{osz}) was calculated in Excel spreadsheets using the ASCE standardized daily Penman-Monteith equation (Eq. 1, Walter et al., 2000, 2002). The resulting standardized reference ET values (ET_{osz}) were then copied into the Access database for use in calculating crop ET (ET_c).

Daily CIMIS ET_o data also had missing values and a few blocks of unrealistically values. Missing values were estimated as was done for other climate data. When a missing, or bad block of ET_o occurred in the data set, average values from the other stations were substituted.

4.2 Reference ET (ET_{osz})

The general procedure used to estimate crop ET was to first determine the evaporative demand, or reference ET, based on climatic conditons and then apply a factor, or crop coefficient, which varies from about 0.1 to a maximum of 1.3 during the growing season. The reason the crop coefficient exceeds one is that the the reference ET used is for a short crop like clipped grass. As crops develop, their leaf-area-index (LAI) typically exceeds that of grass and as crops grow taller, they are aerodynamically rougher than short grass which affects the exchange of sensible heat and water vapor.

Because of some problems that have been encountered with CIMIS reference ET values, ET_o, the ASCE standardized daily Penman-Monteith (P-M) equation was used to calculate reference ET (Walter et al., 2000, 2002). The average annual ASCE standardized reference ET values for all three sites were about 5% higher than annual CIMIS ET_o values. The resulting standardized daily reference ET values (ET_{osz}) were transferred to an Access database for use in

a FORTRAN computer program for calculating crop ET (ET_c) values for the years 1989 through 2001. The average reference ET, weighted by 0.47, 0.18, and 0.35 for CIMIS sites 41, 68, and 87, respectively, was used to calculate daily crop ET. Daily reference crop ET was estimated using Eq. 4.1.

$$ET_{osz} = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T+273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34u_2)} \quad (4.1)$$

where ET_{osz} = the standardized reference crop ET for a short vegetated surface under reference ET conditions in mm/d, R_n = net radiation at the reference surface in MJ/(m^2 d), G = soil heat flux density at the soil surface in MJ/(m^2 d), T = mean daily air temperature at 2-m height in °C, u_2 = mean daily wind speed at 2-m height, e_s = saturation water vapor pressure at the 2-m height calculated as the average vapor pressure at maximum and minimum air temperature in kPa, e_a = actual vapor pressure at the 2-m height in kPa, Δ = the slope of the vapor pressure-temperature curve in kPa/°C, and γ = the psychrometric constant in kPa/°C.

4.3 Crop Coefficients

The estimated crop ET (ET_c), from soil and/or vegetated surface is the product of daily reference ET, the mean daily crop coefficient (K_c), and an adjustment for available soil water between irrigations.

$$ET_c = K_c K_a (ET_{osz}) \quad (4.2)$$

Evaporation (E) from water surfaces was estimated in the same manner using a coefficient for water surface (K_w) in place of K_c. The adjustment for available soil water was made using a linear function for K_a where

$$K_a = \frac{AW}{100 - MAD}, \text{ for AW<(100 – MAD)} \quad (4.3a)$$

$$K_a = 1.0, \quad \text{for AW>(100 – MAD)} \quad (4.3b)$$

where MAD = available soil water in the root zone in percent.

The updated crop coefficients were of the FAO type using linear segments. Base K_c values were mainly the time-averaged initial, mid-season and end season suggested in the publication FAO-56 (Table 12, Allen et al., 1998). The K_c value for the initial period was adjusted based on FAO-56 Eq. 7.1-7.3 and Eq. 60-61. Soils data for IID were obtained from SCS (1991). A depth of 0.5 ft. was assumed as the maximum depth of evaporation for bare soil since these estimates followed irrigations for tillage and planting. The K_c values for the mid-season and end of season were adjusted based on FAO-56 Eq. 62. All adjustments were made using a comprehensive

FORTRAN program called *CropET* developed by W.W. Wheeler & Associates [3] and Ivan's Engineering, Inc., Centennial, Colorado. A listing of data pertinent to the calculation of ET_c is provided in Appendix A.

Planting and harvest dates for 1988-1997 were based mainly on those used by the IID Work Study Team (WST), (Table A3-4, IID-WST, 1998) and the recent report by the Natural Resources Consulting Engineers (NRCE) (App. 6E, NRCE. 2002). The dates used in these reports were based on numerical monthly crop acreage provided by IID. The planting and harvest dates for major crops for 1997-2001 (alfalfa, Bermuda grass, cotton, lettuce, Sudan grass, sugar beets, and wheat) were based on the IID Monthly Crop Acreage report, file "CropAc_89_02.xls." Since numerical data were not available to us, charts of monthly major crop acreage were scanned to approximate the monthly acreage, and the average planting and harvest dates were based on the increase (or decrease) per month weighted by the average date, for the periods of increasing and decreasing acreage. For the remaining crops the planting and harvest dates were assumed to be the average dates for the 1989-96 periods as determined by WST and/or NRCE. The planting and harvest dates for 2001 were determined using IID's monthly crop acreage reports for May 2001 and Mar 2002.

The crop groupings used were similar to those used in the 1995 report (Appendix C, Jensen, 1995) except for some major new crops like Klein grass. Individual crop curves were developed for each of nine alfalfa-cutting periods. For the 1995 report, estimated potential alfalfa ET was multiplied by 0.80 to account for estimated effects of soil water stress and soil salinity, an amount needed to achieve reasonable agreement with water balance data. Only the alfalfa crop ET estimates were reduced. The crop curves for nine cuttings of alfalfa hay estimates "potential" alfalfa ET for well-watered conditions and assuming no effects of soil salinity. For this report, estimated alfalfa ET was based on a management allowed depletion (MAD) of 60% of available water, which represents alfalfa crop ET under irrigation practices and soil salinity in the IID. MAD values for other crops varied from 35 to 60%.

4.4 IID Crop Acreage

The total acreages of field crops, garden crops, permanent crops, and total harvested area from 1989 to 2001 are shown in Fig. 4.1. Total harvested area has remained relatively constant at about 460,800 acres, varying from 453,200 to 467,900 acres. A summary of the annual IID crop and other areas that were used in estimating ET and consumption of irrigation water is presented in Appendix Tables A.1 and A.2.

Field crop acreage generally increased from 1989 to 1998 and then decreased. The decrease in field crop acreage was primarily due to a reduction in wheat. Of the field crops, the acreage of wheat varied the most from year to year. As wheat acreage increased, the area of alfalfa decreased and vice versa. The acreage of Sudan grass and Sudan grass for seed reached maximum values in the mid 1990s then decreased in later years. The acreage of Bermuda grass and Bermuda grass seed steadily increased from 1989 to 2001.

[3] Manual for USBRET, A Daily Crop Water Use Model, Draft. Prepared for the U.U. Bureau of Reclamation, July 1997.

Garden crop acreage decreased from a maximum in 1990 to 1992 and then remained relatively constant since then. Of the garden crops, the acreages of fall and spring lettuce and spring cantaloupes decreased the most from 1989 to 1991. The acreage of carrots and carrot seed generally increased during the 1989 to 1993 period and has remained relatively constant since then.

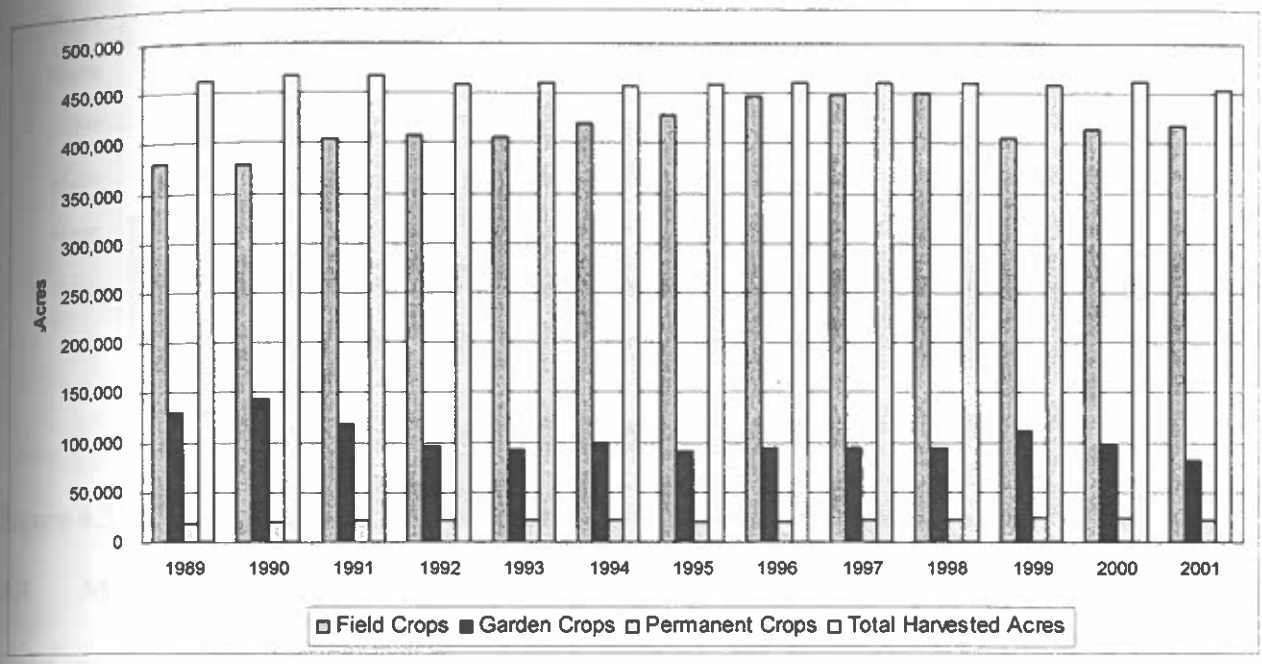

Figure 4.1 Total acreages of field crops, garden crops, permanent crops, and total harvested areas from 1989 through 2001.

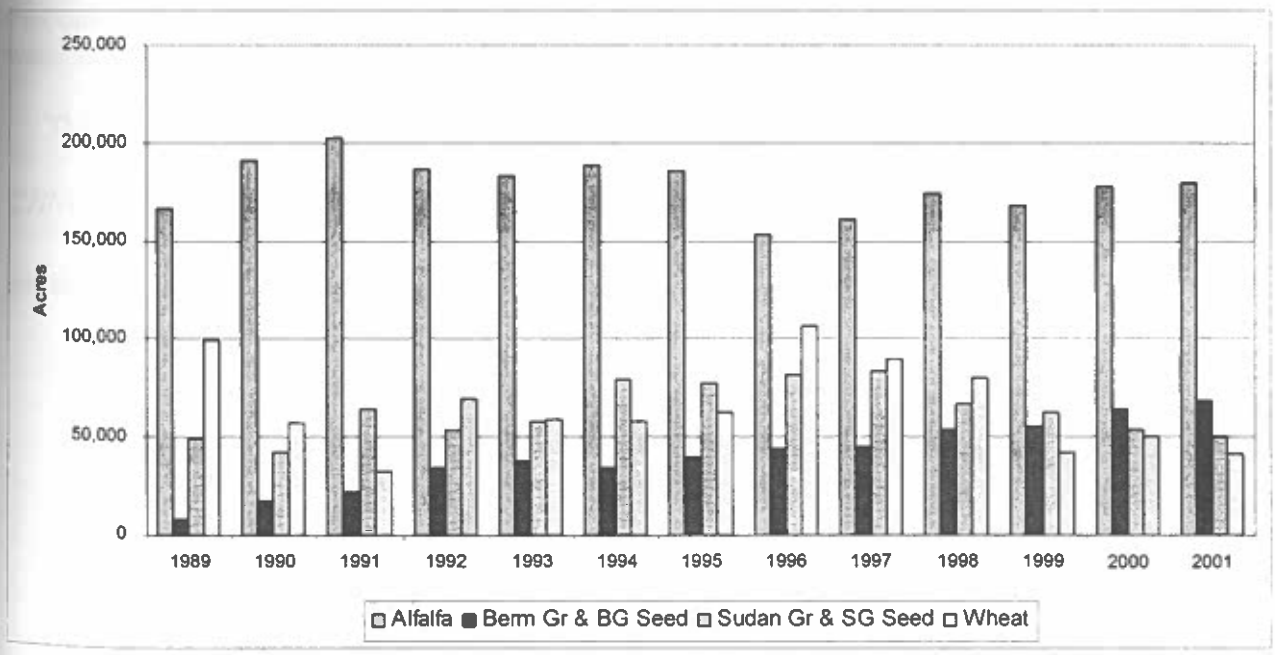

Figure 4.2 Acreages of major field crops from 1989 through 2001.

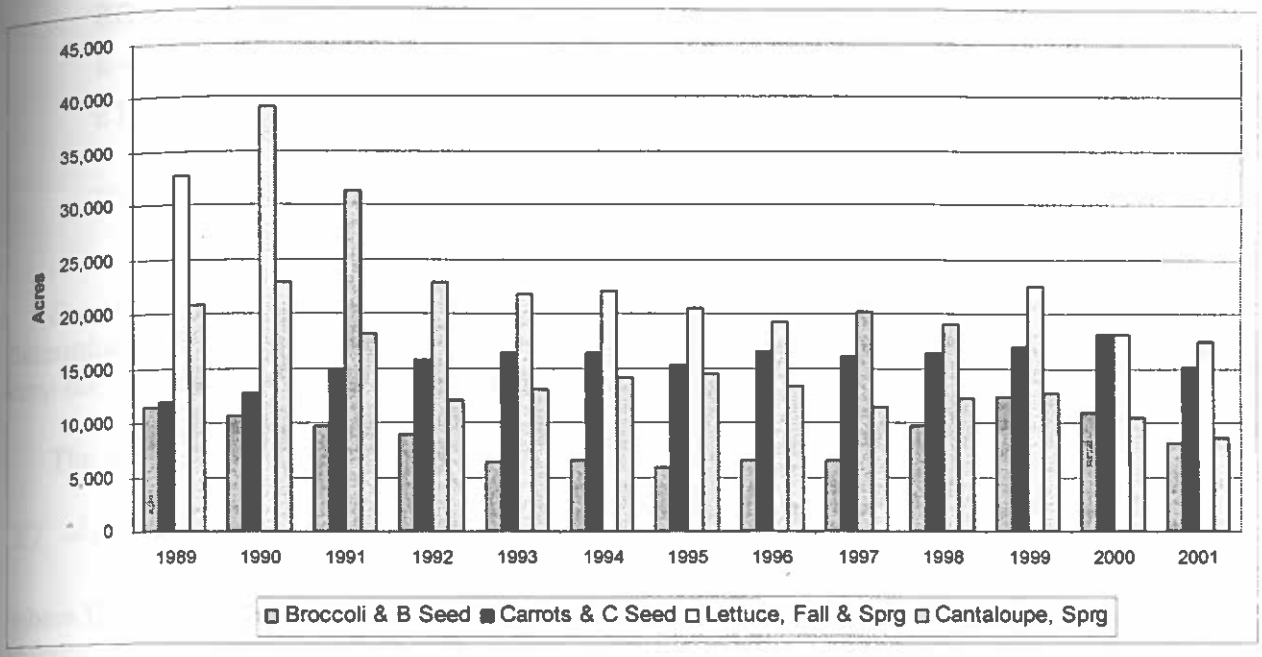

Figure 4.3 Acreages of major garden crops from 1989 through 2001.

4.5 Modeling Crop Water Use and Consumptive Irrigation Requirements

A soil water budget model, *CropET*, was used to analyze crop water use. The model performs an inflow-outflow analysis of the soil water reservoir in the root zone of the crop. The inflows to the soil water reservoir are net irrigation water and precipitation. The outflows from the soil water reservoir are deep percolation below the crop root zone, surface runoff, evaporation from the soil and plant surface, and transpiration by the plant. The available soil water is a function of the incremental soil water holding capacity of the soil.

The basic equation for *CropET* is:

$$CHNG.SM = (P + I) - (DP + RO + E + (ET_c - ET_{GW})) \quad (4.4)$$

where:

CHNG.SM = Change in soil water = EOP.SM - BOP.SM

EOP.SM = Amount of soil water stored in the root zone of the crop at the end of the period.

BOP.SM = Amount of soil water stored in the root zone of the crop at the end of the previous period.

P = Precipitation amount.

I = Net irrigation application.

DP = Deep percolation of precipitation.

RO = Surface runoff of precipitation.

E = Evaporation from the soil surface.

ET_c = Transpiration and evaporation from the plant (i.e. potential crop evapotranspiration).

ET_{gw} = The amount of ET_c met by groundwater contributions from the saturated zone.

CropET uses daily reference-crop evapotranspiration with appropriate daily crop coefficients to determine crop evapotranspiration (ET_c). The crop coefficients used in this study are the single crop coefficients described in Allen et al. (1998).

The basic equation used to calculate ET_c is:

$$ET_c = K_c * ET_{osz} \tag{4.5}$$

where ET_{osz} = reference crop evapotranspiration calculated using the ASCE standardized reference equation, Short (ET_{os})

$$K_c = K_{cm} * K_a * K_{salt} \tag{4.6}$$

where:

K_c = the crop coefficient that includes the impact of soil evaporation due to irrigation and precipitation (K_{cm}), availability of soil water (K_a), and salinity (K_{salt}).

K_a = 1.0 for Aw > XMAD%
Aw/(100 - XMAD%) for Aw <= XMAD%

XKMAD = soil water depletion level at which the plant becomes stressed

Aw = Available water in the soil profile.

The contribution to soil water from daily precipitation is equal to that portion of precipitation that does not runoff (i.e. retained precipitation). Retained precipitation and runoff resulting from precipitation was determined using the Soil Conservation Service Curve Number (CN) method as described in NEH-4 (USDA, SCS, NEH-4, 1985). The CN method considers vegetative cover, topography, antecedent soil water, and soil type to calculate runoff. Retained precipitation is equal to total precipitation minus runoff.

In the model, the amount of water stored in the soil cannot exceed field capacity plus an amount equal to a factor times ET_{osz}. If total precipitation retained for storage in the soil water reservoir exceeds the remaining capacity of the soil, the excess precipitation is lost as deep percolation below the root zone.

On a daily basis, after accounting for losses due to evaporation, transpiration, and deep percolation of precipitation and the gains due to precipitation, the model, depending upon the input criteria controlling irrigation, can call for irrigation. The controlling criteria relate to: (1) checking to see if the date is a preset irrigation date; or (2) checking the soil water deficit to determine if it is below a certain level. On the date that irrigation occurs, the soil water reservoir is filled to field

capacity plus an incremental amount. The incremental amount is equal to ET_{osz}. The incremental amount represents that amount of soil water available to the plant immediately after an irrigation while the soil is draining to field capacity. Generally, the amount of time for the soil to drain is one to two days. In the model, irrigation is a net irrigation amount and no accounting for deep percolation, runoff and/or leaching is included.

ET_{gw}, the contribution from groundwater, is a function of the irrigation water that may infiltrate into the soil beyond the root zone of the vegetation. When the depth to groundwater is very shallow under irrigated fields, the plants consume a portion of this water. In this study, it was assumed that ET_{gw} was equal to zero, because the primarily source of high groundwater is deep percolation from irrigation or leaching.

The calculated daily values of ET_c and I from *CropET* are summarized on a monthly basis. For each crop, the monthly values of CropET and I were multiplied by the reported acreage to determine the total estimated ET_c and irrigation water applied.

4.6 Leaching Requirements (LR)

Many studies have been conducted on the soil salinity problems encountered in the IID. The most recent analysis is the special report prepared by Rhoades (2002). Rhoades simulated a typical six-year crop rotation of alfalfa, wheat and lettuce and computed the leaching requirements by several different methods and models, including the traditional LR equation published in 1976 that has been used in several other recent reports. Rhoades reported that the volume of leaching water when referenced to the water infiltrated to be 0.124 when using the traditional method of calculating the LR. Rhoades concluded that this method was conservative and results in an over estimate of the LR. The computer simulation with the transient solute transport model showed no excessive salt accumulation during any period in the crop rotation. Under steady-state conditions, the LR would decrease from 0.13 to 0.11 when considering horizontal leaching and salt removal in tailwater and from 0.13 to 0.08 when considering salt precipitation. With salt precipitation and salt removal by tail water, the vertical LR would decrease to 0.07.

For this study, we used a LR of 0.11 as estimated in 1994 by the TWG (1994). The volume of water required for leaching would be $0.11/(1 - 0.11)$ or $0.124 \times ET_{c(irr)}$. Since the NRCE (2002) suggested that the change in Colorado River salinity was not considered, we adjusted the volume of leach water by the relative salinity of the Colorado River water at Imperial Dam as shown in Table 4.2. The salinity at Imperial Dam is modulated by flow through reservoirs on the Colorado River. The relative salinity had decreased from a 10-year average (1972-1982) value of near 1.0 following the high runoff in 1983-84. The relative salinity then increased back to the long-term trend by 1992-1993 and near the 1972-82 average by 1994. The long-term trend in Colorado River salinity at Imperial Dam indicates salinity is decreasing. The salinity level from 1998 through 2001 is significantly less than the 1972-82 average of 1.31 dS/m. The contribution of horizontal leaching and salt removal by tailwater is described under water balance calculations.

Table 4.2 *Estimated water required for leaching (LR) during the study period.*

Year	CR Salinity at Imperial Dam dS/m	Ratio of salinity to the 1972-1982 average salinity value	Estimated variable LR coefficient *
1981	1.30	**0.99**	0.133
1982	1.28	0.98	0.140
1983	1.19	0.91	0.138
1984	1.09	0.83	0.128
1985	0.98	0.75	0.117
1986	0.93	0.71	0.106
1987	1.00	0.76	0.100
1988	1.07	0.82	0.116
1989	1.14	0.87	0.123
1990	1.17	0.89	0.125
1991	1.24	0.95	0.134
1992	1.22	0.93	0.131
1993	1.23	0.94	0.133
1994	1.28	**0.98**	0.138
1995	1.26	0.96	0.135
1996	1.27	0.97	0.137
1997	1.15	0.88	0.124
1998	1.06	0.81	0.114
1999	1.09	0.83	0.117
2000	1.08	0.80	0.113
2001	1.07	0.83	0.128

* The leaching volume = C_L x $ET_{c(irr)}$ where $ET_{c(irr)}$ is the volume of irrigation water used in crop ET.

4.7 Water Balance Components

The water balance components were illustrated in Fig. 4.1 of the Jensen-Walter (1997) report and a summary was presented in Table 4.1 of that report. An updated, simplified water balance spreadsheet is presented in Appendix D. A summary of some of main variables is presented and discussed in Section 5.2.

As discussed in the J-W (1997) report, use of "Crop Leaching" as the closure or residual term exaggerates the crop-leaching component because that component is much smaller than the estimated tailwater component. Use of Crop Leaching as the closure term also tends to essentially result in constant on-farm irrigation efficiency because it is included in the numerator of the efficiency equation. Use of the crop-leaching component in the closure term does not reflect the relatively large variation in annual tailwater. When using tailwater as the closure term, the calculated crop leaching was 14.1% (the 1987 and 1988 values that were used in this report were adjusted to 12.4%) of irrigation water crop ET plus a small component of credit given for leaching by tailwater, so-called horizontal leaching. Rhoades (2002) derived a detailed procedure for adjusting vertical-leaching because of horizontal-leaching. In this study, the credit

given for beneficial use of water for leaching was 0.9 x C_L x $ET_{c(irr)}$, whether actually achieved or not, plus 0.05 x tailwater volume. This procedure gave results that were very similar to the results obtained using more complex procedures with high tailwater values.

5.0 RESULTS AND DISCUSSION

5.1 Reference ET

Climate data for CIMIS-68 was missing the first half of 1987. CIMIS station 87 began in 1989. Because of the proximity of the three sites, the average calculated short crop reference ET values were very similar (Fig. 5.1). The annual reference ET values were nearly identical. Average ET_{osz} for CIMIS-41 was 7.7% greater than average CIMIS ETo for the comparable period. Average ET_{osz} for CIMIS-68 was 2.5% greater than CIMIS ET_o values. Average ET_{osz} for CIMIS-87 was 6.5% greater than CIMIS ET_o values.

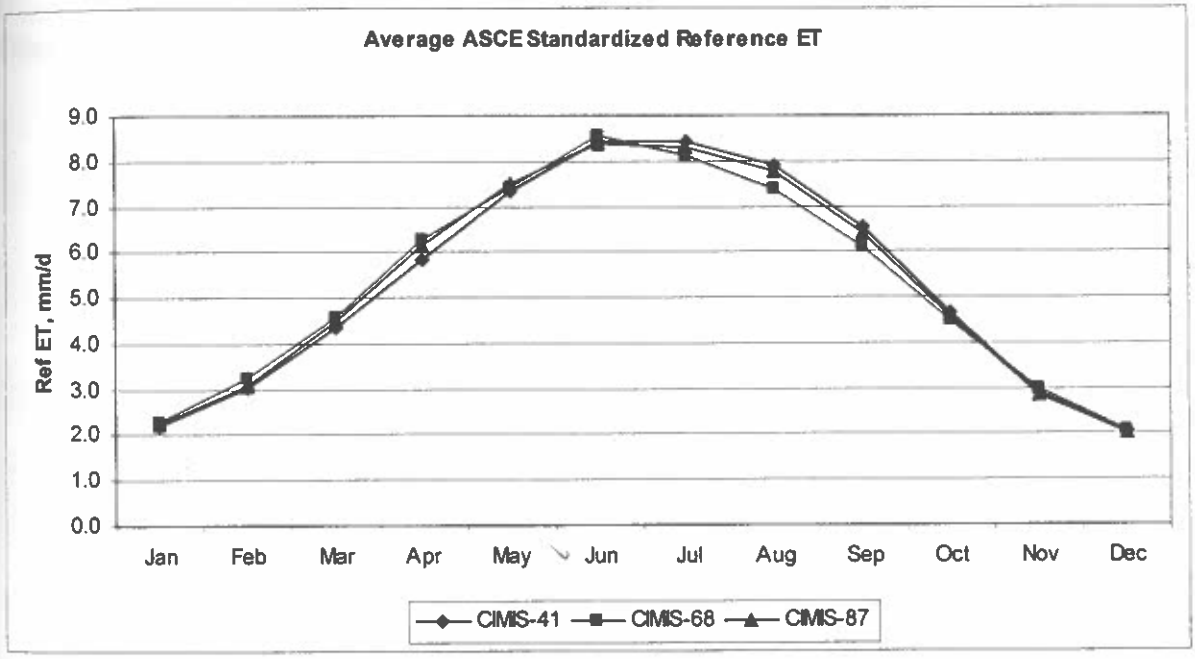

Figure 5.1 Average estimated ASCE standardized reference ET for three CIMIS stations (No. 41, 68, and 87) in the Imperial Valley. The average annual totals were nearly identical totalling 1,943 mm, or 76.5 inches.

The NRCE apparently used CIMIS relative humidity data without adjustment for arid conditions. The average NRCE FAO-PM ET_o estimate was 11% higher than the CIMIS ET_o value (NRCE, page 5, App. 5). A summary of annual estimates of reference ET by CIMIS, NRCE and the ASCE standardized equation for each of the three stations is presented in Table 5.1. Average non-weighted ASCE reference ET estimates are 7% higher than CIMIS ET_o values, but are 3% lower than the NRCE estimates.

Table 5.1 *Summary of average annual reference ET values in inches by CIMIS, NRCE (2002) and the ASCE standardized Penman-Monteith equation after adjusting water vapour pressure for aridity conditions during summer months.*

Source	CIMIS-41	CIMIS-68	CIMIS-87
CIMIS (NRCE*)	69.72	73.47	71.19
NRCE FAO-PM**	79.19	79.40	78.17
% of CIMIS ET_o	13.6	8.1	9.8
ASCE Std. P-M Eq.	76.47	76.49	76.55
% of CIMIS ET_o	**9.7**	**4.1**	**7.5**

* Table 3, Appendix 5, NRCE Report. ** Table 1, Appendix 5, NRCE Report.

A comparison of average monthly CIMIS ET_o, NRCE FAO-PM ET_o, and ASCE ET_{osz} is presented in Fig. 5.2. The results show that when not adjusting water vapor pressure data for non-reference site conditions, NRCE FAO PM estimates exaggerate the reference ET values during the summer months.

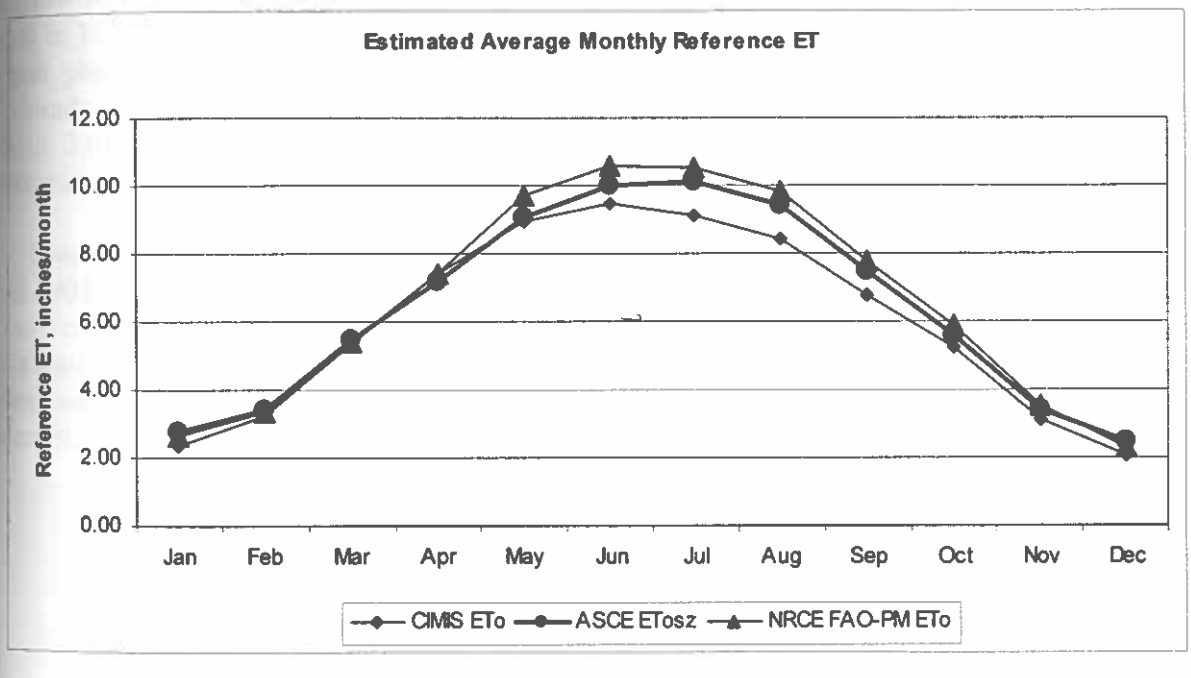

Figure 5.2 Average monthly CIMIS ET_o, NRCE FAO-PM ET_o, and ASCE standardized reference ET (ET_{osz}) for the three CIMIS sites, No. 41, 68, and 87.

Total annual reference ET varies slightly with precipitation in the valley. With increased precipitation, total annual reference ET is slightly less because of lower solar radiation due to greater cloud cover and increased relative humidity. The year-to-year variation in annual reference ET from 1987 through 2001 is relatively small. The standard deviation of average annual reference ET is 3.2 inches. The coefficient of variation is 4.1%.

5.2 Water Balance Components

A summary of the annual IID water balance components for the period 1989-2001 is presented in a spreadsheet in Appendix D. The major components are described in Table 5.2.

5.3 Annual Diversions and Water Deliveries

Colorado River diversions as measured at Pilot Knob, East Highline Canal (EHL), and deliveries to agriculture from 1987 to 2001 are summarized in Fig. 5.3. Precipitation was above normal during 1991, 1992 and 1993. This is reflected in reduced amount of irrigation water ordered by water users. In addition, in 1992, irrigation of alfalfa was essentially terminated for nearly two months in an attempt to control the white fly infestation. Diversions from the Colorado River at Pilot Knob increased about 350,000 ac-ft from 1987 to 1995-1996. The maximum diversion occurred in 1997. The annual diversions did not vary much from 1995-96 to 2001. Total flows at EHL and deliveries to agriculture paralleled diversions at Pilot Knob.

Diversions to IID from the Colorado River as measured at Pilot Knob (Pilot Knob minus outflow to the Coachella Canal plus irrigation from Coachella Canal) increased from 2,774,460 ac-ft in 1987 to a maximum of 3,171,875 ac-ft in 1997—an average increase of about 39,700 ac-ft per year. The years of 1992 and 1993 were exceptions to the general trend. Since 1997, Colorado River diversions to IID have decreased gradually. In 2001, the diversion to IID was about 3,093,874 acre-feet, which is a decrease of 78,000 acre-feet or 2.4 percent from the maximum in 1997.

Deliveries to agricultural users, the main water user, followed similar trends. In 1987, 1997, and 2001, the deliveries were 2,322,200, 2,718,800 and 2,626,700 ac-ft, respectively. Deliveries to agriculture in 2001 decreased 92,100 ac-ft from that in 1997, or 3.4%, or an average decrease of about 23,000 ac-ft per year. As indicated above and in previous reports, deliveries in 1992 were especially low because irrigation was withheld from alfalfa for nearly two months in an attempt to control whitefly and precipitation was above normal.

Table 5.2 *Summary of IID study area annual water balance components for the period 1989-2001.* Sources: Boyle (1993), updated by IID 20-Mar-97 and 25-Apr-97, WST (1998), NRCE (2002), and recent flow data obtained from the USBR.

Row	Description of component	IID Var.	Method or source	Units
	MEASURED INFLOW			
1	AA Canal, Pilot Knob	A1	IID Water Control	ac-ft
2	Outflow to Coachella Canal	A6	IID Water Control	ac-ft
3	IID Deliveries from Coachella Canal		WST & NRCE (1)	ac-ft
4	IID Deliveries from AAC Above EHL		WST & NRCE	ac-ft
5	Surface Inflow from Mexico	E5	IID Water Control	ac-ft
6	Precipitation, weighted average		Avg CIMIS 41, 68 & 87	
7	Volume of precipitation		Avg Precip/12 x 656,306	ac-ft
	ESTIMATED INFLOW/ADJUSTMENTS			
8	Seepage between PK and EHL Canal	A2	USBR	ac-ft
9	Other Surface Inflows	B9	IID Water Control ac-ft (2)	ac-ft
10	Subsurface Inflow	E13	IID Water Control	ac-ft
11	Evaporation, AAC, Area = 756 acres	A5	Ref ET/12 x area x 1.0	ac-ft
12	TOTAL INFLOW		R1-R2+R3-R4+R5+R7 -R8+R9+R10-R11	ac-ft
	MEASURED OUTFLOW			
13	Alamo River Outflow to Salton Sea	E2	IID Water Control	ac-ft
14	New River Outflow to Salton Sea	E3	IID Water Control	ac-ft
15	Direct Outflow to Salton Sea	E4	IID Water Control	ac-ft
16	Total Measured Outflow to Salton Sea	E1	R13+R14+R15	ac-ft
	TOTAL WATER CONSUMPTION			
17	Change in Storage		Assumed = 0	ac-ft
18	Total water consumption, (Water Balance)		R12-R16+R17	ac-ft
	NON-AGRICULTURE WATER USE			
19	Municipal	C4	IID Water Control	ac-ft
20	Industrial	C5	IID Water Control (3)	ac-ft
21	Feedlots	C6	IID Water Control	ac-ft
22	Other Uses	C7	IID Water Control	ac-ft
23	Total Non-Agr Water Use	C3	R19+R20+R21+R22	ac-ft
	ACREAGES USED IN STUDY AREA			
24	Agriculture, (4)	B2		acres
25	Rivers & Drain Vegetation		WST & NRCE	acres
26	Canals & Reservoirs		WST & NRCE	acres
27	Rivers and Drains Water Surfaces		WST & NRCE	acres
28	Non-agricultural Areas		656,306 – SUM(R24:R27)	acres
	Continued:			

Row	Description of component	IID Var.	Method or source	Units
	EST. TOTAL CU ON AGR LAND			
29	Total water consumption, (Water Balance)		R18	ac-ft
30	Total Non-Agr Deliveries		R23	ac-ft
31	Reference ET, ASCE ET_{soz}		ASCE Std. Ref. ET Eqn. (5)	inches
32	ET Drains and Rivers Vegetation		Ref ET/12 x area x 1.1	ac-ft
33	Canals & Reservoir Evaporation		Ref ET/12 x area x 1.0	ac-ft
34	Drains & Rivers Evaporation		Ref ET/12 x area x 1.0	ac-ft
35	Total Water Consumption on Agr Land		R18 – R30 - SUM(R32:R34)	ac-ft
	CALC. IRRIG CU ON AGR LAND			
36	Est. Total CU on Agr. Land, ET_c		Calculated (6)	ac-ft
37	Est. Irrig. Water CU on Agr. Land		Calculated (6)	ac-ft
38	Est. Irrig. Water Requirement, $ET_{c(irr)}$		Calculated (6), weighted avg	ac-in.
39	Est. Crop ET, ET_c		Calculated (6), weighted avg	ac-in.
40	Ratio, ETc/total water CU on agr. Land		R36/R29	- -
	EST. LEACHING & TAILWATER			
41	Relative Salinity of CR Water at Imp. D.		USGS, NRCE, USBR	- -
42	Est. LW, Normal Salinity, C_L x $ET_{c(irr)}$		$C_L = 0.124$	- -
43	Est. Water Needed for LR, DP (vertical)		R41 x R42 x R37	ac-ft
44	Irrigation Water Delivered to Agr users	C2	IID Water Control	ac-ft
45	Estimated Tailwater		R44 – R37 – R43	ac-ft
46	Tailwater, percent of Agr Delivery		100 x R45/R44	%
47	Est. Water Actually Used for Leaching		0.9 x R43 + 0.05 x R45	ac-ft
	IRRIG PERFORMANCE PARAMETERS			
48	Transportation Losses		USBR/IID	ac-ft
49	Seepage, Pilot Knob to EHL	A2	IID Water Control	ac-ft
50	Evaporation, Pilot Knob to EHL		R11	ac-ft
51	Seepage, AAC		USBR	ac-ft
52	Seepage, Main Canals		IID Water Control	ac-ft
53	Seepage, Concrete Laterals		IID Water Control	ac-ft
54	Seepage, Earthen Laterals		IID Water Control	ac-ft
55	Main Canal Spills		IID Water Control	ac-ft
56	Canals & Reservoir Evaporation		R33	ac-ft
57	Lateral Spills		R48 – SUM(R49:R56)	ac-ft
58	Conveyance Efficiency		100(R1–R2-R48)/(R1–R2)	%
59	On-farm Irrigation Efficiency		100(R37+R47)/R44	%
60	Overall System Efficiency		R58*R59/100	%
61	Fraction, Irrig W Consumed on Agr Land		R37/R44	- -
	Continued			

Row	Description of component	IID Var.	Method or source	Units
	DISPOSITION OF CR WATER			
62	Irrigation Water Supply		R1-R2-R8-R23	ac-ft
63	Irrig Water Consumed on Agr Land		R37	ac-ft
64	Irrig Water Consumed by Evap & Phreat		R32+R33+R34	ac-ft
65	Irrig Water Consumed by Non-Agr		R23	ac-ft
66	Irrigation Water Flowing to Salton Sea		R64-R65-R66-R67	ac-ft
67	Total Net Flow form IID to Salton Sea		R16-R5-R9-R10	ac-ft
	OTHER INFORMATION			
68	TOTAL WATER SUPPLY		R1-R2+R3	ac-ft
69	Water Supply per Acre		R68/R24	ac-ft/ac
70	Tailwater per Acre		R45/R24	ac-ft/ac
71	EHL Canal Flow		R1-R2+R3-R4-R8	ac-ft
72	Est. Evaporation, AAC		Ref ET/12 x 756 x 1.0	ac-ft
73	$ET_{c(irr)}$ per Acre		(R37/12)/R24	ac-ft/ac

1. Deliveries for 1998-2001 assumed to be the average of 1987-1997.
2. Estimates for 1997-2001 based on regression of storm flow v. annual precipitation.
3. Estimated for 1998-2001 based on regression of 1987-1997 data.
4. Total farmable area including leached and fallow lands minus 2,636 not in basin (WST).
5. Weighted average, CIMIS 41 x 0.47 + CIMIS 68 x 0.18 + CIMIS 87 x 0.35.
6. Calculated daily using FORTRAN program (*CropET*).

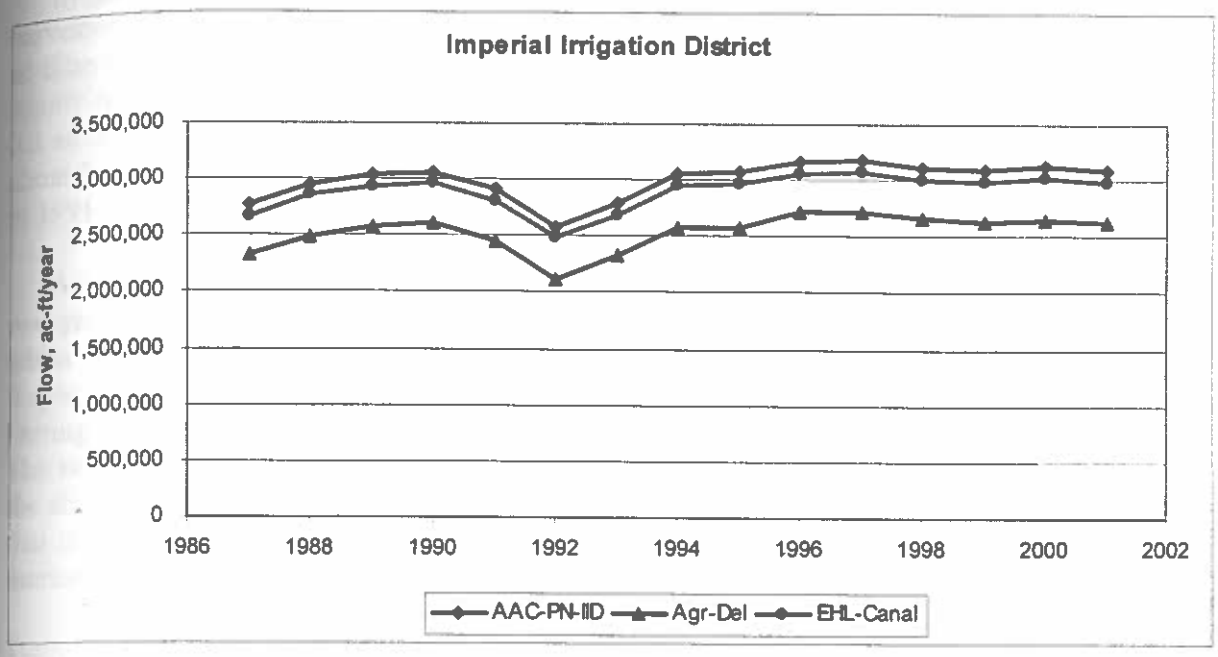

Figure 5.3 Summary of Colorado River diversions to IID as measured at Pilot Knob, East Highline Canal (EHL) and deliveries to agriculture from 1987 to 2001.

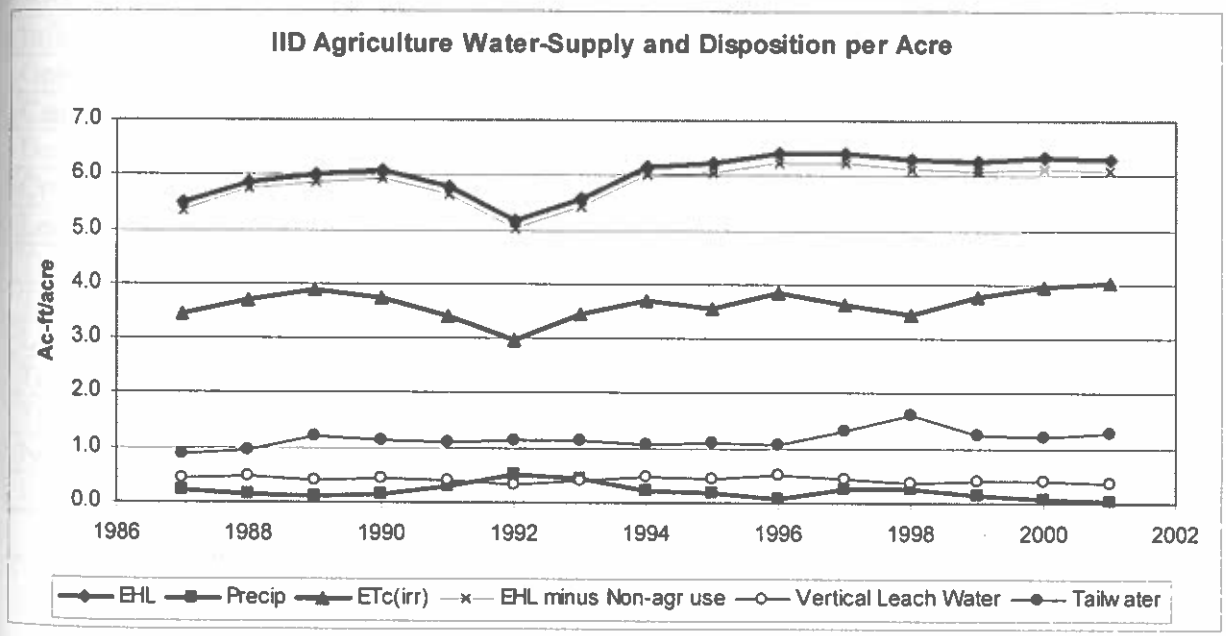

Figure 5.4 Summary of flows at East Highline Canal (EHL), $ET_{c(irr)}$, vertical leach water, tailwater and precipitation from 1987 to 2001 expressed on a per acre basis. Data for 1987 and 1988 are from Jensen and Walter (1997) after adjusting vertical leach water based on the same LR as used for 1989-2001.

Irrigation water supply at East Highland Canal increased from about 5.5 ac-ft per acre of harvested agricultural land in 1987 to about 6.0 ac-ft/ac in 1990, and to a maximum of about 6.4 ac-ft/ac in 1997. Beginning in 1998, it has been relative constant at 6.3 ac-ft per acre. The water supply relative to the flow at the AAC at Pilot Knob less deliveries to Coachella Canal is about 0.2 ac-ft/ac higher. When subtracting deliveries to non-agricultural uses, these values would be about 0.2 ac-ft/ac less. Calculated $ET_{c(irr)}$ clearly reflects the years of above normal precipitation in 1991-93 and 1997-98.

A summary of major water balance components for 1987-2001 is presented in Table 5.3 as two-year averages except for 1991-1993 when irrigation practices were not normal due to the white fly infestation. Significant changes in diversions of Colorado River water and its disposition within the IID since 1987-1988 are summarized for three time periods in Table 5.4. During 1989-1990, Colorado River diversions began to increase from the 1987-1988 average. The two-year period of 1994-1995 is the period after the abnormal years of 1991-1993. During the six-year period of 1996-2001, diversions remained relatively constant. These results indicate that the 9% increase in flow to the EHL Canal from 1987-88 to 1996-2001 resulted in a 20% increase in net flow to the Salton Sea from IID.

Table 5.3 *Summary of major water balance components expressed as two-year averages in 1000s of ac-ft per year except for the period 1991-1993.*

Description	87-88	89-90	91-93	94-95	96-97	98-99	00-01
AAC, Pilot K to IID	2,866	3,046	2,757	3,061	3,165	3,101	3,106
Inflow to IID, EHL	2,764	2,944	2,654	2,960	3,065	2,999	3,005
Operational losses	278	269	276	285	217	250	243
Canal spills	117	111	131	142	74	107	101
Delivery to agr users	2,408	2,594	2,2295	2,578	2,715	2,642	2,634
Crop ETc(irr)	1,741	1,817	1,573	1,840	1,928	1,785	1,859
Leach water	216	206	184	221	221	182	184
Tailwater (TW)	451	571	538	516	566	676	591
Total, LeachW +TW	667	777	722	738	788	857	775
LW+TW, % agr del	27%	30%	31%	29%	29%	32%	29%
Total losses	1,062	1,157	1,129	1,165	1,078	1,214	1,118
Total losses, % agr	38.4%	39.3%	42.5%	39.4%	35.2%	40.5%	37.2%
Net flow, IID to Sea	863	963	911	1,044	1,058	1,021	1,020
Increase, % of 87-88	- -	12%	6%	21%	23%	18%	18%

Table 5.4 *Summary of changes in major water balance components expressed in 1000s of ac-ft per year and percentage change for three time periods.*

Description	1989-1990 period		1994-1995 period		1996-2001 period	
	1000s Ac-ft	%	1000s Ac-ft	%	1000s Ac-ft	%
AAC, PK Inflow to IID	180	6.5%	196	7.1%	259	9.4%
Crop $ET_{c(irr)}$	76	4.4%	99	5.7%	117	6.7%
Total leach & tailwater	110	16.5%	71	10.6%	140	21.0%
Net inflow to Salton Sea	100	11.3%	180	20.3%	177	20.0%

5.4 Consumptive Use (Crop ET, Vegetation ET, and Evaporation)

Total crop ET (ET_c) was estimated using Eq. 4.2. The basic calculations were done using the *CropET* Model as described in Section 4.5. The calculated crop ET (ET_c) and consumptive irrigation requirement needed to meet crop ET ($ET_{c(irr)}$) are summarized in Fig. 5.5 along with the overall IID water balance. The effects of above normal rainfall in 1992 coupled with restricted irrigation of alfalfa affected crop ET and irrigation water requirements. Likewise, above normal rainfall in 1997 and 1998 affected crop ET and consumptive irrigation requirements. The IID water balance appears to be unusually high in 1997 and 1998. The reasons for this are discussed in the next section. High IID water balance values in 1997 and 1998 significantly affect calculated tailwater values as will be shown later.

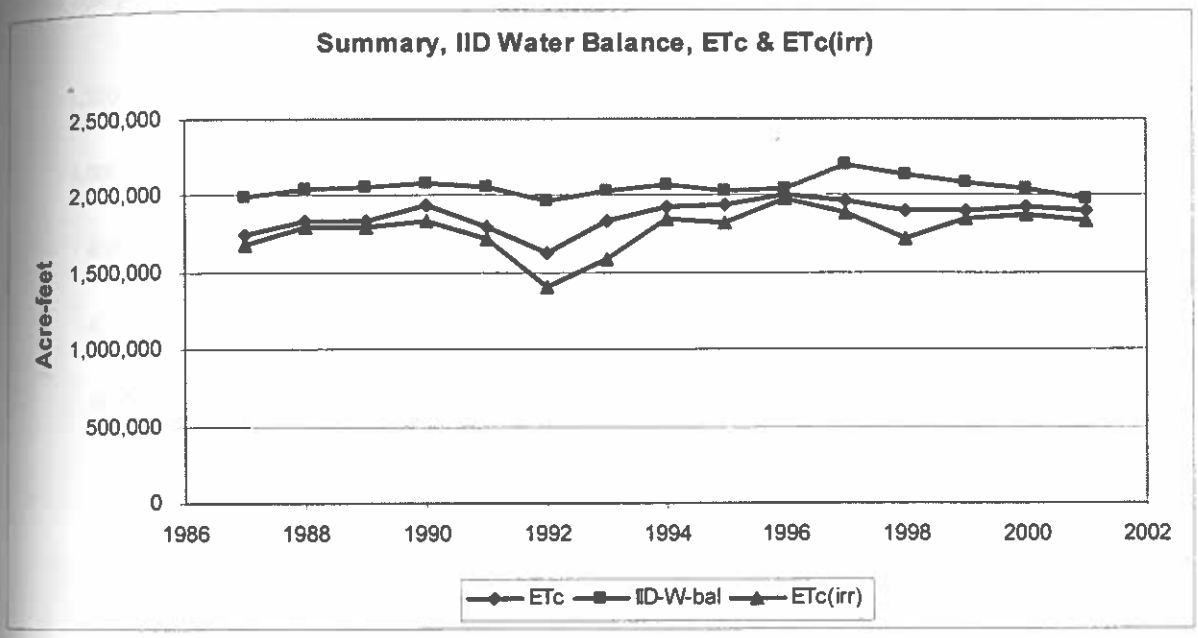

Figure 5.5 Summary of the IID water balance (IID-W-Bal), calculated crop ET (ETc) and irrigation water required to meet crop ET ($ET_{c(ir)}$). Data for 1987 and 1988 are from Jensen and Walter (1997).

5.5 Agricultural Tailwater and Leaching Requirement

Total annual tailwater was estimated as agricultural water delivery minus estimated crop ET (ET_c) and the leaching requirement water. For estimating irrigation performance parameters, as was done in the J-W (1997) report, the volume of water assumed to be beneficially used was 90% of the estimated vertical leach-water (0.124 x $ET_{c(irr)}$), which may or may not have been achieved, plus 5% of the tailwater that was assumed effective in removing soil salinity (horizontal leaching). The tailwater was estimated as the total water delivered to agriculture minus $ET_{c(irr)}$ and the vertical leach-water (0.124 x $ET_{c(irr)}$). The variation in estimated tailwater from 1989 through 2001 is summarized in Fig. 5.6 along with irrigation water inflow to the Salton Sea and total net inflow to the Sea from IID. The high IID water balance in 1997 and 1998 affected the calculated tailwater volume. The tailwater trend line, calculated excluding

1992, is increasing. If the volume actually used for vertical leaching is not achieved, the actual tailwater volume will be higher than that shown.

The effect of increasing salinity of Colorado River water following high flows in 1983-84 is apparent, as is the decrease in salinity during the 1998-2001 period. The decrease in Colorado River salinity in 1998 that continued through 2001 decreased the calculated LR volume and increased the estimated tailwater.

The volume of tailwater expressed as a percentage of water delivered to agriculture is shown in Fig. 5.7. As mentioned, the high IID water balance in 1997 and 1998 has a significant effect on the calculated percentage of tailwater. The reduced water delivery to agriculture in 1992 affects the percentage of tailwater. The overall upward trend with time is apparent.

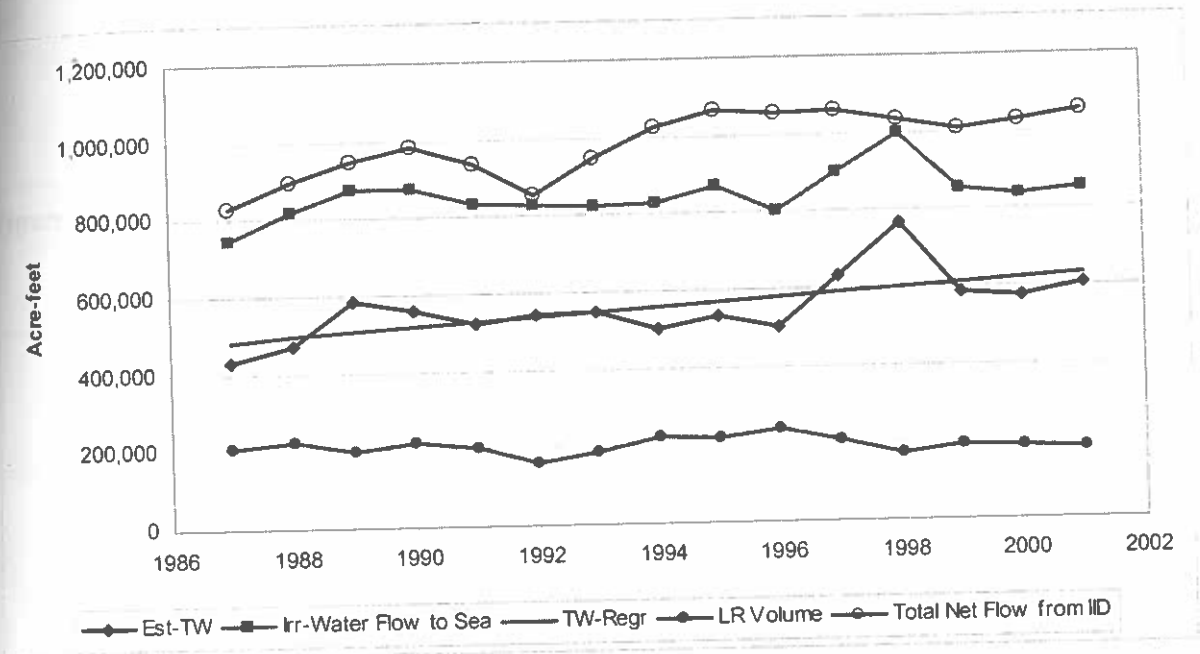

Figure 5.6 Summary of total net flow from IID and irrigation water flow to the Salton Sea, the estimated leaching requirement volume, and the estimated tailwater. Data for 1987 and 1988 are from Jensen and Walter (1997).

The high volume of irrigation water flow to the Salton Sea in 1998 and estimated tailwater shown in Fig. 5.6 appears to be unusually high. Further evaluation of the causes for these high values indicated that delivery of water to all users in 1998, and especially agricultural uses, greatly exceeded the consumptive irrigation water requirements. A comparison of the difference between calculated crop ET minus calculated crop consumptive irrigation water requirements and annual precipitation, or the impact of precipitation, is shown in Fig.5.8. The dashed line is the average (ET_c-$ET_{c(irr)}$) weighted by (the value of current year + 0.5 x the value of year +1)/1.5 to account for carry over in soil water. The 1989-2001 average (ET_c-$ET_{c(irr)}$) = 0.21 ac-ft/ac and the average annual precipitation = 0.21 ac-ft/ac. This indicates that the model calculated $ET_{c(irr)}$ accurately accounted for the direct impacts of rainfall since runoff was only 2-3%.

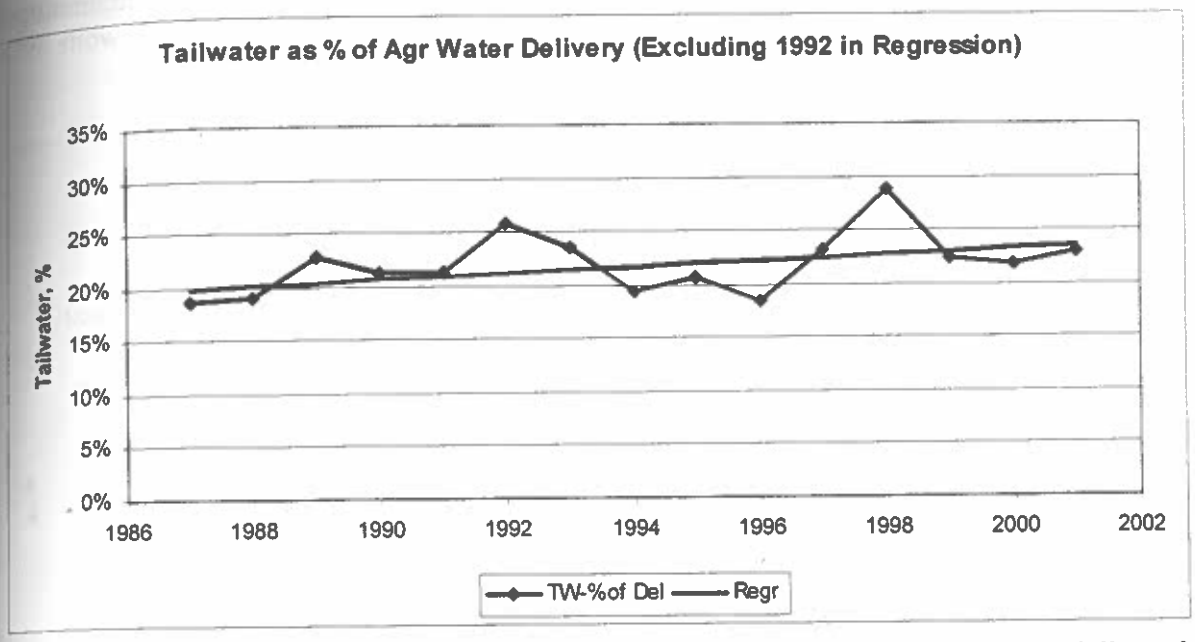

Figure 5.7 Summary of irrigation tailwater expressed as a percentage of water delivered to agriculture assuming that the leaching requirement has been met. Data for 1987 and 1988 are from Jensen and Walter (1997) after recalculating the leach water.

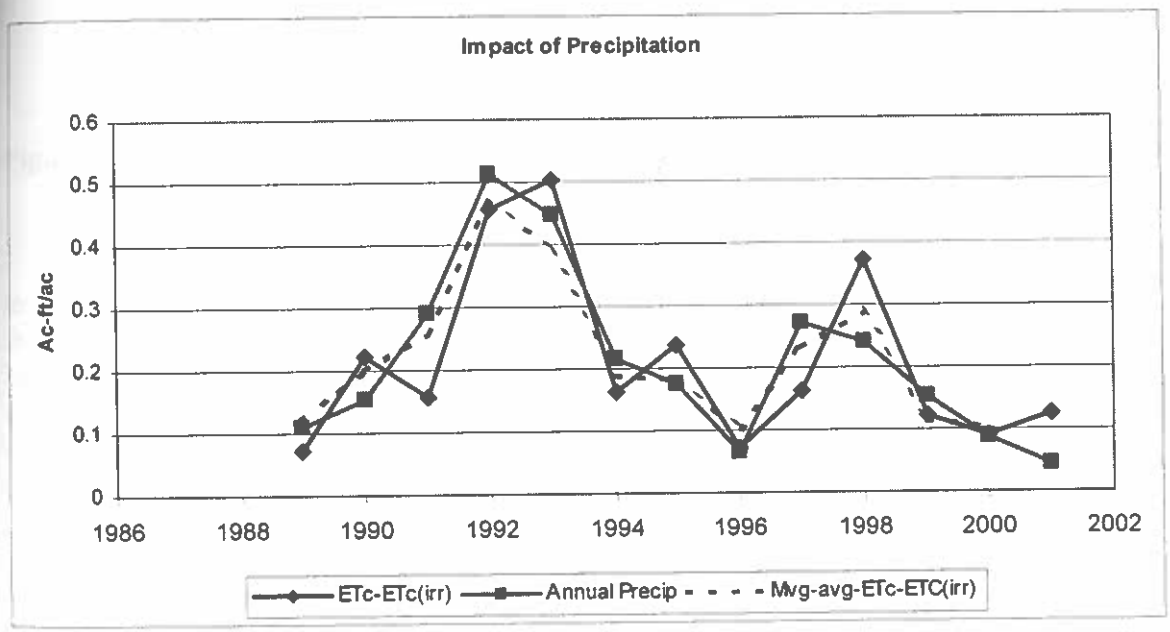

Figure 5.8 Comparison of calculated crop ET (ET_c) minus calculated consumptive irrigation water requirement ($ET_{c(irr)}$) with annual IID precipitation in ac-ft/ac.

A comparison of cumulative water delivery to agriculture minus cumulative consumptive irrigation requirement for the period 1996-2001 was made as shown in Fig. 5.9. The data clearly show that in 1997, the cumulative delivery minus cumulative consumptive irrigation water

requirements was above the years of 1996, 1999, 2000 and 2001. The cumulative values for 1998 show much higher values than for the years 1996, 1999, 2000, and 2001.

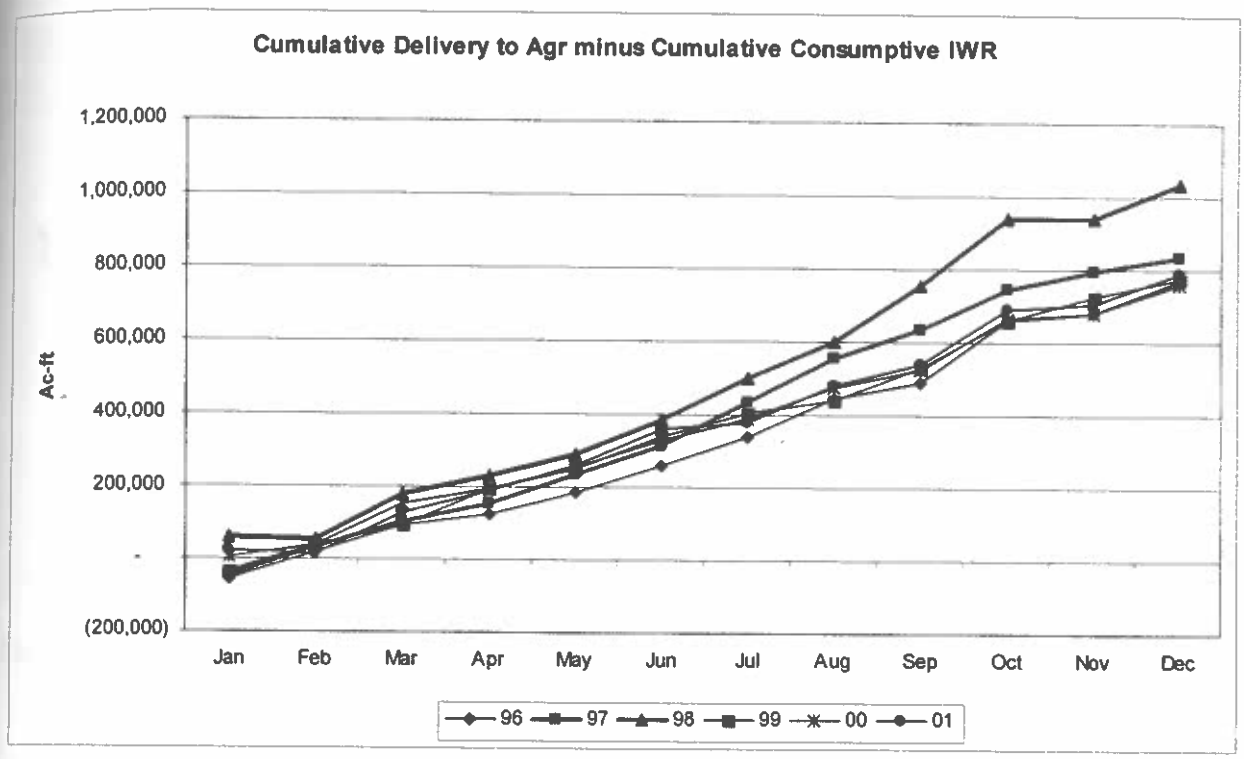

Figure 5.9 Comparison of cumulative water delivery to agricultural users minus cumulative consumptive irrigation water requirements for 1996-2001.

To better illustrate the values in 1997 and 1998, the 1997 and 1998 cumulative water delivery to users minus cumulative consumptive irrigation water requirement values were compared with the average for the years 1996, 1999, 2000 and 2001 in Fig. 5.10. The results shown in Fig. 5.10 indicate that deliveries to agricultural users in 1997 and 1998 generally exceeded the average values for the other years. The difference between 1997 values and the average for the other years was 63,800 ac-ft. The difference between 1998 values and the average for the other years was 264,700 ac-ft. These data clearly show that the calculated tailwater for 1997 and 1998 shown in Fig. 5.6 were due to excess water deliveries to agriculture in those years. In 1998, the cumulative total was 265,000 ac-ft more than the average for the other years. The major differences occurred during the latter half of the year. These results indicate that delivery to water users was not adequately responsive to climate effects on evaporative demand and need for irrigation and the excess delivery accounts for the high estimated tailwater values in 1997 and 1998.

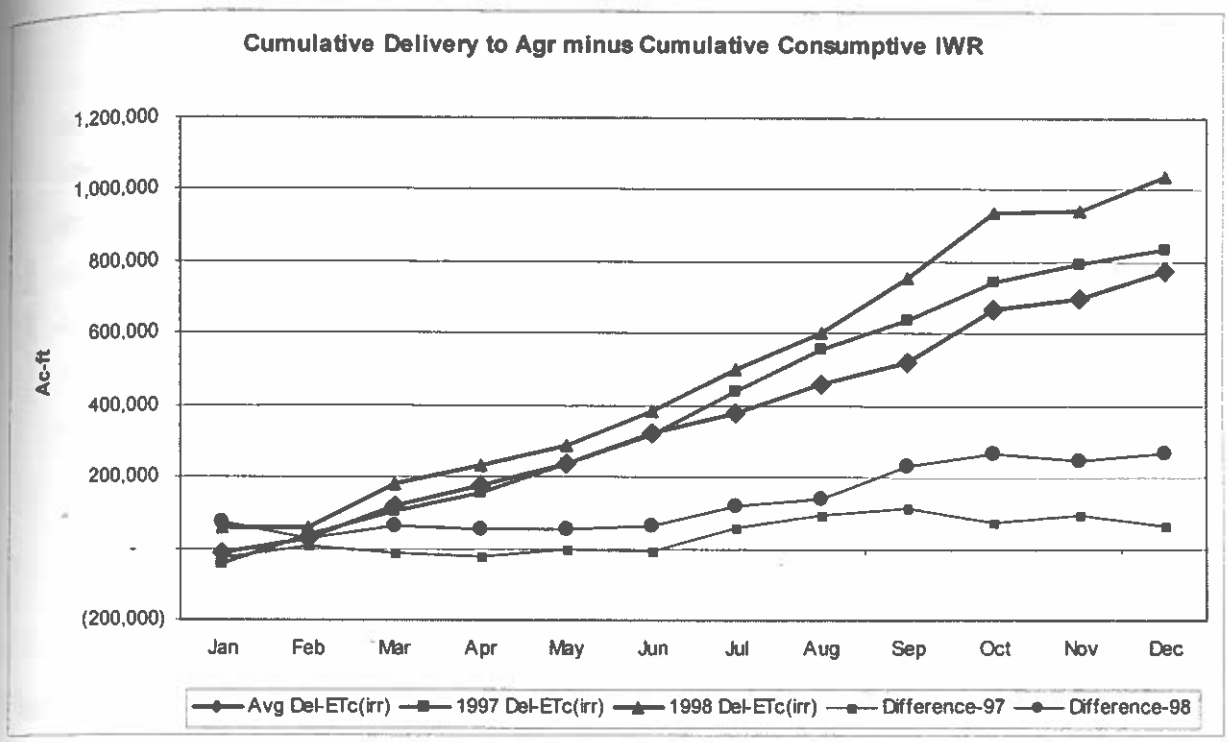

Figure 5.10 Comparison of cumulative water delivery to agricultural users minus cumulative consumptive irrigation water requirements for 1997 and 1998 with the average values for 1996 and 1999-2001.

5.6 Annual Net Surface Flow to the Salton Sea

The total net flow to the Salton Sea from IID was relatively constant from 1994 to 2001 (Fig. 5.6) The flow of Colorado River water to the Salton Sea also shown in Fig. 5.6 indicates a relatively constant annual volume except for the years 1997 and 1998. The reasons for the unusual values in 1997 and 1998 were discussed in Section 5.5.

5.7 Impacts of Surface Flows on the Salton Sea

The increase in net total flow from IID from 1992 to 1995 is reflected in the rise of the Salton Sea during that period. The level of the Sea has been relatively stable since 1997. Average net IID flow to the Salton Sea for the 1997-2001 period was 1,037,300 ac-ft. This is about the same as for 1994-1996. The estimated Salton Sea level is very sensitive to inconsistencies since the estimate for January 1 is the estimated change added to the previous year's value. The estimated elevation from 1996 to 2001 required an increase in the evaporation coefficient from 0.84 to 0.91, or an increase of 8%. A review of annual reference ET calculations indicated that CIMIS-41 reference ET values were about 5% low from 1998 through 2001. A check of the annual average wind speeds for CIMIS-41 indicated that they were about 10% low from 1999 through 2001 compared with other years.

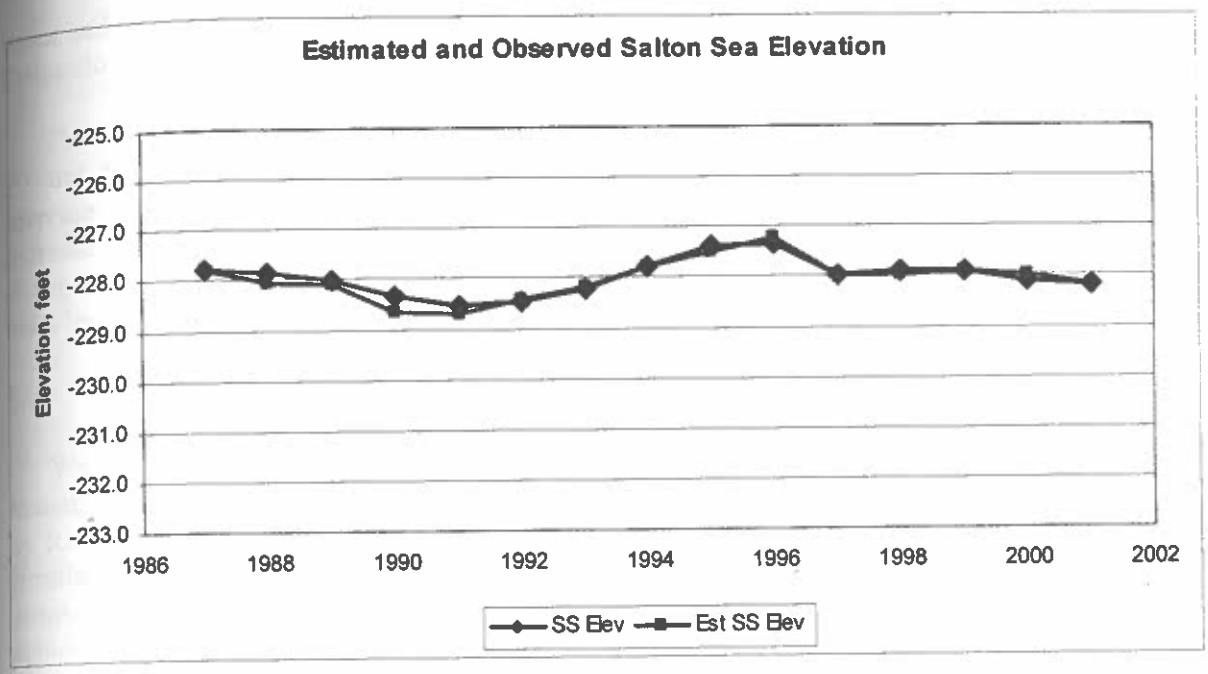

Figure 5.11 Estimated and observed January elevation of the Salton Sea from 1987 to 2001.

5.8 Irrigation Management

This water use assessment did not attempt to address irrigation water management practices because no direct observations or measurements had been made. The NRCE report suggested that even more tailwater would be beneficial because of estimates of salt leaching by tailwater. However, as indicated in our review of the NRCE report, the errors involved in calculating leaching of salt from soil by tailwater invalidate such claims. Use of tailwater for leaching purposes is a highly inefficient use of water. Using corrected values from the NRCE report shows that vertical leaching is about 20 times more effective per ac-ft of water used than is tailwater leaching as illustrated in Appendix E.

Several recent studies on fine-textured (heavy) soils in the Imperial Valley have shown that the intake rate decreases rapidly after the cracks fill so that very little water is infiltrated after the first few hours of applying water. Therefore, there is little benefit from holding water on these soils more than a few hours. Data in Appendix 7 of the NRCE report indicated runoff from Fields 1 and 2 occurred for about nine hours. Recent studies such as those by Bali et al. (2001) and Grismer and Bali (2001) show tailwater can be reduced to less than 5% with little loss in crop yields using a simple volume balance model to determine the irrigation cutoff time or distance water has advanced as developed by Grismer and Tod (1994). Such studies indicate significant opportunities for improving irrigation water management that do not have significant costs associated with the practice.

As shown in Section 5.5, when climate conditions vary from long-term average conditions such above normal precipitation years of 1997 and 1998, the water deliveries to users appear to be too high. This indicates that better guidelines are needed for water users and IID to adjust

water orders and deliveries for the decreased evaporative demand and the effects of decreasing Colorado River water salinity on irrigation water requirements.

The increases in water diversions to IID from the 1987-88 period to the average of the 1989-90 and 1994-95 periods resulted in an increase of 14% in leach water plus tailwater. The increase in diversion from 1987-88 to the average for 1996-2001 period resulted in a 21% increase in leach water plus tailwater. This indicates that on-farm water management has changed little over the past 13-14 years in IID at a time when available irrigation technology has been improving.

5.9 Salinity Management

We have estimated the volume of water that could be beneficially used for salinity management using a conservative value for the leaching requirement. Other studies such as that by Rhoades (2002) have shown that the LR is likely smaller than that which we used based on a simulated crop rotation and more complex methods of estimating the LR. Rhoades has also pointed out that leaching irrigations are not needed and how better salinity management can be achieved.

6.0 SUMMARY AND CONCLUSIONS

6.1 General Summary and Conclusions

The objective of this investigation was to update the water use assessment of the Imperial Irrigation District through 2001. Using data from California's CIMIS network, NRCE's report, WST's report and the USBR, the Jensen and Walter (1997) study was updated. Several important findings of the current investigation include:

- The major change in Colorado River water diversions to IID was the increase from 1987 to 1990 and for years 1994 to 2001. This increase resulted in a 16% increase in tailwater plus leach water from 1987-88 to 1989-90 and a 21% increase from 1987-88 to 1996-2001.

- Colorado River water diverted to IID per cropped acre increased from about 6.1 ac-ft/ac in 1987 to a maximum of 6.9 ac-ft/ac in 1997.

- Irrigation water supply at East Highland Canal increased from about 5.5 ac-ft per acre of harvested agricultural land in 1987 to about 6.1 ac-ft/ac in 1990, and to a maximum of about 6.4 ac-ft/ac in 1997. Beginning in 1998, the supply was relative constant at 6.3 ac-ft per acre.

- The volume of tailwater as a percentage of agricultural water deliveries had an upward trend. The depth of tailwater per acre increased significantly in 1997 and remained high through 2001 largely because of the decrease in Colorado River salinity and the resulting calculated volume of leach water.

- Net inflow to Salton Sea from IID increased from 1987 to 1990 and again to the 1994-2001 period. The 9% increase in flow to the EHL from 1987-88 to the 1996-2001 period resulted in a 20% increase in net flow to the Salton Sea.

6.2 Estimated Water Loss

Table 7.1 from the Jensen-Walter (1997) report comparing various estimates of water loss from the Imperial Irrigation District is updated in Table 6.1. Added to the table is the average for the period 1997-2001. One of the significant changes is the decrease in calculated volume of water used for vertical and horizontal leaching. The main reason for the decrease is because of the decrease in Colorado River salinity at Imperial Dam as shown in Table 4.2 (0.124 x Crop ET x Annual Relative Salinity). As calculated leach water decreases, calculated tail water increases (Calculated tailwater = water delivered to agriculture minus $ET_{c(irr)}$ minus calculated leach water). The resulting overall loss during the 1997-2001 period was 39% or about the same as the 1987-1996 average of 40%. As IID has improved its system for ordering and distributing Colorado River water for irrigation, it still maintained the increased volumes ordered and delivered to agriculture. The obvious effect with little change in crop ET is increased tailwater and overall water loss.

Table 6.1 *Estimated water loss from the Imperial Irrigation District for the 1975-1979 period as presented in Table 2 f Decision 1600 (CSWCB, 1984), for the 1987-1996 period (Jensen and Walter, 1997), and this report for 1997-2001.* Sources: CSWRCB (1984) and this report.

L	Variable	DWR 1 & DWR 17	ELMORE	IID, 16	IID 1987-1996	J-W IID 1987-96	J-W IID 1997-01
1	Period, record	1975-79	1976-80	1977-79	1987-96	1987-96	1997-01
2	Inflow to Drop 1	2,791,000	2,744,000[e]	2,757,000[h]	2,827,000[n]	2,827,000[n]	3,015,857[n]
3	Operational Losses	253,000	97,000[f]	254,000	280,000	280,000	238,358
4	Canal Spill	53,000[a]	58,000	135,000	123,000	123,000	96,102
5	Delivery to users	2,537,000	2,500,000[g]	2,368,000[i]	2,476,000[o]	2,476,000[o]	2,654,504[o]
6	Crop ET	1,664,000	- - -	1,736,000	1,737,000	1,737,000	1,834,304
7	Leachwater	250,000[b]	309,000	281,000	323,000[j]	259,000[l]	200,383[p]
8	Tailwater	380,000[c]	559,000	312,000	416,000[k]	480,000[m]	632,702[q]
9	Excess leach & tailwater	190,000[d]	0	0	- - -	- - -	- - -
10	TOTAL (7+8+9)	820,000	868,000	593,000	739,000	739,000	820,200
11	TOTAL LOSS (3+4+10)	1,126,000	1,023,000	982,000	1,142,000	1,142,000	1,163,690
12	Loss as % of Inflow	40%	37%	36%	40%	40%	39%

[a] Assumed by DWR to include the 53,000 canal spills on line 4.
[b] Assumed by DWR that 15% of crop ET is necessary for leaching.
[c] Assumed value based on IID maximum allowable tailwater. Actual values include some quantities reported on line 9.
[d] Water loss that exceeds assumed leachwater and tailwater values. Quantity must be allowed to each source of loss could not be determined.
[e] Included by Board from IID, 3, p. 112 for comparison.
[f] Includes canal seepage only.
[g] Includes the 58,000 ac-ft annual canal spills.
[h] Includes 34,000 ac-ft annual seepage recovery.
[i] Includes the 39,000 ac-ft annual delivery to non-farm users.
[j] Closure (residual) on "crop leaching".
[k] Calculated tailwater.
[l] Calculated leachwater (14.1% of crop ET + reclamation leaching).
[m] Closure (residual) on tailwater.
[n] Value at EHL Canal.
[o] Delivery to agricultural users.
[p] Calculated leachwater (12.4% of crop ET), salinity adjusted annually.
[q] Calculated tailwater (water delivered – crop ET – leachwater).

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8.0 APPENDICES

A. Crop Acreage

Table A.1 *Imperial Irrigation District, Reported Annual Irrigated Land*

Table A.2 *Summary of crop and other areas used in estimating evapotranspiration and consumption of irrigation water.*

B. Monthly Calculated Crop ET from 1989 to 2001

C. Table 7.1 Calculations

D. Water Balance Spreadsheet

E. Review of NRCE (2002) Report

APPENDIX A

CROP ACREAGE

Table A.1 *Imperial Irrigation District, Reported Annual Irrigated Land*

Table A.2 *Summary of crop and other areas used in estimating evapotranspiration and consumption of irrigation water.*

TABLE 1

IMPERIAL IRRIGATION DISTRICT -- REPORTED ANNUAL IRRIGATED LAND

SOURCE: Imperial Irrigation District Annual Inventory of Crops Receiving Water

(acres)

ID No.	FIELD CROPS:	1989	1990	1991	1992	1,993	1,994	1995	1996	1997	1998	1999	2000	2001
1	Alfalfa, row	21,671	26,675	38,869	43,446			185512	39,405	43,594	53,688	64,327	72,149	72,903
2	Alfalfa, flat	145,028	164,133	163,276	142,759		188,309	0	113,429	117,388	120,675	103,944	105,705	106,915
3	Alfalfa, new (Boyle, 93)	33	38	40	0									
4	Alfalfa, subtotal	166,732	190,846	202,185	186,205	182,910	188,309	185,512	152,834	160,982	174,363	168,271	177,854	179,818
5	Alfalfa Seed	3,070	4,523	17,397	7,099	7,949	6,675	13423	13,238	14,248	19,781	24,362	18,223	19,598
6	Barley	0	203	145	92	182	239	606	58	91	337	868	109	40
7	Oats	4,806	2,602	3,750	1,981	1,262	1,539	2,063	1,267	1,753	2,411	212	850	2,641
8	Bermuda grass	4,249	4,498	5,776	15,359	17,367	17,056	21704	20,952	24,301	31,774	31,731	41,918	34,742
9	Bermuda grass (Seed)	3,778	13,410	15,890	19,098	20,494	17,535	17854	22,636	20,613	21,865	23,448	22,185	34,000
10	Corn, Field	142	210	35	178	477	405	734	453	1,683	579	844	824	385
11	Cotton	9,568	11,014	9,401	4,227	7,255	6,891	6881	4,601	3,970	4,640	7,131	5,641	13,034
38	Klein Grass					0	135	135	452	567	1,623	3,113	6,998	10,262
12	Rye Grass	8,205	8,876	9,091	9,591	6,227	5,867	4685	2,978	4,600	4,968	3,034	2,860	2,277
13	Rye Grass (Seed)	395	56	0	162	162	0	37	37	-	-	-	-	-
14	Sorghum (Grain)	50	0	0	68	98	113	20	2,536	255	40	82	205	268
15	Sorghum (Silage)	280	369	336	176	314	388	517	100	376	193	75	-	620
16	Sudan Grass	48,792	41,482	64,513	53,352	57,850	78,878	77383	81,896	83,562	66,568	62,286	53,446	49,577
17	Sudan Grass (Seed)	342	1,055	167	72	273	266	151	300	310	391	595	148	530
18	Sugar beets	29,163	41,508	41,591	39,703	41,492	34,802	31612	33,980	39,327	34,258	33,997	31,475	26,300
19	Wheat,	99,891	56,833	32,552	69,180	59,283	58,247	62117	106,513	90,005	80,184	42,464	49,868	41,357
20	Rape					45	558	919	773	778	5,098	3,034	621	905
21	Red beets	0	0	0	0	69	38	13	23	30	10	16	6	-
22	Safflower	0	0	0	0	942	80	74	-	-	-	-	-	129
23	Sesbania	20	55	368	110	47	256	514	120	322	-	-	-	-
24	Sesbania (Seed)	0	0	6	190	106	0							
25	Misc (other field crops)	189	40	509	176	750	472	1,538	417	465	557	695	977	1,448
27	**Total Field Crops**	379,672	377,580	403,712	407,019	405,554	418,749	428,492	446,164	448,238	449,640	406,258	414,208	417,931
28	Misc Field Crops:													
29	Alicia grass	0	0	1	71	1	1	1	1	1	1	1	1	-
30	Bamboo							0	15	81	94	109	43	208
31	Buffle grass					525	283	184	169	112	37	37	67	25
32	Dichondra Grass						0	95	-	-	-	-	-	-
33	Dunaliella	20	20	25	25	25	25	25	25	25	25	25	-	25
34	Flax	0	0	0	0	121	13	18	8	4	12	55	-	31
35	Grass, mixed	5	0	102	0	30	28	476	29	84	74	10	602	704
36	Hemp	0	0	0	0	0	0	498	-	-	94	94	-	202
37	Kenaf	0	0	361	80			0	16	3	65	-	-	-
39	Lemon Grass					0	0	79	5	5	5	5	5	5
40	Soybeans	144	0	0	0	0	80							
41	Spir. algae	20	20	20	0	20	20	70	70	70	70	70	70	70
42	Rice	0	0	0	0	10	10	10	-	-	-	140	-	-
43	Sugar Cane	0	0	0	0	18	12	82	79	80	80	133	189	178
44	Clover							0	-	-	-	16	-	-
45	Misc Subtotal	189	40	509	176	750	472	1,538	417	465	557	695	977	1,448

	GARDEN CROPS:	1989	1990	1991	1992	1,993	1,994	1995	1996	1997	1998	1999	2000	2001
46	Artichokes	237	442	560	560	563	360	375	228	388	229	191	240	97
47	Broccoli	11,343	10,484	9,543	8,889	6,406	6,406	5,926	6,311	6,480	9,589	12,305	10,916	8,153
48	Broccoli (Seed)	183	168	168	33	10	91	20	207	23	156	91	100	9
49	Cabbage	846	1,192	1,365	1,011	1,483	1,483	757	710	981	1,126	1,284	877	880
50	Cabbage (Chinese)	20	33	66	66	28	35	-	-	5	-	157	165	-
51	Carrots	11,874	12,682	14,635	15,557	16,312	16,312	14,959	16,469	16,014	16,416	16,995	18,167	15,034
52	Carrots (Seed)	20	20	283	117	93	76	336	138	5	-	70	-	39
53	Cauliflower	6,673	7,334	6,087	6,237	3,755	3,755	2,762	2,776	2,553	3,313	3,960	3,642	3,729
54	Cauliflower (Seed)	46	46	26	51	91	105	30	2	11	66	15	71	25
55	Corn, Ear	1,724	1,822	2,973	3,830	2,879	4,491	3,896	4,372	5,500	6,088	6,790	5,921	3,502
56	Lettuce (Fall)	16,031	19,021	15,021	10,843	10,353	8,644	16,802	16,299	15,971	14,752	17,842	15,261	12,980
57	Lettuce (Spring)	16,031	19,021	15,021	10,843	10,353	8,644							
58	Lettuce (Misc)	279	263	226	249	249	4,023	429	170	53	166	25	92	92
59	Lettuce (Romaine)	360	737	1,024	1,024	893	832	809	600	1,505	1,505	1,969	643	306
60	Lettuce (Mixed)					0		2,476	2,230	2,663	2,681	2,722	2,093	4,128
61	Melons:													
62	Cantaloupes (Fall)	8,174	10,498	3,264	262	525	246	455	-	2,138	1,871	1,380	847	1,409
63	Cantaloupes (Spring)	20,684	22,837	17,972	12,042	13,057	14,093	14,476	13,337	11,397	12,216	12,650	10,423	8,536
64	Cantaloupes (Seed)	183	0	224	0									
65	Honeydew (Fall)	1,761	2,148	489	140	0	203	74	316	180	406	320	354	351
66	Honeydew (Spring)	389	800	303	92	335	579	476	682	688	457	1,139	1,067	471
67	Honeydew (Seed)	0	0	105	0									
68	Melons (Mixed, fall)	484	376	241	0	79	233	-	5	108	12	319	182	39
69	Melons Mixed (Sprg)	72	912	158	67	225	530	533	505	1,087	438	504	531	234
70	Watermelons	3,830	3,234	2,326	2,485	2,596	3,498	2,619	2,822	2,419	1,635	2,158	1,143	715
71	Watermelons (Seed)	90	0	76	0	0	78	-	-	1	-	-	-	-
72	Misc Melons													
73	Onions	8,903	10,125	11,862	10,126	10,767	12,004	11,258	13,324	10,176	9,757	11,526	12,377	9,858
74	Onion (Seed)	2,261	3,339	2,540	2,790	2,315	1,929	1,317	1,882	3,573	2,256	3,541	3,812	1,541
75	Peppers, Bell	241	157	235	352	332	588	642	568	459	370	429	361	216
76	Peppers (Hot)	15	59	10	27	71	71	291	39	56	29	-	-	3
77	Peppers (Sweet)	0	70	65	5	20	1							
78	Potatoes	152	177	621	604	970	1,304	1,923	2,538	2,784	2,622	3,159	2,775	2,935
79	Rapini	505	479	520	520	589	546	744	704	722	1,150	1,323	1,505	1,302
80	Tomatoes (Spring)	12,640	10,835	6,332	3,483	1,892	3,486	1,836	2,022	840	655	2,024	798	690
81	Vegetables (Mixed)	1,350	1,382	1,635	1,178	2,059	2,134	1,663	803	1,761	1,711	2,162	1,961	1,593
82	Vegetables (Mixed Sd)	83	138	86	8	0	12	12	13	15	-	66	31	129
83														
	MISCELLANEOUS GARDEN CROPS													
84	Beans	202	157	75	0	0	3	51	355	203	23	150	-	15
85	Blackeyed Peas	188	182	330	0	0	57	-	-	314	-	80	10	10
86	Celery	334	280	457	629	67	58	94	109	236	77	118	105	114
87	Cucumbers	161	59	39	11	0	12	44	19	-	18	57	29	5
88	Eggplant	25	167	167	30	5	5	66	70	5	5	7	-	4
89	Flowers	19	0	42	42	25	25	107	94	125	116	279	317	319
90	Flowers (Seed)	0	0	195	195	128	81	49	50	40	48	26	6	-
91	Garlic	42	353	464	414	85	457	335	437	165	104	308	76	-
92	Herbs (mixed)	47	133	182	133	123	0	-	13	17	2	60	20	62
93	Herbs (Seed)	0	0	24	59	21	0	-	-	200	-	2	-	64
94	Kale	0	0	0	182	214	245	107	-	54	96	65	-	4
95	Kava	0	0	60	0			-	-	20	140	-	-	-
96	Casaba (Fall)	0	65	73	73	0	0							
97	Casaba (Spring)	0	127	31	32	0	0							
98	Crenshaw (Spring)	66	0	0	38	58	0	-	-	15	-	-	-	-
99	Crenshaw (Fall)	229	0	2	2	0	0	-	-	-	-	-	22	34
100	Mustard	117	12	0	12	0	7	-	122	178	134	30	170	103
101	Mustard (Seed)	123	13	0	0	43	0	17	15	13	13	12	-	10
102	Parsnips	50	50	0	50	107	144	50	-	42	44	14	48	20
103	Peanuts	100	0	0	0	0	0							
104	Radishes	0	87	0	0	52	36	73	146	37	155	18	9	104
105	Radishes (Seed)	25	49	49	49	0	13	16	-	8	17	-	-	-
106	Rutabagas	30	25	0	12	10	1	-	-	81	-	5	-	-
107	Spinach	85	191	222	169	451	366	345	372	646	950	1,229	485	874
108	Spinach (Chinese)					40	22	-	22	-	30	-	-	-
109	Squash	206	216	201	187	102	220	223	59	150	114	191	108	60
110	Squash (Seed)					16	0	12	-	9	33	155	54	-
111	Swiss Chard (Seed)	0	0	20	0	16	0	-	-	40	5	21	-	-
112	Tomatoes (Fall)	568	581	53	0	958	0	149	-	22	-	-	-	-
113	Turnips	243	178	188	188	179	238	198	193	377	141	168	155	160
114	Misc Other (See below)	0	0	0	0	300	292	289	1,720	1,477	151	1,432	465	611
115	Subtotal	2,860	2,925	2,874	2,507	3,000	2,282	2,225	3,796	4,474	2,416	4,427	2,079	2,573
116	**Total Garden**	130,343	143,756	118,936	95,998	92,299	99,074	90,121	93,868	95,030	94,088	111,543	98,434	81,569
117	Misc (other garden):													
118	Chicory	0	0	0	0	3	35	6	6	-	-	-	-	-
119	Chinese grass					3	25	25	10	-	-	-	-	-
120	Garbonzo beans	0	0	0	0	0	0	75	1,211	1,034	51	1,057	108	-
121	Okra	0	0	0	0	112	42	77	96	91	30	30	230	271
122	Okra (Seed)	0	0	0	0	3	63	-	-	44	-	25	-	-
123	Parsley					75	1	-	-	2	-	134	-	-
124	Peas & Peas (Seed)	0	0	0	0	0	2	16	7	7	-	-	-	3
125	Rhubarb					0	0	10	10	-	-	5	-	-
126	Endive (Seed)							-	150	55	25	51	-	58
127	Water Lilies	0	0	0	0	104	124	80	110	84	30	30	22	106
128	Cilantro							-	-	-	-	60	-	48
129	Collards							-	-	10	6	38	-	45
130	Fennel							-	-	-	-	2	2	-
131	Sweet Basil							-	120	150	9	-	103	80
132	Misc Subtotal	0	0	0	0	300	292	289	1,720	1,477	151	1,432	465	611

	PERMANENT CROPS:	1989	1990	1991	1992	1,993	1,994	1995	1996	1997	1998	1999	2000	2001
133	Artichokes	(Moved)												
134	Asparagus	5,376	6,145	6,445	6,466	6,111	6,136	5265	4,919	5,337	5,574	6,166	5,922	4,557
135	Citrus							0	-	-	-	-	-	-
136	Grapefruit	688	688	864	920	1,036	1,078	1157	1,200	1,194	1,337	1,412	1,384	1,395
137	Lemons	580	580	660	691	789	799	811	1,161	1,834	1,914	2,094	2,357	2,357
138	Mixed Citrus	33	33	33	33	29	29	29	78	278	944	1,004	872	888
139	Oranges	402	472	1,060	525	632	632	667	667	780	840	947	927	767
140	Tangerines	58	58	510	440	626	625	662	662	662	692	712	692	692
141	Dates	63	63	18	18	42	42	42	82	82	98	93	93	146
142	Duck Ponds (Feed)	7,819	7,863	8,099	8,244	8,243	8,070	7994	8,798	8,837	8,979	9,105	10,025	9,483
143	Fish Farms	721	908	908	903	1,175	1,173	1173	1,173	1,263	1,293	1,293	1,293	1,138
144	Fruit, Mixed	10	340	240	165	15	10	10	10	10	10	5	5	30
145	Grapes, Table	0	0	0	0			0	-	-	-	4	4	4
146	Jojoba	2,117	2,117	2,117	2,117	2,017	2,017	1943	400	202	2	2	2	2
147	Pasture, Permanent	501	599	607	610	695	798	728	696	722	684	701	546	566
148	Peaches	396	396	368	198	229	145	85	2	2	7	7	7	7
149	Misc (other P crops)	72	76	108	137	298	290	325	580	402	432	306	305	315
150	Total Permanent Crops	18,836	20,338	22,037	21,467	21,937	21,844	20,891	20,428	21,605	22,806	23,851	24,434	22,347
151	Misc (other permanent)													
152	Eucalyptus	8	12	13	17	23	15	15	14	14	14	14	13	13
153	Guar Beans					0	0	20	276	104	153	-	-	-
154	Ornamental Trees					5	5	5	5	15	15	15	15	15
155	Pomegranates							0	-	-	-	2	2	2
156	Mangos					150	150	150	150	150	125	150	150	150
157	Nursery	13	13	13	24	24	24	24	24	24	30	30	30	30
158	Palms	24	24	55	69	69	69	84	84	78	78	78	78	88
159	Pecans	27	27	27	27	27	27	27	27	17	17	17	17	17
160	Misc Subtotal	72	76	108	137	298	290	325	580	402	432	306	305	315
161	TOTAL CROPS	528,851	541,674	544,685	524,484	519,790	539,667	539,504	560,460	564,873	566,534	541,652	537,076	521,847

	TOTAL HARVESTED CROPLAND & PASTURE													
162	Idle			158,098	146,721									
163	Fallow	25,278	19,671	17,018	23,318			20,393	19,136	17,448	17076	17125	16863	24574
164	Leaching	3,869	5,798	660	2,937			2,257	503	263	190	2640	623	163
165	TOTAL,	557,998	567,143	720,461	697,460	519,790	539,667	562,154	580,099	582,584	583,800	561,417	554,562	546,584
166	TOTAL, Boyle	558,002	567,143	720,461	697,460									
167	Difference	(4)	0	0	0									
		OK	OK	OK	OK									
168	FIELD CROPS, %	71.8%	69.7%	74.1%	77.6%	78.0%	77.6%	79.4%	79.6%	79.4%	79.4%	75.0%	77.1%	80.1%
169	GARDEN CROPS, %	24.6%	26.5%	21.8%	18.3%	17.8%	18.4%	16.7%	16.7%	16.8%	16.6%	20.6%	18.3%	15.6%
170	PERM. CROPS, %:	3.6%	3.8%	4.0%	4.1%	4.2%	4.0%	3.9%	3.6%	3.8%	4.0%	4.4%	4.5%	4.3%

TABLE 2
SUMMARY OF IRRIGATED CROP AREA USED IN DETERMINATION OF EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(acres)

Crops	FIELD CROPS:	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
4	Alfalfa	166,732	190,846	202,185	186,205	182,910	188,309	185,512	152,834	160,982	174,363	168,271	177,854	179,818
5	Alfalfa (Seed)	3,070	4,523	17,397	7,099	7,949	6,675	13,423	13,238	14,248	19,781	24,362	18,223	19,598
6 + 7	Barley & Oats	4,806	2,805	3,895	2,073	1,444	1,778	2,669	1,325	1,844	2,748	1,080	959	2,681
8	Bermuda Grass	4,249	4,498	5,776	15,359	17,367	17,056	21,704	20,952	24,301	31,774	31,731	41,918	34,742
9	Bermuda grass (Seed)	3,778	13,410	15,890	19,098	20,494	17,535	17,854	22,636	20,613	21,865	23,448	22,185	34,000
10	Corn, Field	142	210	35	178	477	405	734	453	1,683	579	844	824	385
11	Cotton	9,568	11,014	9,401	4,227	7,255	6,891	6,881	4,601	3,970	4,640	7,131	5,641	13,034
38	Klein Grass	0	0	0	0	0	135	135	452	567	1,623	3,113	6,998	10,262
12 + 13	Rye Grass & R G (Sd)	8,600	8,932	9,091	9,753	6,389	5,867	4,722	3,015	4,600	4,968	3,034	2,860	2,277
16 + 17	Sudan Grass & SG(Sd)	49,134	42,537	64,680	53,424	58,123	79,144	77,534	82,196	83,872	66,959	62,881	53,594	50,107
18 /2	Sugar Beets (Fall)	14,582	20,754	20,796	19,852	20,746	17,401	15,806	16,990	19,664	17,129	16,999	15,738	13,150
18 / 2	Sugar Beets (Spring)	14,582	20,754	20,796	19,852	20,746	17,401	15,806	16,990	19,664	17,129	16,999	15,738	13,150
19	Wheat	99,891	56,833	32,552	69,180	59,283	58,247	62,117	106,513	90,005	80,184	42,464	49,868	41,357
14 + 15 +20 + 21 + 22 + 23 + 24 + 25	Miscellaneous	539	464	1,219	720	2,371	1,905	3,595	3,969	2,226	5,898	3,902	1,809	3,370
	Total Field Crops	379,672	377,580	403,712	407,019	405,554	418,749	428,492	446,164	448,238	449,640	406,258	414,208	417,931
	GARDEN CROPS:	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
47	Artichokes	237	442	560	560	563	360	375	228	388	229	191	240	97
48 + 49	Broccoli & Br. (Seed)	11,526	10,652	9,711	8,922	6,416	6,497	5,946	6,518	6,503	9,745	12,396	11,016	8,162
50 + 51	Cabbage & Ch Cabb	866	1,225	1,431	1,077	1,511	1,518	757	710	986	1,126	1,441	1,042	880
52 + 53	Carrots & Car. (Seed)	11,894	12,702	14,918	15,674	16,405	16,388	15,295	16,607	16,019	16,416	17,065	18,167	15,073
54 + 55	Cauliflower & Caul (Sd)	6,719	7,380	6,113	6,288	3,846	3,860	2,792	2,778	2,564	3,379	3,975	3,713	3,754
56	Corn, Ear	1,724	1,822	2,973	3,830	2,879	4,491	3,896	4,372	5,500	6,088	6,790	5,921	3,502
57 +	Lettuce, (All Fall)	16,350	19,521	15,646	11,480	10,924	11,072	18,659	17,799	18,082	16,928	20,200	16,675	15,243
58 +	Lettuce, (All Spring)	16,350	19,521	15,646	11,480	10,924	11,072	1,857	1,500	2,111	2,176	2,358	1,414	2,263
	Melons:													
63 + 65/2	Cantaloupes (Fall)	8,266	10,498	3,376	262	525	246	455	0	2,138	1,871	1,380	847	1,409
64 + 65/2	Cantaloupes (Spring)	20,776	22,837	18,084	12,042	13,057	14,093	14,476	13,337	11,397	12,216	12,650	10,423	8,536
66 + 68/2 + 69	Melons, Fall	2,337	2,524	895	140	79	436	74	321	288	418	639	536	390
67 + 68/2 + 70	Mellons, Spring	553	1,712	626	159	560	1,109	1,009	1,187	1,775	895	1,643	1,598	705
71 + 72	Watermelons & Seed	3,920	3,234	2,402	2,485	2,596	3,576	2,619	2,822	2,420	1,635	2,158	1,143	715
74 + 75	Onions & Onion Seeds	11,164	13,464	14,402	12,916	13,082	13,933	12,575	15,206	13,749	12,013	15,067	16,189	11,399
79	Peppers, (Bell, Hot Sweet) Potatoes	152	177	621	604	970	1,304	1,923	2,538	2,784	2,622	3,159	2,775	2,935
	Rapini													
	Spinach & Ch Spinach													
	Squash & Sq. (Seed)													
	Tomatoes (Fall)													
81	Tomatoes (Spring)	12,640	10,835	6,332	3,483	1,892	3,486	1,836	2,022	840	655	2,024	798	690
	Turnips													
82 + 83	Veg Mixed & Mixed Sd	1,433	1,520	1,721	1,186	2,059	2,146	1,675	816	1,776	1,711	2,228	1,992	1,722
Sum Remaining	Misc Other	3,438	3,690	3,480	3,411	4,012	3,488	3,902	5,107	5,711	3,965	6,179	3,945	4,094
	Total Garden Crops	130,343	143,756	118,936	95,998	92,299	99,074	90,121	93,868	95,030	94,088	111,543	98,434	81,569
	PERMANENT CROPS:	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
134	Asparagas	5,376	6,145	6,445	6,466	6,111	6,136	5,265	4,919	5,337	5,574	6,166	5,922	4,557
136 + 137 + 138 + 139 + 140	Citrus:	1,761	1,831	3,127	2,609	3,112	3,163	3,326	3,768	4,748	5,727	6,169	6,232	6,099
141	Dates	63	63	18	18	42	42	42	82	82	98	93	93	146
142	Duck Ponds (Feed)	7,819	7,863	8,099	8,244	8,243	8,070	7,994	8,798	8,837	8,979	9,105	10,025	9,483
143	Fish Farms	721	908	908	903	1,175	1,173	1,173	1,173	1,263	1,293	1,293	1,293	1,138
146	Jojoba	2,117	2,117	2,117	2,117	2,017	2,017	1,943	400	202	2	2	2	2
147	Pasture, Permanent	501	599	607	610	695	798	728	696	722	684	701	546	566
144 + 148	Peaches & Mixed Fruit	396	396	368	198	229	145	85	2	2	7	7	7	7
160	Misc	82	416	348	302	313	300	335	590	412	442	315	314	349
	Total Permanent Crops	18,836	20,338	22,037	21,467	21,937	21,844	20,891	20,428	21,605	22,806	23,851	24,434	22,347
	TOTAL CROPS	528,851	541,674	544,685	524,484	519,790	539,667	539,504	560,460	564,873	566,534	541,652	537,076	521,847
	Less multiple cropping	65,896	73,775	77,402	65,827	59,171	81,880	81,033	99,848	104,167	105,473	82,090	75,562	68,664
	TOTAL HARVESTED CROPLAND & PASTURE	462,955	467,899	467,283	458,657	460,619	457,787	458,471	460,612	460,706	461,061	459,562	461,514	453,183

Miscellaneous Field Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	100%	91%	83%	78%	69%	64%	67%	72%	82%	84%	75%	87%
Reported Acres												
1989 539	539	493	445	418	372	346	362	389	443	453	403	466
1990 464	464	424	383	360	320	297	312	335	381	390	347	402
1991 1219	1219	1115	1007	945	841	781	819	879	1001	1025	912	1055
1992 720	720	659	595	558	497	462	484	519	591	606	538	623
1993 2371	2371	2169	1958	1838	1636	1520	1593	1709	1948	1994	1773	2052
1994 1905	1905	1743	1573	1477	1314	1221	1280	1373	1565	1602	1425	1649
1995 3595	3595	3289	2969	2787	2481	2305	2416	2592	2953	3024	2689	3111
1996 3969	3969	3631	3278	3077	2739	2545	2667	2861	3260	3339	2968	3435
1997 2226	2226	2036	1839	1726	1536	1427	1496	1605	1829	1872	1665	1926
1998 5898	5898	5395	4871	4572	4070	3781	3964	4252	4845	4961	4411	5104
1999 3902	3902	3569	3223	3025	2692	2502	2622	2813	3205	3282	2918	3377
2000 1809	1809	1655	1494	1402	945	882	869	996	994	1074	1667	2103
2001 3370	2229	2039	1841	1728	1538	1429	1498	1607	1831	1875	1667	1929

APPENDIX B

MONTHLY CALCULATED CROP EVAPOTRANSPIRATION FROM 1989 TO 2001

Page 1:
- Average Crop Evapotranspiration (all crops), ac-in/ac
- Average Consumptive Irrigation Requirement (all crops), ac-in/ac

Page 2:
- Average Crop Evapotranspiration (all crops), ac-ft
- Average Consumptive Irrigation Requirement (all crops), ac-ft

Pages 1-14:
- Crop Evapotranspiration (individual crops), ac-in/ac

Pages 1-14:
- Consumptive Irrigation Requirement (individual crops), ac-in/ac

Not corrected

CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.86	2.89	5.03	6.25	6.36	5.16	5.03	4.23	3.72	2.67	2.34	1.80	47.34
1990	2.48	2.62	4.31	5.76	7.21	5.56	5.07	4.25	3.58	2.60	2.13	1.94	47.53
1991	1.85	2.37	3.54	5.22	6.52	5.51	4.46	4.23	3.19	2.54	1.93	1.50	42.85
1992	2.26	2.68	3.45	5.42	5.98	5.24	4.61	3.35	2.02	2.63	1.89	1.59	41.11
1993	1.86	2.43	4.12	5.75	6.70	5.58	5.18	4.61	4.04	2.91	2.07	2.05	47.30
1994	2.25	2.40	3.92	5.45	6.24	5.80	5.28	4.53	3.90	2.71	2.12	1.51	46.10
1995	2.25	2.63	4.03	5.80	6.21	5.82	4.81	4.37	3.65	2.37	1.78	1.53	45.24
1996	2.74	2.82	4.41	5.96	6.89	5.06	4.67	4.31	3.42	2.66	2.05	1.84	46.82
1997	2.44	2.89	4.54	5.46	6.52	5.16	4.79	4.30	3.12	2.67	1.78	1.77	45.43
1998	2.06	2.13	3.87	5.12	6.30	5.34	5.26	4.59	3.82	2.92	2.02	2.26	45.68
1999	2.57	2.69	4.25	4.94	6.60	5.62	4.80	4.56	3.62	2.97	2.10	2.13	46.83
2000	2.25	2.68	4.02	6.10	7.05	5.50	5.35	4.79	3.98	2.80	1.95	1.98	48.45
2001	1.96	2.38	3.84	5.25	6.55	5.92	5.64	5.46	4.52	3.43	2.82	2.01	49.77
AVG	2.22	2.59	4.10	5.58	6.55	5.48	5.00	4.43	3.58	2.76	2.08	1.84	46.19

CONSUMPTIVE IRRIGATION REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.68	2.19	6.43	5.84	5.28	5.60	4.73	4.40	4.22	0.58	3.56	1.94	46.45
1990	2.88	2.44	4.32	5.69	6.41	4.96	5.86	3.94	3.59	0.93	3.41	0.45	44.89
1991	1.13	3.86	1.35	6.15	6.23	4.87	4.36	4.96	2.32	2.64	3.00	0.19	41.04
1992	1.48	1.80	2.72	4.45	5.11	4.33	4.48	1.75	5.59	0.81	2.54	0.67	35.73
1993	0.39	0.75	4.69	4.28	6.25	5.88	4.90	4.58	4.63	1.07	3.01	0.80	41.23
1994	4.09	0.87	4.45	5.98	5.42	5.00	5.31	4.40	4.31	0.69	3.10	0.60	44.23
1995	1.88	3.36	2.70	5.85	5.74	5.37	5.53	4.01	4.04	0.67	2.64	0.77	42.56
1996	4.34	2.07	4.70	6.87	5.36	4.63	5.20	3.93	3.94	0.90	3.03	1.04	46.00
1997	3.73	2.28	4.78	6.27	4.94	4.75	4.80	4.12	2.39	2.01	2.32	1.23	43.61
1998	1.49	1.84	3.12	5.82	5.73	4.36	5.31	4.43	4.30	0.91	3.45	0.73	41.48
1999	4.10	1.79	4.94	4.33	6.23	4.78	4.86	5.28	2.92	2.12	2.22	1.83	45.40
2000	3.03	2.62	3.42	6.72	6.28	5.15	6.18	4.39	4.36	1.33	3.16	0.71	47.34
2001	1.65	3.76	1.72	6.10	6.30	4.84	8.00	5.06	4.85	1.53	3.64	0.81	48.28
AVG	2.45	2.28	3.80	5.72	5.79	4.96	5.35	4.25	3.96	1.25	3.01	0.91	43.71

Not corrected

CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ACRE-FEET)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	73,206	112,632	197,509	244,392	247,799	201,800	179,962	153,392	138,751	108,856	98,358	75,911	1,832,569
1990	103,463	109,373	179,075	239,860	300,763	232,500	200,725	166,656	138,649	104,275	88,009	80,162	1,943,510
1991	77,227	99,701	147,402	216,987	271,231	228,148	193,357	177,262	133,295	107,342	82,085	63,922	1,797,958
1992	92,094	108,678	139,280	216,941	238,783	208,270	178,397	126,228	75,479	101,377	73,861	62,077	1,621,466
1993	74,592	96,289	162,282	225,453	262,173	216,456	194,409	170,250	151,723	115,525	84,018	83,260	1,836,431
1994	95,013	100,156	165,784	229,512	262,497	243,642	219,377	184,912	158,623	114,050	91,068	64,754	1,929,389
1995	95,767	111,370	169,293	243,051	260,281	242,916	217,630	193,185	159,512	104,369	78,186	66,997	1,942,556
1996	120,544	122,721	191,646	258,641	298,873	219,103	195,780	176,732	140,945	113,626	89,194	80,291	2,008,097
1997	106,303	125,837	196,752	238,014	284,439	225,267	201,819	179,813	130,322	114,833	78,465	77,911	1,959,775
1998	88,884	91,478	166,675	221,737	272,230	229,846	209,037	179,067	148,791	117,516	83,176	93,127	1,901,563
1999	105,046	109,848	172,075	198,869	265,117	227,403	197,575	184,029	144,769	122,185	87,604	88,843	1,903,364
2000	90,381	109,081	162,800	244,911	282,335	221,204	209,696	184,545	152,643	109,505	77,928	78,531	1,923,560
2001	77,024	93,600	152,008	206,475	256,725	231,586	206,709	199,513	165,107	126,955	107,230	76,087	1,899,018
AVG	92,273	106,982	169,429	229,603	269,480	225,242	200,344	175,045	141,432	112,340	86,091	76,298	1,884,558

CONSUMPTIVE IRRIGATION REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ACRE-FEET)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	66,349	85,518	252,852	228,409	205,580	218,692	168,960	159,765	157,174	23,730	149,538	81,601	1,798,169
1990	119,857	102,031	179,537	236,836	267,404	207,152	232,262	154,642	139,048	37,345	140,762	18,436	1,835,312
1991	47,001	162,425	56,243	255,770	259,188	201,588	188,961	207,461	96,793	111,634	127,662	8,113	1,722,839
1992	60,565	72,746	109,798	177,864	204,142	171,933	173,423	65,984	209,196	31,392	99,452	26,152	1,402,648
1993	15,742	29,535	184,887	167,988	244,781	227,987	183,934	169,050	173,731	42,311	122,414	32,578	1,594,940
1994	173,038	36,537	188,305	251,717	227,933	210,367	220,733	179,612	175,362	29,130	132,958	25,550	1,851,241
1995	80,219	142,159	113,679	245,238	240,704	224,022	250,068	177,411	176,715	29,540	115,698	33,762	1,829,214
1996	190,839	90,219	204,293	298,159	232,310	200,541	218,175	160,966	162,444	38,238	131,874	45,449	1,973,508
1997	162,971	99,153	207,351	273,429	215,545	207,212	202,130	172,085	99,783	86,284	102,091	54,204	1,882,239
1998	63,999	79,091	134,619	251,694	247,738	187,534	211,125	172,838	167,469	36,844	141,928	29,947	1,724,826
1999	167,801	72,962	199,882	174,336	250,348	193,480	200,249	213,177	116,902	87,386	92,674	76,307	1,845,504
2000	122,052	106,650	138,266	269,532	251,253	207,245	242,228	169,040	167,337	52,173	125,952	28,116	1,879,843
2001	65,098	148,082	68,240	240,100	247,066	189,160	293,120	184,938	177,356	56,555	138,683	30,710	1,839,108
AVG	102,733	94,393	156,766	236,236	238,000	203,609	214,259	168,228	155,332	50,966	124,745	37,763	1,783,030

ALFALFA
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.75	3.27	5.84	6.80	8.56	8.95	9.26	7.72	7.27	4.69	4.10	2.95	72.17
1990	3.55	2.95	5.01	6.28	8.43	8.29	8.89	7.74	6.61	4.46	3.72	3.25	69.18
1991	2.44	2.66	4.39	5.85	7.31	7.40	8.35	7.60	6.10	4.58	3.56	2.52	62.76
1992	3.12	2.89	3.80	5.67	7.13	8.50	8.32	4.85	2.04	4.46	3.22	2.52	56.50
1993	2.61	2.65	4.69	6.12	7.88	8.51	9.08	7.99	6.97	4.78	3.58	3.21	68.08
1994	3.07	2.74	4.66	6.16	7.68	8.69	9.04	7.76	6.96	4.73	3.82	2.48	67.77
1995	2.80	2.81	4.76	6.66	7.76	8.84	8.85	8.37	7.26	4.74	3.71	2.70	69.26
1996	3.40	3.06	4.84	6.52	8.81	8.45	8.85	8.51	6.84	4.85	3.95	3.15	71.21
1997	3.43	3.18	5.18	5.58	8.14	8.35	8.59	7.96	6.04	4.70	3.26	3.06	67.47
1998	2.71	2.22	4.47	5.36	7.43	8.13	8.82	7.80	6.66	4.76	3.40	3.42	65.19
1999	3.43	3.00	4.92	5.23	7.76	7.87	8.19	7.84	6.49	4.90	3.61	3.35	66.58
2000	3.08	2.85	4.58	6.51	8.37	8.04	8.74	7.75	6.50	4.34	3.07	3.05	66.86
2001	2.49	2.44	4.41	5.82	7.78	8.57	8.39	7.97	6.82	4.70	3.91	2.83	66.13
AVG	2.99	2.82	4.74	6.04	7.93	8.35	8.72	7.68	6.35	4.67	3.61	2.96	66.86

ALFALFA, SEED
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.79	2.03	2.93	3.21	5.32	5.88	4.54	5.13	4.24	2.86	1.84	1.23	40.99
1990	1.97	1.84	2.57	2.97	5.13	5.47	3.80	4.95	3.73	2.52	1.87	1.28	38.10
1991	1.63	1.64	2.35	2.57	4.90	4.72	3.90	4.90	3.55	2.72	1.77	0.99	35.63
1992	1.43	1.61	2.12	2.80	4.24	5.46	3.48	4.63	2.06	1.44	1.79	1.14	32.19
1993	1.38	1.61	2.80	2.70	5.03	5.44	4.14	5.34	4.05	2.78	1.56	1.31	38.14
1994	1.84	1.63	2.45	2.38	4.99	5.33	4.27	5.17	4.08	2.63	1.68	1.08	37.54
1995	1.57	1.78	2.69	2.78	4.97	5.47	4.07	5.18	4.47	2.58	1.70	1.24	38.50
1996	1.95	1.67	2.64	3.16	5.42	5.49	4.22	5.60	3.96	2.91	1.79	1.38	40.19
1997	1.74	1.91	2.77	2.79	5.00	5.47	4.40	5.11	3.82	2.58	1.70	1.23	38.50
1998	1.47	1.44	2.28	2.74	4.43	5.33	4.17	5.07	4.06	2.37	1.62	1.62	36.59
1999	1.94	1.53	2.70	2.71	4.59	5.09	3.97	4.77	3.96	2.52	1.78	1.61	37.15
2000	1.66	1.58	2.42	3.27	5.06	5.12	3.68	4.94	4.00	2.39	1.38	1.32	36.81
2001	1.63	1.60	2.23	2.38	4.93	5.29	3.60	5.11	4.01	2.52	1.61	1.30	36.20
AVG	1.69	1.68	2.54	2.80	4.92	5.35	4.02	5.07	3.84	2.52	1.70	1.29	37.43

BARLEY & OATS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	3.22	4.58	7.58	7.07	1.85	0	0	0	0	0	0.73	2.09	27.13
1990	3.69	4.28	6.77	5.84	0.70	0	0	0	0	0	0.00	0.80	22.09
1991	2.18	3.92	5.61	7.92	5.19	0	0	0	0	0	0.74	1.82	27.38
1992	3.08	4.02	5.17	5.01	0.48	0	0	0	0	0	0.68	1.63	20.06
1993	2.55	3.71	6.36	5.72	0.61	0	0	0	0	0	1.12	2.49	22.57
1994	3.41	3.77	6.15	5.51	0.50	0	0	0	0	0	0.69	1.58	21.60
1995	3.00	4.20	6.28	6.11	0.68	0	0	0	0	0	0.74	1.83	22.84
1996	3.65	4.26	6.74	6.06	0.64	0	0	0	0	0	1.26	2.64	25.24
1997	3.60	4.46	6.82	5.35	0.53	0	0	0	0	0	0.67	1.97	23.39
1998	2.94	3.34	5.79	5.34	0.63	0	0	0	0	0	0.72	2.34	21.10
1999	3.65	4.15	6.59	5.13	0.49	0	0	0	0	0	0.84	2.33	23.18
2000	3.19	4.12	6.12	6.03	0.47	0	0	0	0	0	0.52	2.02	22.47
2001	2.97	3.76	5.87	5.45	0.54	0	0	0	0	0	0.88	2.63	22.11
AVG	3.16	4.04	6.30	5.89	1.03	0	0	0	0	0	0.74	2.01	23.17

BERMUDA GRASS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.26	3.94	6.61	7.86	10.07	10.97	10.77	9.62	8.34	5.87	3.74	2.42	82.48
1990	2.45	3.61	5.81	7.30	9.72	9.92	10.37	9.08	7.47	5.43	3.72	2.44	77.32
1991	1.98	3.31	4.71	6.86	8.72	9.00	9.45	9.09	7.03	5.74	3.48	1.90	71.28
1992	2.05	3.40	4.45	6.65	8.18	9.69	9.95	9.34	7.28	5.17	3.21	1.89	71.24
1993	1.74	3.14	5.43	7.15	9.04	10.19	10.26	9.75	7.87	5.83	3.34	2.44	76.17
1994	2.24	3.17	5.32	7.20	8.83	10.01	10.37	9.55	7.77	5.60	3.65	1.89	75.58
1995	1.99	3.54	5.38	7.50	8.83	10.16	10.17	9.67	8.35	5.85	3.38	2.16	76.99
1996	2.42	3.59	5.77	7.57	10.26	10.27	10.27	10.41	7.77	6.00	3.69	2.57	80.60
1997	2.41	3.75	5.92	7.10	9.22	10.42	10.17	9.73	7.00	5.76	3.27	2.29	77.04
1998	1.99	2.83	4.93	6.70	8.46	9.91	10.53	9.63	7.71	5.85	3.19	2.69	74.41
1999	2.43	3.50	5.64	6.54	8.86	9.64	9.66	9.23	7.17	5.99	3.40	2.66	74.70
2000	2.11	3.48	5.22	7.74	9.42	9.60	10.17	9.18	7.52	5.07	3.09	2.30	74.89
2001	1.99	3.17	5.06	6.82	8.94	9.76	9.72	9.33	7.61	5.37	3.47	2.23	73.45
AVG	2.16	3.42	5.40	7.15	9.12	9.97	10.14	9.51	7.61	5.66	3.43	2.30	75.86

BERMUDA GRASS, SEED
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.08	3.46	3.75	6.82	8.95	7.39	7.58	8.39	7.34	2.89	3.22	2.32	64.20
1990	2.74	3.14	3.13	6.31	8.55	6.72	7.38	8.05	6.34	2.60	3.19	2.40	60.53
1991	2.15	2.83	3.01	5.89	7.68	6.73	6.71	8.03	5.61	2.70	2.94	1.94	56.21
1992	2.21	3.07	2.68	5.74	7.24	6.64	7.17	8.17	5.89	2.45	2.74	1.89	55.88
1993	2.05	2.83	2.69	6.21	8.03	7.04	7.22	8.51	6.90	2.90	2.78	2.45	59.60
1994	2.50	2.71	3.08	6.25	7.81	6.67	7.25	8.29	6.87	2.75	3.07	1.94	59.20
1995	2.22	3.05	3.14	6.50	7.85	6.47	7.23	8.44	7.15	2.85	2.87	2.08	59.85
1996	2.81	3.08	3.29	6.57	9.04	7.48	7.33	8.96	6.80	2.92	3.16	2.39	63.82
1997	2.86	3.23	3.24	6.17	8.16	7.11	7.20	8.44	6.09	2.78	2.95	2.11	60.32
1998	2.29	2.41	2.80	5.95	7.44	6.66	7.51	8.41	6.57	2.86	2.71	2.62	58.23
1999	2.80	2.96	3.40	5.81	7.80	6.15	7.00	8.17	5.78	2.75	2.86	2.48	57.95
2000	2.52	2.93	2.93	6.78	8.31	6.97	7.24	8.03	6.14	2.33	2.60	2.32	59.08
2001	2.12	2.70	3.07	5.93	7.90	6.95	7.05	8.20	6.11	3.37	3.03	1.87	58.30
AVG	2.41	2.95	3.09	6.23	8.06	6.84	7.22	8.31	6.43	2.78	2.93	2.22	59.48

CORN, FIELD
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.49	2.17	7.34	9.54	4.64	0	0	0	0	0	0	0	24.18
1990	0.92	2.19	6.55	8.89	8.76	0.28	0.00	0.00	0	0	0	0	27.59
1991	0.22	1.46	3.86	8.32	10.35	4.34	0.00	0.00	0	0	0	0	28.54
1992	0.40	1.53	3.73	8.04	9.95	7.97	0.14	0.00	0	0	0	0	31.77
1993	0.00	0.53	3.10	8.30	9.94	1.32	0	0	0	0	0	0	23.19
1994	0.77	1.78	5.67	8.75	9.00	1.45	0	0	0	0	0	0	27.41
1995	0.78	1.93	5.69	9.17	9.78	2.86	0	0	0	0	0	0	30.21
1996	0.86	1.88	5.94	9.26	11.62	3.24	0	0	0	0	0	0	32.79
1997	0.51	1.82	5.91	8.66	9.70	1.54	0	0	0	0	0	0	28.15
1998	0.44	1.38	4.90	8.17	8.93	1.41	0	0	0	0	0	0	25.22
1999	0.51	1.71	5.55	7.97	9.16	1.04	0	0	0	0	0	0	25.95
2000	0.45	1.71	5.40	9.44	9.72	1.61	0	0	0	0	0	0	28.33
2001	0.44	1.51	5.14	8.33	9.41	1.32	0	0	0	0	0	0	26.14
AVG	0.52	1.66	5.29	8.68	9.31	2.18	0.011	0	0	0	0	0	27.65

COTTON
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	1.17	2.16	4.59	9.06	12.89	11.62	3.80	0.06	0	0	45.36
1990	0	0	0.81	1.77	3.39	6.30	10.46	11.06	5.33	0.61	0.04	0	39.77
1991	0	0	0.32	1.40	3.19	6.57	10.83	11.14	3.54	0.14	0	0	37.13
1992	0	0	0.31	1.61	3.11	7.20	11.58	11.32	5.72	0.06	0	0	40.90
1993	0	0	1.08	1.90	3.93	7.71	11.73	11.97	5.71	0.28	0	0	44.31
1994	0	0	0.99	1.68	3.31	6.60	10.64	11.63	5.18	0.23	0.06	0	40.33
1995	0	0	0.75	1.43	3.05	7.05	11.27	11.82	5.35	0.22	0	0	40.94
1996	0	0	1.20	2.10	4.42	7.90	11.90	12.77	5.55	0.24	0	0	46.08
1997	0	0	0.80	1.79	3.81	7.59	11.59	11.96	6.08	0.77	0	0	44.39
1998	0	0	0.30	1.33	2.13	5.57	9.91	11.62	5.78	0.27	0.02	0	36.93
1999	0	0	0.74	1.56	3.12	5.57	9.08	11.08	4.62	0.43	0.03	0	36.22
2000	0	0	0.18	1.85	2.97	5.23	9.51	11.05	4.03	0.21	0.03	0	35.06
2001	0	0	0.00	1.13	1.79	4.35	7.86	10.52	6.25	0.29	0.03	0	32.22
AVG	0	0	0.67	1.67	3.29	6.67	10.71	11.50	5.15	0.29	0.02	0	39.97

KLEIN GRASS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.24	3.88	6.50	7.69	9.85	10.80	10.66	9.37	8.20	5.77	3.69	2.25	80.91
1990	2.41	3.57	5.70	7.17	9.53	9.78	10.21	8.94	7.32	5.35	3.67	2.39	76.04
1991	1.97	3.27	4.63	6.74	8.59	8.85	9.27	8.89	6.90	5.64	3.43	1.88	70.05
1992	2.05	3.32	4.42	6.49	8.05	9.58	9.87	9.17	7.14	5.14	3.16	1.81	70.18
1993	1.72	3.12	5.35	7.00	8.89	10.06	10.09	9.61	7.73	5.74	3.30	2.44	75.04
1994	2.23	3.12	5.25	7.04	8.68	9.77	10.27	9.37	7.71	5.45	3.60	1.90	74.39
1995	1.96	3.49	5.25	7.36	8.76	9.91	10.04	9.41	8.26	5.76	3.32	2.13	75.66
1996	2.37	3.53	5.70	7.49	10.04	10.10	10.11	10.22	7.67	5.89	3.64	2.56	79.31
1997	2.36	3.69	5.85	7.00	9.01	10.26	10.05	9.59	6.91	5.66	3.22	2.30	75.90
1998	1.92	2.84	4.83	6.57	8.33	9.75	10.36	9.50	7.57	5.77	3.17	2.53	73.14
1999	2.36	3.44	5.57	6.40	8.72	9.48	9.46	9.07	7.04	5.90	3.36	2.62	73.41
2000	2.08	3.43	5.16	7.59	9.28	9.44	10.00	9.03	7.41	4.98	3.03	2.29	73.74
2001	1.95	3.12	5.00	6.70	8.76	9.61	9.51	9.19	7.50	5.31	3.40	2.16	72.20
AVG	2.13	3.37	5.32	7.02	8.96	9.80	9.99	9.34	7.49	5.57	3.38	2.25	74.61

RYE GRASS & SEED
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.51	3.56	5.93	7.10	3.88	0.10	0	0	0.03	2.44	3.06	2.37	29.98
1990	2.81	3.25	5.22	6.53	4.87	0.40	0	0	0	0.00	1.36	2.18	26.62
1991	2.23	2.98	4.25	6.17	4.22	0.25	0	0	0	0.62	2.10	1.83	24.65
1992	2.33	3.05	4.01	5.74	2.04	0.05	0	0	0	0.43	1.82	1.84	21.30
1993	1.95	2.82	4.89	6.35	2.54	0.08	0	0	0	0.92	2.15	2.42	24.11
1994	2.59	2.86	4.78	6.45	4.24	0.36	0	0	0.00	1.23	2.62	1.84	26.95
1995	2.28	3.18	4.83	6.41	1.85	0.05	0	0	0.03	2.32	2.78	2.11	25.86
1996	2.78	3.23	5.20	6.33	1.65	0.02	0	0	0	1.97	2.93	2.51	26.61
1997	2.73	3.39	5.31	6.28	2.48	0.04	0	0	0	1.21	2.22	2.25	25.90
1998	2.24	2.54	4.45	5.94	2.53	0.14	0	0	0	1.01	2.19	2.63	23.66
1999	2.78	3.15	5.08	5.83	2.79	0.11	0	0	0	1.12	2.36	2.61	25.81
2000	2.43	3.12	4.74	6.93	3.78	0.14	0	0	0	0.87	2.12	2.24	26.37
2001	2.26	2.85	4.53	6.12	4.09	0.18	0	0	0	1.81	3.14	2.01	26.98
AVG	2.38	3.07	4.86	6.32	3.15	0.15	0	0	0.005	1.23	2.37	2.22	25.75

SUDAN GRASS, NOV-OCT, KC AVERAGE CUTTING EFFECT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.53	3.48	6.13	7.32	9.37	10.30	10.05	8.96	7.77	3.86	1.70	2.11	72.58
1990	2.90	3.35	5.40	6.79	9.06	9.26	9.67	8.46	6.95	4.26	1.70	2.17	69.96
1991	2.31	3.07	4.40	6.38	8.14	8.40	8.79	8.46	6.54	3.51	1.62	1.65	63.25
1992	2.41	3.15	4.15	6.18	7.63	9.09	9.27	8.66	6.77	4.21	1.51	1.68	64.70
1993	2.01	2.91	5.05	6.64	8.44	9.48	9.58	9.09	7.33	3.82	1.50	2.18	68.02
1994	2.67	2.95	4.94	6.68	8.22	9.35	9.70	8.87	7.26	2.90	1.58	1.64	66.76
1995	2.36	3.29	4.99	7.00	8.29	9.43	9.55	8.97	7.81	3.74	1.54	1.89	68.85
1996	2.88	3.34	5.37	7.06	9.54	9.60	9.63	9.70	7.27	4.19	1.71	2.24	72.52
1997	2.82	3.50	5.49	6.61	8.60	9.70	9.50	9.09	6.51	3.65	1.44	2.03	68.92
1998	2.31	2.62	4.60	6.24	7.89	9.23	9.79	8.99	7.17	3.58	1.45	2.36	66.22
1999	2.87	3.25	5.25	6.07	8.27	8.97	9.03	8.61	6.66	3.93	1.55	2.35	66.81
2000	2.51	3.22	4.89	7.19	8.79	8.99	9.47	8.54	7.01	4.01	1.46	2.03	68.11
2001	2.34	2.95	4.68	6.36	8.35	9.09	9.05	8.72	7.11	3.56	2.73	1.89	66.82
AVG	2.46	3.16	5.03	6.66	8.51	9.30	9.47	8.85	7.09	3.79	1.65	2.02	67.96

SUDAN GRASS, APR-OCT, KC AVERAGE CUTTING EFFECT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	1.82	7.84	10.62	10.39	9.25	8.03	3.94	0	0	51.89
1990	0	0	0	1.70	7.52	9.53	10.00	8.72	7.18	3.44	0	0	48.08
1991	0	0	0	1.67	6.80	8.68	9.06	8.72	6.73	4.08	0	0	45.74
1992	0	0	0	1.67	6.34	9.38	9.57	8.95	6.99	4.18	0	0	47.09
1993	0	0	0	1.79	7.02	9.78	9.88	9.37	7.55	4.01	0	0	49.40
1994	0	0	0	1.75	6.80	9.64	10.00	9.16	7.49	3.27	0	0	48.10
1995	0	0	0	1.89	6.87	9.74	9.87	9.25	8.05	3.27	0	0	48.95
1996	0	0	0	1.70	7.86	9.89	9.90	10.02	7.48	4.37	0	0	51.21
1997	0	0	0	1.69	7.16	10.00	9.84	9.37	6.71	4.08	0	0	48.85
1998	0	0	0	1.66	6.50	9.52	10.12	9.27	7.40	4.44	0	0	48.91
1999	0	0	0	1.55	6.92	9.24	9.32	8.90	6.88	4.05	0	0	46.86
2000	0	0	0	1.77	7.27	9.29	9.78	8.83	7.22	3.62	0	0	47.78
2001	0	0	0	1.59	6.93	9.39	9.35	9.01	7.34	3.58	0	0	47.18
AVG	0	0	0	1.71	7.06	9.59	9.77	9.14	7.31	3.87	0	0	48.46

SUDAN GRASS, MAY-AUG, KC AVERAGE CUTTING EFFECT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	1.95	8.69	10.49	3.13	0	0	0	0	24.25
1990	0	0	0	0	1.83	7.78	10.08	4.79	0	0	0	0	24.48
1991	0	0	0	0	1.79	7.15	9.16	5.29	0	0	0	0	23.38
1992	0	0	0	0	1.68	7.65	9.65	4.63	0	0	0	0	23.61
1993	0	0	0	0	1.87	7.98	9.95	3.94	0	0	0	0	23.74
1994	0	0	0	0	1.74	7.82	10.13	4.52	0	0	0	0	24.22
1995	0	0	0	0	1.81	7.88	9.97	4.58	0	0	0	0	24.24
1996	0	0	0	0	1.91	8.01	10.00	4.20	0	0	0	0	24.11
1997	0	0	0	0	1.79	8.18	9.90	4.39	0	0	0	0	24.26
1998	0	0	0	0	1.73	7.82	10.21	4.68	0	0	0	0	24.45
1999	0	0	0	0	1.74	7.63	9.42	5.15	0	0	0	0	23.94
2000	0	0	0	0	1.84	7.37	9.85	4.76	0	0	0	0	23.82
2001	0	0	0	0	1.70	7.50	9.42	5.15	0	0	0	0	23.77
AVG	0	0	0	0	1.80	7.80	9.86	4.56	0	0	0	0	24.02

SUGAR BEETS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	3.25	4.66	7.69	9.09	9.55	3.84	0	0	1.09	2.05	2.89	3.05	47.17
1990	3.80	4.36	6.96	8.34	9.31	3.25	0	0	0	0.57	1.28	2.24	40.10
1991	2.88	3.97	5.74	8.20	9.02	3.82	0	0	0	0.88	1.64	1.91	38.06
1992	3.11	4.15	5.37	7.79	8.07	2.95	0	0	0.19	1.06	1.90	2.18	36.77
1993	2.66	3.74	6.58	8.34	8.98	3.38	0	0	0.23	1.27	2.06	2.83	40.06
1994	3.47	3.89	6.37	8.32	8.26	3.03	0	0	0.30	1.24	2.31	2.13	39.31
1995	3.14	4.23	6.49	8.61	8.41	2.96	0	0	0.34	1.29	2.15	2.46	40.08
1996	3.71	4.34	6.97	8.73	9.80	3.19	0	0	1.09	2.35	3.01	3.26	46.45
1997	3.75	4.54	7.05	8.00	8.53	2.02	0	0	0.47	1.38	2.15	2.66	40.55
1998	3.04	3.39	6.00	7.79	8.22	3.66	0	0	1.11	2.18	2.47	3.42	41.28
1999	3.75	4.18	6.81	7.61	8.81	4.99	0	0	0.59	1.68	2.42	3.31	44.14
2000	3.25	4.17	6.37	8.83	8.94	2.99	0	0	0.64	1.40	2.19	2.75	41.52
2001	3.01	3.86	6.06	7.92	8.72	3.61	0	0	0.24	3.85	4.26	2.52	44.05
AVG	3.29	4.11	6.50	8.27	8.82	3.36	0	0	0.48	1.63	2.36	2.67	41.50

WHEAT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.59	3.78	7.28	8.55	3.02	0.00	0	0	0	0	0	0.05	24.27
1990	1.81	3.30	6.50	8.32	8.56	0.94	0	0	0	0	0	0.37	29.81
1991	1.67	3.24	5.35	7.68	9.03	2.48	0	0	0	0	0	0.38	29.84
1992	1.81	3.57	5.00	7.52	5.94	0.45	0	0	0	0	0	0.11	24.39
1993	1.37	3.05	6.13	8.07	6.81	0.33	0	0	0	0	0	0.34	26.09
1994	1.99	3.29	6.00	8.11	5.34	0.29	0	0	0	0	0	0.34	25.36
1995	3.64	3.80	6.09	8.47	5.15	0.15	0	0	0	0	0	0.39	27.70
1996	3.95	3.84	6.52	8.47	6.09	0.08	0	0	0	0	0	0.20	29.14
1997	2.09	3.78	6.69	8.03	6.34	0.41	0	0	0	0	0	0.24	27.58
1998	1.60	2.74	5.61	7.55	8.49	1.78	0	0	0	0	0	0.49	28.25
1999	2.17	3.54	6.41	7.43	8.38	1.46	0	0	0	0	0	0.18	29.56
2000	1.72	3.37	5.95	8.79	8.08	0.89	0	0	0	0	0	0.17	28.98
2001	1.60	3.02	5.66	7.69	8.80	1.70	0	0	0	0	0	0.16	28.62
AVG	2.08	3.41	6.09	8.05	6.93	0.84	0	0	0	0	0	0.26	27.66

MISCELLANEOUS FIELD CROPS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.26	3.99	6.64	7.96	10.17	11.16	10.90	9.70	8.43	5.91	3.78	2.44	83.33
1990	2.47	3.64	5.85	7.36	9.84	10.03	10.47	9.19	7.54	5.46	3.75	2.44	78.04
1991	1.98	3.34	4.77	6.93	8.82	9.09	9.53	9.17	7.09	5.80	3.50	1.90	71.91
1992	2.06	3.41	4.50	6.70	8.26	9.85	10.09	9.41	7.35	5.23	3.24	1.90	71.99
1993	1.74	3.15	5.48	7.21	9.17	10.29	10.40	9.86	7.94	5.91	3.37	2.49	77.00
1994	2.28	3.20	5.36	7.25	8.88	10.15	10.49	9.63	7.88	5.63	3.68	1.90	76.33
1995	2.00	3.56	5.42	7.59	8.98	10.21	10.37	9.74	8.46	5.91	3.40	2.15	77.78
1996	2.41	3.62	5.82	7.65	10.34	10.39	10.42	10.50	7.87	6.08	3.72	2.60	81.41
1997	2.41	3.79	5.95	7.17	9.32	10.51	10.30	9.84	7.05	5.82	3.30	2.29	77.76
1998	1.99	2.84	4.99	6.76	8.55	10.03	10.60	9.76	7.79	5.88	3.23	2.69	75.10
1999	2.43	3.53	5.69	6.59	8.95	9.72	9.79	9.33	7.22	6.05	3.43	2.61	75.34
2000	2.11	3.49	5.31	7.81	9.52	9.75	10.26	9.28	7.59	5.12	3.10	2.30	75.63
2001	2.01	3.20	5.07	6.90	9.05	9.87	9.84	9.45	7.71	5.43	3.49	2.26	74.26
AVG	2.17	3.44	5.45	7.22	9.22	10.08	10.27	9.60	7.69	5.71	3.46	2.31	76.61

ARTICHOKES
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.39	3.99	6.66	7.99	10.22	11.21	8.40	0	0.69	5.09	3.99	2.78	63.41
1990	3.30	3.82	6.15	7.75	10.35	10.60	8.90	0	0.63	4.74	3.96	2.81	63.00
1991	2.63	3.50	5.01	7.28	9.30	9.60	8.26	0	0.59	5.00	3.70	2.17	57.04
1992	2.74	3.59	4.72	7.05	8.70	10.39	8.23	0	0.58	4.41	3.42	2.17	55.99
1993	2.29	3.31	5.76	7.59	9.65	10.85	8.79	0	0.64	5.08	3.55	2.85	60.36
1994	3.04	3.36	5.63	7.62	9.39	10.69	9.04	0	0.63	4.79	3.88	2.17	60.23
1995	2.69	3.75	5.69	7.99	9.46	10.79	7.97	0	0.68	5.06	3.59	2.48	60.16
1996	3.28	3.80	6.12	8.07	10.91	10.96	8.76	0	0.62	5.24	3.93	2.96	64.64
1997	3.21	3.98	6.26	7.54	9.83	11.09	8.78	0	0.55	5.02	3.48	2.64	62.38
1998	2.63	2.98	5.25	7.12	9.01	10.56	8.99	0	0.64	5.06	3.41	3.09	58.74
1999	3.27	3.71	5.98	6.94	9.44	10.25	8.20	0	0.60	5.15	3.62	3.07	60.22
2000	2.86	3.67	5.57	8.23	10.03	10.30	8.50	0	0.60	4.35	3.28	2.63	60.02
2001	2.66	3.36	5.34	7.25	9.55	10.40	8.22	0	4.43	5.70	3.69	2.57	63.17
AVG	2.84	3.60	5.70	7.57	9.68	10.59	8.54	0	0.91	4.98	3.65	2.65	60.72

BROCCILI
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.839	1.519	0	0	0	0	0	0	0.478	1.383	2.235	2.750	11.203
1990	3.292	0.000	0	0	0	0	0	0	0.000	0.714	1.166	2.332	7.503
1991	2.673	1.368	0	0	0	0	0	0	0.145	1.312	1.445	1.515	8.457
1992	1.425	0.732	0	0	0	0	0	0	0.000	1.130	1.144	1.792	6.224
1993	2.330	2.897	0	0	0	0	0	0	0.000	1.336	1.221	2.375	10.158
1994	3.099	2.542	0	0	0	0	0	0	0.553	1.319	2.042	2.100	11.655
1995	2.727	1.214	0	0	0	0	0	0	0.445	1.368	1.942	2.453	10.149
1996	3.296	0.204	0	0	0	0	0	0	0.000	1.177	1.531	2.683	8.890
1997	3.255	0.740	0	0	0	0	0	0	0.050	1.315	1.340	2.402	9.103
1998	2.679	1.094	0	0	0	0	0	0	0.049	1.329	1.326	2.804	9.281
1999	3.326	1.264	0	0	0	0	0	0	0.046	1.366	1.445	2.784	10.231
2000	2.907	1.383	0	0	0	0	0	0	0.000	1.114	0.899	1.787	8.090
2001	2.661	3.417	2.197	0	0	0	0	0	0.034	1.311	2.859	2.607	15.086
AVG	2.808	1.413	0.169	0	0	0	0	0	0.138	1.244	1.584	2.337	9.695

CABBAGE, ALL
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.97	3.39	0.00	0	0	0	0	0	0.48	1.11	1.75	2.45	12.14
1990	3.36	2.55	0.00	0	0	0	0	0	0.34	1.02	1.34	2.20	10.80
1991	2.67	3.55	1.07	0	0	0	0	0	0.84	1.13	1.73	1.83	12.82
1992	2.80	3.63	0.96	0	0	0	0	0	0.83	0.98	1.08	1.27	11.54
1993	2.21	2.76	0.52	0	0	0	0	0	0.34	1.10	1.29	2.29	10.50
1994	3.10	3.38	0.73	0	0	0	0	0	0.00	1.05	1.00	1.39	10.66
1995	2.68	3.81	2.77	0	0	0	0	0	0.98	1.26	2.01	2.39	15.90
1996	3.34	1.66	0.00	0	0	0	0	0	1.78	0.26	0.15	0.07	7.26
1997	3.11	3.74	0.71	0	0	0	0	0	2.75	1.19	0.08	0.36	11.92
1998	2.53	2.80	0.68	0	0	0	0	0	2.24	0.34	0.05	0.16	8.79
1999	3.11	3.47	0.89	0	0	0	0	0	2.38	0.57	0.04	0.02	10.47
2000	2.70	3.45	0.60	0	0	0	0	0	2.46	0.54	0.08	0.02	9.85
2001	2.55	3.16	0.57	0	0	0	0	0	0.61	1.64	3.19	2.61	14.33
AVG	2.86	3.18	0.73	0	0	0	0	0	1.23	0.94	1.06	1.31	11.31

CARROTS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.97	4.15	6.93	8.09	3.03	0	0	0	0	0.15	1.01	1.61	27.92
1990	3.26	3.89	4.19	7.49	1.41	0	0	0	0	0.13	0.97	1.42	22.77
1991	2.49	3.57	4.81	7.27	3.49	0	0	0	0	0.98	1.39	1.73	25.73
1992	2.80	3.65	4.59	6.84	0.49	0	0	0	0	1.01	1.29	1.84	22.51
1993	2.33	3.37	4.16	6.28	0	0	0	0	0	1.00	1.36	2.48	20.99
1994	3.10	3.42	4.56	3.36	0	0	0	0	0	0.61	1.25	1.69	17.99
1995	2.74	3.82	4.21	4.32	0	0	0	0	0	0.79	1.21	2.00	19.08
1996	3.34	3.87	4.44	4.58	0	0	0	0	0	0.77	1.26	2.22	20.48
1997	3.27	4.06	4.04	5.92	0	0	0	0	0	0.89	1.16	2.11	21.45
1998	4.22	3.04	4.80	5.72	0	0	0	0	0	0.91	1.15	2.46	22.30
1999	4.63	3.78	4.33	5.67	0	0	0	0	0	0.91	1.24	2.44	22.98
2000	2.91	3.74	4.22	6.49	0	0	0	0	0	0.74	1.11	2.12	21.32
2001	2.71	3.42	4.49	5.75	0	0	0	0	0	1.03	3.35	2.60	23.35
AVG	3.14	3.68	4.60	5.98	0.65	0	0	0	0	0.76	1.37	2.05	22.22

CAULIFLOWER
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.95	0.34	0	0	0	0	0	0	0.73	1.35	2.95	2.86	10.17
1990	1.96	0.00	0	0	0	0	0	0	0.49	0.83	1.83	2.63	7.73
1991	4.22	2.19	0	0	0	0	0	0	0.00	0.80	1.04	1.62	9.86
1992	4.21	3.45	0	0	0	0	0	0	0.18	0.72	1.36	1.99	11.91
1993	3.88	1.57	0	0	0	0	0	0	0.19	0.85	1.76	2.81	11.05
1994	4.30	0.00	0	0	0	0	0	0	0.18	0.82	1.93	2.14	9.36
1995	4.18	0.00	0	0	0	0	0	0	0.27	0.81	1.13	1.97	8.37
1996	4.81	3.83	0	0	0	0	0	0	0.39	0.93	2.05	2.88	15.21
1997	3.27	0.65	0	0	0	0	0	0	0.35	0.88	1.75	2.59	9.49
1998	2.68	0.51	0	0	0	0	0	0	0.41	0.91	1.73	3.03	9.27
1999	3.34	0.52	0	0	0	0	0	0	0.35	0.93	1.88	2.99	10.00
2000	2.92	0.61	0	0	0	0	0	0	0.40	0.79	1.68	2.58	8.97
2001	2.71	0.74	0	0	0	0	0	0	0.06	0.94	2.79	2.63	9.88
AVG	3.42	1.11	0	0	0	0	0	0	0.31	0.89	1.84	2.52	10.10

CORN, EAR
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.460	2.227	6.828	9.225	11.755	2.672	0	0	0	0	0	0	33.166
1990	0.925	2.542	6.512	8.537	11.257	0.625	0	0	0	0	0	0	30.397
1991	0.214	1.567	4.240	8.020	10.242	6.440	0	0	0	0	0	0	30.723
1992	0.394	1.749	4.173	7.764	9.567	11.126	0.296	0	0	0	0	0	35.068
1993	0.000	0.525	3.494	8.124	10.624	4.829	0	0	0	0	0	0	27.595
1994	0.765	2.088	5.806	8.398	10.302	2.810	0	0	0	0	0	0	30.168
1995	0.776	2.319	5.894	8.792	10.403	4.591	0	0	0	0	0	0	32.776
1996	0.808	2.248	6.210	8.883	11.983	6.083	0	0	0	0	0	0	36.216
1997	0.500	2.101	6.156	8.308	10.787	2.659	0	0	0	0	0	0	30.511
1998	0.438	1.582	5.118	7.840	9.898	2.381	0	0	0	0	0	0	27.257
1999	0.449	1.975	5.808	7.642	10.357	2.408	0	0	0	0	0	0	28.641
2000	0.456	1.958	5.578	9.047	11.010	3.251	0	0	0	0	0	0	31.300
2001	0.434	1.708	5.323	7.993	10.473	2.667	0	0	0	0	0	0	28.599
AVG	0.509	1.891	5.472	8.352	10.666	4.042	0.023	0	0	0	0	0	30.955

Not corrected

LETTUCE, ALL
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.67	2.80	0.0	0	0	0	0	0	0	1.02	3.01	0.58	9.09
1990	1.96	3.54	0.12	0	0	0	0	0	0	0.91	2.93	0.57	10.03
1991	1.57	3.25	0	0	0	0	0	0	0	1.09	2.47	1.41	9.80
1992	2.06	1.62	0	0	0	0	0	0	0	0.87	2.03	1.55	8.12
1993	1.55	2.32	0	0	0	0	0	0	0	0.95	2.15	1.90	8.87
1994	2.26	1.44	0	0	0	0	0	0	0	0.74	1.96	1.70	8.11
1995	1.69	2.85	0	0	0	0	0	0	0	0.60	1.68	1.95	8.76
1996	2.13	2.36	0	0	0	0	0	0	0	0.73	1.91	2.33	9.45
1997	2.08	2.85	0	0	0	0	0	0	0	0.84	1.78	1.95	9.51
1998	1.73	2.05	0	0	0	0	0	0	0	0.65	1.62	2.36	8.41
1999	1.79	3.34	2.13	0	0	0	0	0	0	0.66	1.77	2.24	11.93
2000	1.76	3.11	0	0	0	0	0	0	0	0.44	1.52	1.23	8.07
2001	1.57	1.58	0.09	0	0	0	0	0	0	0.39	1.31	1.72	6.67
AVG	1.83	2.55	0.18	0	0	0	0	0	0	0.76	2.01	1.65	8.98

CANTLOUPE, FALL
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	0	0	0	0.12	1.67	3.35	3.29	2.09	10.52
1990	0	0	0	0	0	0	0	1.45	4.43	4.78	1.62	0.00	12.28
1991	0	0	0	0	0	0	0	0.38	2.96	4.88	1.72	0.00	9.94
1992	0	0	0	0	0	0	0	2.42	5.79	2.97	0.00	0.00	11.18
1993	0	0	0	0	0	0	0	0	0.00	0.41	1.70	2.34	4.45
1994	0.67	0	0	0	0	0	0	0	0.92	2.78	3.12	1.65	9.13
1995	0	0	0	0	0	0	0	0	0.62	2.52	2.83	1.89	7.85
1996	0	0	0	0	0	0	0	0.70	2.74	4.34	3.29	1.71	12.77
1997	0	0	0	0	0	0	0	0.13	1.39	3.28	2.86	1.98	9.64
1998	0	0	0	0	0	0	0	0.12	1.56	3.33	2.81	2.32	10.15
1999	0	0	0	0	0	0	0	0.13	1.42	3.41	2.99	2.30	10.24
2000	0	0	0	0	0	0	0	0.10	1.52	2.88	2.71	1.96	9.16
2001	0	0	0	0	0	0	0	0.12	1.52	3.09	3.05	1.96	9.73
AVG	0.05	0	0	0	0	0	0	0.44	2.04	3.23	2.46	1.55	9.77

CANTLOUPE, SPRING
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0.50	2.27	6.21	8.11	0.00	0	0	0	0	0	0	17.09
1990	0.02	0.50	1.33	4.37	8.29	8.46	1.20	0	0	0	0	0	24.16
1991	0	0.31	0.83	3.63	7.37	7.59	0.69	0	0	0	0	0	20.42
1992	0	0.37	1.16	4.79	7.07	2.35	0	0	0	0	0	0	15.74
1993	0	0.22	0.90	3.86	7.73	6.49	0	0	0	0	0	0	19.19
1994	0	0.37	1.15	4.33	7.60	6.76	0	0	0	0	0	0	20.20
1995	0	0.32	1.05	4.44	7.64	5.88	0	0	0	0	0	0	19.33
1996	0	0.41	1.36	4.87	8.86	5.84	0	0	0	0	0	0	21.35
1997	0	0.43	1.34	4.56	7.99	5.61	0	0	0	0	0	0	19.93
1998	0	0.32	1.11	4.28	7.32	5.27	0	0	0	0	0	0	18.30
1999	0	0.42	1.26	4.18	7.67	5.23	0	0	0	0	0	0	18.75
2000	0	0.40	1.28	4.95	8.15	5.70	0	0	0	0	0	0	20.47
2001	0	0.34	1.20	4.33	7.76	5.59	0	0	0	0	0	0	19.21
AVG	0.00	0.38	1.25	4.52	7.81	5.44	0.15	0	0	0	0	0	19.55

MELONS, SPRINGS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0.64	5.69	8.36	8.83	0.00	0	0	0	0	0	0	23.52
1990	0.02	0.53	3.89	7.75	10.25	9.03	1.39	0	0	0	0	0	32.86
1991	0	0.31	2.05	7.19	9.21	8.09	0.82	0	0	0	0	0	27.66
1992	0	0.38	3.22	7.05	8.01	2.55	0	0	0	0	0	0	21.21
1993	0	0.22	2.40	7.52	9.44	6.96	0	0	0	0	0	0	26.53
1994	0	0.37	3.22	7.62	9.14	7.17	0	0	0	0	0	0	27.52
1995	0	0.32	2.93	7.99	9.20	6.25	0	0	0	0	0	0	26.68
1996	0.02	0.57	4.50	8.07	10.48	6.48	0	0	0	0	0	0	30.11
1997	0	0.43	3.74	7.54	9.48	6.00	0	0	0	0	0	0	27.20
1998	0	0.32	3.05	7.12	8.70	5.65	0	0	0	0	0	0	24.82
1999	0	0.42	3.44	6.94	9.09	5.59	0	0	0	0	0	0	25.48
2000	0	0.40	3.57	8.23	9.63	6.03	0	0	0	0	0	0	27.85
2001	0	0.34	3.36	7.25	9.21	5.95	0	0	0	0	0	0	26.10
AVG	0.00	0.40	3.46	7.59	9.28	5.83	0.17	0	0	0	0	0	26.73

MELONS, FALL
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	0	0	0	0.65	4.49	6.32	4.10	2.56	18.11
1990	0	0	0	0	0	0	0	1.21	6.87	5.89	2.04	0.00	16.02
1991	0	0	0	0	0	0	0	0.28	4.22	6.27	2.16	0.00	12.94
1992	0	0	0	0	0	0	0.02	2.92	7.90	3.68	0.00	0.00	14.52
1993	0	0	0	0	0	0	0	0.00	0.00	0.26	2.58	2.91	5.75
1994	0.85	0	0	0	0	0	0	0.00	0.63	4.14	3.99	2.06	11.67
1995	0.0	0	0	0	0	0	0	0.00	0.38	3.55	3.69	2.36	9.98
1996	0.0	0	0	0	0	0	0	0.49	3.51	6.48	4.04	2.16	16.68
1997	0.0	0	0	0	0	0	0	0.13	1.09	5.22	3.58	2.47	12.49
1998	0.0	0	0	0	0	0	0	0.12	1.26	5.27	3.51	2.90	13.05
1999	0.0	0	0	0	0	0	0	0.13	1.16	5.38	3.72	2.86	13.25
2000	0.0	0	0	0	0	0	0	0.10	1.23	4.54	3.37	2.44	11.68
2001	0.0	0	0	0	0	0	0	0.12	1.24	4.88	3.79	2.44	12.48
AVG	0.07	0	0	0	0	0	0.00	0.47	2.61	4.76	3.12	1.94	12.97

WATERMELON, ALL
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.10	1.28	5.82	7.99	10.05	2.08	0	0	0	0	0	0	27.32
1990	0.10	0.92	4.50	7.39	9.87	8.42	0	0	0	0	0	0	31.19
1991	0.00	0.51	2.86	6.88	8.87	8.73	0.83	0	0	0	0	0	28.68
1992	0.01	0.85	3.59	6.72	8.28	3.62	0	0	0	0	0	0	23.08
1993	0.00	0.20	2.33	6.90	9.20	8.98	0	0	0	0	0	0	27.61
1994	0.02	0.63	3.55	7.24	8.95	9.74	1	0	0	0	0	0	31.02
1995	0.47	2.11	5.27	7.62	9.01	5.97	0	0	0	0	0	0	30.45
1996	0.05	0.91	4.57	2.34	0.24	0.01	0	0	0	0	0	0	8.11
1997	0.00	0.74	4.33	7.19	9.37	7.24	0	0	0	0	0	0	28.88
1998	0.00	0.60	3.57	6.78	8.59	6.84	0	0	0	0	0	0	26.38
1999	0.00	0.75	4.05	6.61	9.00	6.67	0	0	0	0	0	0	27.07
2000	0.00	0.72	3.94	7.84	9.56	7.22	0	0	0	0	0	0	29.29
2001	0.00	0.62	3.80	6.92	9.10	7.04	0	0	0	0	0	0	27.47
AVG	0.06	0.83	4.01	6.80	8.47	6.35	0.13	0	0	0	0	0	26.66

ONIONS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.76	3.47	5.86	0.04	0.00	0.00	0	0	0	0.17	0.08	0.96	12.33
1990	2.91	3.93	6.32	7.70	8.77	1.04	0	0	0	0.00	0.61	0.82	32.10
1991	1.64	3.33	5.15	7.47	8.45	2.75	0	0	0	0.64	0.94	1.01	31.37
1992	2.28	3.68	4.85	7.05	7.39	0.72	0	0	0	0.76	0.91	1.18	28.81
1993	2.05	3.40	5.92	7.45	7.39	0.00	0	0	0	0.45	0.89	1.31	28.87
1994	2.53	3.45	5.79	7.58	7.83	0.00	0	0	0	0.57	0.99	1.04	29.76
1995	2.27	3.85	5.85	7.97	7.98	0.59	0	0	0	0.62	0.92	1.20	31.24
1996	2.76	3.91	6.29	8.01	9.12	0.00	0	0	0	0.61	1.00	1.39	33.08
1997	4.23	4.09	6.43	7.45	8.18	0.00	0	0	0	0.55	0.87	1.24	33.06
1998	3.74	3.06	5.39	7.09	7.62	0.56	0	0	0	0.54	0.85	1.45	30.29
1999	4.21	3.81	6.15	6.92	7.95	0.41	0	0	0	0.55	0.91	1.42	32.31
2000	2.35	3.77	5.73	8.22	8.46	0.55	0	0	0	0.46	0.82	1.25	31.60
2001	2.22	3.45	5.49	7.23	8.06	0.57	0	0	0	0.53	2.51	0.32	30.38
AVG	2.69	3.63	5.79	6.94	7.48	0.55	0	0	0	0.49	0.95	1.12	29.63

POTATOES
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.80	4.57	7.55	3.99	0	0	0	0	0	0.31	2.61	2.14	23.97
1990	3.47	4.18	6.38	2.82	0	0	0	0	0	0	0.00	0.41	17.26
1991	1.80	3.49	5.48	5.55	0	0	0	0	0	0	1.78	1.79	19.89
1992	3.00	3.42	0.41	0.00	0	0	0	0	0	0	0	1.11	7.94
1993	1.75	3.50	6.30	6.43	0.45	0	0	0	0	0	0	1.77	20.19
1994	2.53	3.65	6.14	4.99	0	0	0	0	0	0	0	0.96	18.26
1995	2.14	4.05	6.13	3.14	0	0	0	0	0	0	0	1.00	16.44
1996	2.53	4.09	6.56	3.04	0	0	0	0	0	0	0	1.81	18.03
1997	2.74	4.35	6.67	2.47	0	0	0	0	0	0	0	1.73	17.96
1998	2.30	3.26	5.60	2.41	0	0	0	0	0	0	0	2.03	15.59
1999	2.83	4.05	6.37	2.28	0	0	0	0	0	0	0	2.01	17.54
2000	2.47	4.00	5.93	3.16	0	0	0	0	0	0	0	1.72	17.28
2001	2.31	3.66	5.67	2.57	0	0	0	0	0	0	0	2.26	16.46
AVG	2.51	3.87	5.78	3.30	0.04	0	0	0	0	0.02	0.34	1.59	17.45

TOMATOES
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.48	2.67	6.89	9.16	10.94	2.22	0	0	0	0	0	0	32.36
1990	1.09	2.50	5.89	8.47	11.32	10.34	2.49	0	0	0	0	0	42.10
1991	0.18	2.06	4.28	7.96	10.15	8.11	0	0	0	0	0	0	32.73
1992	0.13	2.15	4.28	7.71	9.38	5.48	0	0	0	0	0	0	29.12
1993	0.16	1.96	4.96	8.29	10.53	9.11	0	0	0	0	0	0	35.01
1994	0.44	2.05	5.09	8.33	10.25	9.24	0.11	0	0	0	0	0	35.50
1995	0.28	2.22	4.91	8.71	10.34	10.43	1.71	0	0	0	0	0	38.60
1996	0.64	2.40	5.84	8.83	11.88	8.89	0	0	0	0	0	0	38.47
1997	0.51	2.42	5.73	8.25	10.71	8.63	0	0	0	0	0	0	36.25
1998	0.42	1.82	4.76	7.78	9.82	8.15	0	0	0	0	0	0	32.75
1999	0.41	2.26	5.42	7.59	10.28	7.95	0	0	0	0	0	0	33.90
2000	0.40	2.25	5.20	9.00	10.92	8.41	0	0	0	0	0	0	36.18
2001	0.36	2.02	4.95	7.93	10.40	8.36	0	0	0	0	0	0	34.03
AVG	0.42	2.21	5.25	8.31	10.53	8.10	0.33	0	0	0	0	0	35.15

MISCELLANEOUS VEGETABLES & VEGETABLE SEEDS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	1.60	6.28	9.16	11.72	11.07	0	0	0	0	0	0	39.82
1990	0	1.44	5.54	8.47	11.32	9.99	0	0	0	0	0	0	36.76
1991	0	1.31	4.44	7.96	10.17	9.00	0	0	0	0	0	0	32.87
1992	0	1.39	4.34	7.71	9.51	9.73	0	0	0	0	0	0	32.68
1993	0	1.25	5.19	8.30	10.56	10.20	0	0	0	0	0	0	35.49
1994	0	1.28	5.06	8.33	10.26	10.09	0	0	0	0	0	0	35.02
1995	0	1.41	5.16	8.74	10.34	10.16	0	0	0	0	0	0	35.80
1996	0	1.44	5.63	8.83	11.93	10.38	0	0	0	0	0	0	38.20
1997	0	1.50	5.68	8.25	10.75	10.38	0	0	0	0	0	0	36.55
1998	0	1.13	4.69	7.78	9.85	9.87	0	0	0	0	0	0	33.32
1999	0	1.40	5.31	7.59	10.32	9.60	0	0	0	0	0	0	34.22
2000	0	1.41	5.20	9.00	10.97	9.84	0	0	0	0	0	0	36.42
2001	0	1.24	4.95	7.93	10.44	9.89	0	0	0	0	0	0	34.45
AVG	0	1.37	5.19	8.31	10.63	10.01	0	0	0	0	0	0	35.51

MISCELANEOUS GARDEN CROPS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	1.60	6.28	9.16	11.72	11.07	0	0	0	0	0	0	39.82
1990	0	1.44	5.54	8.47	11.32	9.99	0	0	0	0	0	0	36.76
1991	0	1.31	4.44	7.96	10.17	9.00	0	0	0	0	0	0	32.87
1992	0	1.39	4.34	7.71	9.51	9.73	0	0	0	0	0	0	32.68
1993	0	1.25	5.19	8.30	10.56	10.20	0	0	0	0	0	0	35.49
1994	0	1.28	5.06	8.33	10.26	10.09	0	0	0	0	0	0	35.02
1995	0	1.41	5.16	8.74	10.34	10.16	0	0	0	0	0	0	35.80
1996	0	1.44	5.63	8.83	11.93	10.38	0	0	0	0	0	0	38.20
1997	0	1.50	5.68	8.25	10.75	10.38	0	0	0	0	0	0	36.55
1998	0	1.13	4.69	7.78	9.85	9.87	0	0	0	0	0	0	33.32
1999	0	1.40	5.31	7.59	10.32	9.60	0	0	0	0	0	0	34.22
2000	0	1.41	5.20	9.00	10.97	9.84	0	0	0	0	0	0	36.42
2001	0	1.24	4.95	7.93	10.44	9.89	0	0	0	0	0	0	34.45
AVG	0	1.37	5.19	8.31	10.63	10.01	0	0	0	0	0	0	35.51

ASPARAGUS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.39	1.92	3.20	4.06	8.09	10.24	10.01	8.90	7.44	4.43	2.27	1.27	63.21
1990	1.51	1.75	2.87	5.04	8.93	9.21	9.61	8.39	6.49	3.96	2.23	1.29	61.28
1991	1.20	1.60	2.33	4.66	8.02	8.34	8.73	8.37	6.10	4.22	2.06	0.99	56.64
1992	1.26	1.64	2.21	4.66	7.52	9.03	9.23	8.60	6.31	3.81	1.92	0.99	57.16
1993	1.05	1.52	2.68	4.90	8.32	9.43	9.53	9.02	6.85	4.30	2.00	1.30	60.89
1994	1.39	1.54	2.63	4.87	8.09	9.29	9.65	8.79	6.80	4.10	2.18	0.99	60.32
1995	1.23	1.72	2.66	5.15	8.15	9.38	9.50	8.90	7.28	4.31	2.01	1.14	61.41
1996	1.50	1.74	2.86	5.24	9.43	9.53	9.56	9.62	6.78	4.43	2.20	1.35	64.24
1997	1.47	1.82	2.92	4.90	8.48	9.64	9.46	9.00	6.08	4.24	1.97	1.21	61.19
1998	1.21	1.37	2.44	4.61	7.76	9.18	9.75	8.91	6.70	4.28	1.92	1.42	59.53
1999	1.50	1.70	2.79	4.50	8.14	8.91	8.99	8.54	6.23	4.41	2.03	1.40	59.12
2000	1.31	1.68	2.61	5.34	8.67	8.95	9.41	8.48	6.52	3.74	1.85	1.20	59.75
2001	1.22	1.54	2.50	4.68	8.23	9.04	8.99	8.64	6.64	3.95	2.07	1.69	59.17
AVG	1.33	1.66	2.67	4.82	8.29	9.25	9.42	8.78	6.63	4.17	2.06	1.25	60.30

CITRUS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.75	2.43	4.05	4.87	6.35	7.16	7.22	6.50	5.63	3.95	2.57	1.86	54.34
1990	1.91	2.21	3.56	4.50	6.13	6.43	6.95	6.14	5.04	3.64	2.55	1.89	50.95
1991	1.52	2.03	2.90	4.23	5.51	5.83	6.31	6.13	4.74	3.88	2.39	1.45	46.92
1992	1.59	2.08	2.74	4.10	5.16	6.31	6.66	6.29	4.91	3.49	2.20	1.46	46.97
1993	1.33	1.92	3.33	4.41	5.72	6.59	6.88	6.61	5.31	3.95	2.29	1.91	50.23
1994	1.76	1.95	3.26	4.42	5.56	6.49	6.96	6.43	5.27	3.76	2.50	1.45	49.81
1995	1.56	2.17	3.30	4.64	5.60	6.55	6.86	6.52	5.66	3.94	2.31	1.66	50.77
1996	1.90	2.20	3.54	4.69	6.46	6.65	6.90	7.04	5.27	4.06	2.53	1.98	53.22
1997	1.86	2.31	3.62	4.38	5.82	6.73	6.83	6.58	4.72	3.89	2.24	1.77	50.76
1998	1.52	1.73	3.04	4.13	5.33	6.41	7.04	6.52	5.20	3.93	2.20	2.07	49.13
1999	1.88	2.15	3.47	4.03	5.60	6.22	6.49	6.25	4.83	4.04	2.33	2.05	49.34
2000	1.66	2.13	3.23	4.78	5.94	6.25	6.80	6.21	5.08	3.42	2.11	1.76	49.35
2001	1.54	1.94	3.09	4.21	5.65	6.32	6.50	6.32	5.15	3.63	2.38	1.73	48.46
AVG	1.68	2.10	3.32	4.41	5.76	6.46	6.80	6.43	5.14	3.81	2.35	1.77	50.02

DATES
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.35	1.54	5.67	7.74	9.91	10.88	10.64	9.46	8.20	5.75	3.69	2.55	76.37
1990	0.38	1.40	5.00	7.17	9.57	9.80	10.22	8.95	7.34	5.31	3.66	2.60	71.38
1991	0.31	1.25	4.03	6.73	8.60	8.88	9.28	8.93	6.89	5.64	3.43	2.00	65.96
1992	0.32	1.37	3.89	6.52	8.04	9.59	9.81	9.17	7.15	5.08	3.16	2.01	66.11
1993	0.27	1.22	4.69	7.02	8.92	10.03	10.13	9.61	7.73	5.75	3.29	2.63	71.28
1994	0.35	1.27	4.57	7.05	8.68	9.88	10.26	9.37	7.66	5.47	3.59	2.00	70.16
1995	0.31	1.35	4.65	7.39	8.74	9.98	10.10	9.48	8.24	5.74	3.32	2.30	71.60
1996	0.38	1.42	5.04	7.46	10.07	10.13	10.15	10.26	7.66	5.91	3.64	2.74	74.86
1997	0.37	1.47	5.11	6.98	9.08	10.24	10.06	9.60	6.87	5.66	3.22	2.44	71.10
1998	0.31	1.10	4.24	6.58	8.33	9.76	10.36	9.49	7.58	5.72	3.15	2.86	69.48
1999	0.38	1.39	4.81	6.41	8.73	9.47	9.55	9.10	7.04	5.88	3.35	2.84	68.95
2000	0.33	1.37	4.64	7.61	9.27	9.52	10.01	9.03	7.39	4.98	3.03	2.43	69.61
2001	0.31	1.15	4.43	6.71	8.82	9.62	9.57	9.22	7.50	5.28	3.41	2.39	68.40
AVG	0.34	1.33	4.68	7.03	8.98	9.83	10.01	9.36	7.48	5.55	3.38	2.45	70.40

DUCK PONDS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.06	2.48	1.70	0.37	0	0	0	0.80	2.13	3.75	2.76	1.93	16.96
1990	2.28	2.60	3.63	2.87	0	0	0	0.93	1.90	3.48	2.73	1.95	22.36
1991	1.82	2.38	2.97	2.89	0	0	0	0.94	1.78	3.68	2.56	1.50	20.52
1992	1.90	2.44	2.79	2.65	0	0	0	0.96	1.85	3.28	2.36	1.50	19.72
1993	1.58	2.25	3.40	2.91	0	0	0	0.92	1.97	3.74	2.46	1.97	21.21
1994	2.10	2.28	3.33	3.05	0	0	0	0.95	1.95	3.54	2.68	1.50	21.38
1995	1.86	2.55	3.36	3.00	0	0	0	0.90	2.16	3.73	2.48	1.72	21.75
1996	2.27	2.59	3.61	3.14	0	0	0	1.07	1.96	3.86	2.72	2.04	23.25
1997	2.22	2.71	3.69	2.86	0	0	0	0.98	1.75	3.69	2.41	1.83	22.13
1998	1.82	2.03	3.11	2.72	0	0	0	0.99	1.97	3.72	2.36	2.14	20.85
1999	2.26	2.52	3.55	2.68	0	0	0	0.94	1.81	3.81	2.50	2.12	22.19
2000	1.98	2.50	3.28	3.18	0	0	0	0.88	1.92	3.22	2.27	1.82	21.03
2001	1.84	2.29	3.12	2.78	0	0	0	0.99	4.25	3.94	2.54	1.44	23.18
AVG	1.92	2.43	3.19	2.70	0	0	0	0.94	2.11	3.65	2.53	1.80	21.27

FISH FARMS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.75	2.43	4.05	5.38	8.40	10.86	11.51	10.24	8.87	6.22	3.99	2.78	76.48
1990	1.91	2.21	3.56	5.02	8.09	9.79	11.04	9.68	7.93	5.74	3.96	2.81	71.74
1991	1.52	2.03	2.90	4.69	7.29	8.89	10.05	9.66	7.45	6.10	3.70	2.17	66.44
1992	1.59	2.08	2.74	4.60	6.84	9.66	10.61	9.92	7.73	5.49	3.42	2.17	66.86
1993	1.33	1.92	3.34	4.90	7.56	10.03	10.95	10.40	8.36	6.21	3.55	2.85	71.39
1994	1.76	1.95	3.26	4.90	7.33	9.88	11.08	10.14	8.29	5.91	3.88	2.17	70.56
1995	1.56	2.17	3.30	5.16	7.40	9.97	10.93	10.26	8.91	6.21	3.59	2.48	71.92
1996	1.90	2.20	3.54	5.23	8.56	10.17	10.98	11.09	8.29	6.39	3.93	2.96	75.24
1997	1.86	2.31	3.63	4.89	7.69	10.26	10.88	10.38	7.43	6.12	3.48	2.64	71.55
1998	1.53	1.73	3.04	4.61	7.04	9.77	11.19	10.27	8.19	6.18	3.41	3.09	70.04
1999	1.89	2.15	3.47	4.49	7.40	9.49	10.34	9.85	7.61	6.36	3.62	3.07	69.72
2000	1.66	2.13	3.23	5.33	7.89	9.52	10.82	9.78	8.00	5.39	3.28	2.63	69.64
2001	1.54	1.95	3.09	4.68	7.46	9.59	10.34	9.97	8.11	5.70	3.69	2.59	68.71
AVG	1.68	2.10	3.32	4.91	7.61	9.84	10.82	10.13	8.09	6.00	3.65	2.65	70.79

JOJOBA
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.34	0.51	2.86	4.07	5.21	5.72	5.59	4.97	4.31	3.02	1.94	1.27	39.81
1990	0.37	0.46	2.51	3.76	5.03	5.15	5.37	4.70	3.85	2.79	1.92	1.28	37.19
1991	0.29	0.42	2.02	3.54	4.52	4.66	4.88	4.69	3.62	2.97	1.80	0.99	34.38
1992	0.31	0.44	1.99	3.43	4.23	5.04	5.15	4.82	3.75	2.67	1.66	0.99	34.47
1993	0.26	0.40	2.37	3.69	4.69	5.27	5.32	5.05	4.06	3.02	1.73	1.30	37.14
1994	0.34	0.41	2.31	3.70	4.56	5.19	5.39	4.92	4.03	2.87	1.89	0.99	36.59
1995	0.30	0.45	2.35	3.88	4.59	5.24	5.30	4.98	4.33	3.02	1.74	1.14	37.32
1996	0.37	0.46	2.56	3.92	5.29	5.32	5.34	5.39	4.03	3.11	1.91	1.36	39.05
1997	0.36	0.48	2.59	3.66	4.77	5.38	5.28	5.04	3.61	2.97	1.69	1.21	37.04
1998	0.30	0.36	2.13	3.46	4.37	5.13	5.44	4.99	3.98	3.00	1.66	1.41	36.22
1999	0.37	0.45	2.40	3.37	4.59	4.98	5.02	4.78	3.70	3.09	1.76	1.40	35.89
2000	0.32	0.45	2.38	4.00	4.87	5.00	5.26	4.75	3.88	2.62	1.59	1.20	36.31
2001	0.30	0.39	2.26	3.52	4.64	5.05	5.02	4.84	3.94	2.77	1.79	1.19	35.71
AVG	0.32	0.44	2.36	3.69	4.72	5.16	5.26	4.92	3.93	2.92	1.78	1.21	36.70

PASTURE, PERMANENT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.56	1.88	5.21	6.33	8.50	9.03	8.97	8.05	6.85	4.81	3.11	2.25	65.54
1990	0.63	1.58	4.58	6.01	8.14	8.08	8.66	7.52	6.24	4.48	3.15	2.05	61.11
1991	0.46	1.45	3.62	5.71	7.25	7.52	7.80	7.48	5.74	4.77	3.08	1.62	56.49
1992	0.47	1.49	3.41	5.54	6.84	7.92	8.37	7.64	6.08	4.32	2.57	1.72	56.37
1993	0.43	1.54	4.20	5.97	7.54	8.44	8.36	8.23	6.35	4.90	2.98	2.01	60.95
1994	0.56	1.59	4.05	6.00	7.36	8.29	8.57	7.95	6.38	4.62	3.15	1.43	59.95
1995	0.44	1.47	4.30	6.13	7.49	8.32	8.52	8.12	6.76	4.86	3.01	1.67	61.08
1996	0.59	1.78	4.53	6.29	8.43	8.56	8.50	8.63	6.46	4.99	3.08	2.33	64.16
1997	0.55	1.66	4.65	5.85	7.77	8.51	8.42	8.20	5.79	4.77	2.66	2.00	60.84
1998	0.49	1.39	3.75	5.60	7.10	8.08	8.81	7.98	6.44	4.84	2.61	2.44	59.52
1999	0.54	1.61	4.37	5.40	7.37	7.93	8.16	7.60	5.85	4.97	2.98	2.19	58.98
2000	0.53	1.67	4.15	6.48	7.67	8.05	8.41	7.61	6.19	4.23	2.52	2.14	59.64
2001	0.45	1.35	3.94	5.68	7.48	7.98	8.23	7.68	6.45	4.45	2.77	2.14	58.59
AVG	0.51	1.57	4.21	5.92	7.61	8.21	8.45	7.90	6.28	4.69	2.90	2.00	60.25

PEACHES & MIXED FRUIT
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.41	2.12	4.60	6.47	8.30	9.14	8.91	7.94	6.87	4.82	3.02	1.84	65.44
1990	1.54	1.93	4.05	5.99	8.02	8.21	8.58	7.50	6.15	4.45	3.00	1.86	61.27
1991	1.23	1.76	3.28	5.63	7.21	7.44	7.79	7.48	5.78	4.73	2.80	1.44	56.55
1992	1.28	1.83	3.13	5.46	6.74	8.05	8.22	7.69	5.99	4.26	2.59	1.43	56.68
1993	1.07	1.67	3.79	5.87	7.47	8.41	8.49	8.06	6.48	4.82	2.69	1.88	60.72
1994	1.42	1.71	3.71	5.89	7.28	8.28	8.61	7.86	6.43	4.59	2.94	1.44	60.13
1995	1.26	1.89	3.76	6.17	7.33	8.37	8.47	7.96	6.91	4.82	2.72	1.64	61.27
1996	1.53	1.93	4.06	6.24	8.45	8.49	8.52	8.60	6.43	4.96	2.97	1.97	64.16
1997	1.50	2.01	4.13	5.83	7.61	8.59	8.43	8.05	5.76	4.74	2.64	1.75	61.04
1998	1.23	1.51	3.44	5.50	6.99	8.18	8.69	7.97	6.35	4.79	2.59	2.05	59.29
1999	1.53	1.88	3.92	5.36	7.32	7.94	8.01	7.63	5.90	4.93	2.74	2.03	59.19
2000	1.33	1.86	3.72	6.36	7.77	7.98	8.38	7.58	6.20	4.18	2.49	1.73	59.58
2001	1.24	1.68	3.55	5.60	7.40	8.06	8.02	7.72	6.29	4.42	2.79	1.72	58.50
AVG	1.35	1.83	3.78	5.88	7.53	8.24	8.39	7.85	6.27	4.65	2.77	1.75	60.29

MISCELLANEOUS PERMANENT CROPS
CROP EVAPOTRANSPIRATION
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.41	1.97	3.90	5.87	8.62	9.56	9.33	8.31	7.18	5.05	3.18	1.89	66.27
1990	1.54	1.80	3.43	5.47	8.34	8.60	8.96	7.85	6.44	4.66	3.16	1.90	62.14
1991	1.22	1.65	2.78	5.11	7.48	7.79	8.14	7.82	6.06	4.96	2.95	1.47	57.44
1992	1.28	1.69	2.66	5.01	7.02	8.43	8.60	8.05	6.28	4.47	2.73	1.47	57.68
1993	1.07	1.56	3.21	5.34	7.77	8.80	8.87	8.43	6.79	5.05	2.84	1.90	61.63
1994	1.41	1.58	3.14	5.34	7.56	8.67	8.99	8.22	6.73	4.80	3.10	1.48	61.01
1995	1.26	1.76	3.19	5.62	7.62	8.74	8.86	8.33	7.24	5.04	2.87	1.67	62.18
1996	1.51	1.79	3.44	5.70	8.79	8.89	8.90	9.00	6.73	5.19	3.13	1.99	65.07
1997	1.48	1.87	3.50	5.32	7.92	8.99	8.81	8.42	6.03	4.97	2.78	1.79	61.88
1998	1.23	1.40	2.92	5.01	7.26	8.56	9.08	8.33	6.65	5.02	2.73	2.10	60.30
1999	1.53	1.74	3.33	4.89	7.61	8.32	8.39	7.99	6.18	5.16	2.89	2.08	60.10
2000	1.34	1.73	3.16	5.81	8.09	8.34	8.76	7.94	6.49	4.38	2.62	1.77	60.41
2001	1.24	1.58	3.01	5.10	7.69	8.44	8.39	8.08	6.59	4.63	2.94	1.77	59.46
AVG	1.35	1.70	3.21	5.35	7.83	8.62	8.78	8.21	6.57	4.88	2.92	1.79	61.20

ALFALFA
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	3.93	7.04	7.16	7.47	11.58	8.15	8.06	7.66	0.00	6.83	3.15	71.03
1990	3.49	3.28	4.01	7.28	7.32	7.92	11.36	7.18	7.10	0.00	6.82	0.00	65.77
1991	0.00	7.03	0.00	7.15	7.69	7.43	7.56	10.88	4.08	3.40	6.83	0.00	62.07
1992	0.00	3.65	3.31	3.85	7.20	7.57	7.60	0.00	10.56	0.00	5.59	1.21	50.53
1993	0.00	0.00	7.01	2.50	8.61	11.10	7.98	8.44	7.41	0.00	6.84	0.00	59.89
1994	6.56	0.00	7.07	7.01	7.21	7.47	8.47	8.26	7.36	0.00	6.82	0.00	66.23
1995	2.27	4.49	2.41	7.24	7.16	8.81	11.26	7.91	7.49	0.00	6.83	0.00	65.86
1996	6.61	0.00	7.30	7.29	7.53	8.18	10.37	8.27	7.65	0.00	6.89	0.00	70.07
1997	6.59	0.00	6.96	7.69	7.29	8.28	8.39	8.16	3.23	3.78	5.56	1.22	67.15
1998	0.00	3.64	3.25	7.60	7.16	7.73	8.39	8.25	7.18	0.00	6.85	0.00	60.06
1999	6.54	0.00	7.43	4.07	7.17	7.72	7.68	11.18	3.80	3.36	3.61	3.18	65.76
2000	3.46	3.19	3.63	7.86	7.50	8.01	11.18	7.81	7.07	0.00	6.74	0.00	66.44
2001	0.00	7.08	0.00	7.10	7.27	7.32	14.62	7.22	7.13	0.00	6.82	0.00	64.55
AVG	2.73	2.79	4.57	6.45	7.43	8.39	9.46	7.82	6.75	0.81	6.39	0.67	64.26

ALFALFA, SEED
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.00	5.52	1.47	5.78	7.20	1.37	5.80	6.98	0.00	1.21	5.48	40.80
1990	0.00	0.00	4.38	2.60	4.61	3.76	6.46	1.25	5.79	1.37	0.00	5.48	35.70
1991	0.00	0.00	1.20	5.62	1.26	7.00	3.30	3.72	5.72	0.00	1.21	0.00	29.04
1992	0.00	3.10	2.32	0.00	6.95	1.27	6.45	0.00	0.00	9.31	0.00	0.00	29.41
1993	0.00	0.00	0.00	2.41	4.55	7.01	3.78	3.38	7.00	0.00	2.35	4.35	34.82
1994	0.00	0.00	0.00	7.60	0.00	7.13	7.07	0.00	7.04	0.00	5.57	0.00	34.39
1995	0.00	1.19	0.00	7.05	0.00	7.10	5.91	1.29	7.04	0.00	5.57	0.00	35.15
1996	1.28	0.00	5.50	1.33	5.79	7.04	1.39	5.84	6.97	0.00	3.56	0.00	38.69
1997	3.01	0.00	3.61	3.28	3.73	7.19	3.29	3.76	3.27	2.38	1.21	0.00	34.73
1998	2.98	0.00	2.34	1.39	5.70	4.65	4.13	3.36	3.67	3.64	3.57	0.00	35.43
1999	0.00	0.00	6.73	0.00	7.05	2.48	4.84	5.74	1.25	2.53	4.38	0.00	35.00
2000	0.00	2.31	4.37	0.00	6.99	3.74	6.40	1.28	5.73	0.00	1.22	5.48	37.52
2001	0.00	0.00	1.23	6.24	1.29	5.81	7.28	0.00	6.95	0.00	3.58	3.16	35.54
AVG	0.56	0.51	2.86	3.00	4.13	5.49	4.74	2.72	5.19	1.48	2.57	1.84	35.09

BARLEY & OATS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	4.79	9.90	4.98	0	0	0	0	0	0	0	6.13	25.80
1990	4.53	4.81	4.99	4.98	0	0	0	0	0	0	0	0.82	20.11
1991	2.10	2.53	4.81	9.12	0	0	0	0	0	0	0	7.03	25.59
1992	0.00	4.69	2.56	2.30	0	0	0	0	0	0	0	5.42	14.97
1993	0.00	1.66	7.95	1.71	0	0	0	0	0	0	0	5.74	17.06
1994	4.51	0.86	8.88	0.87	0	0	0	0	0	0	0	5.10	20.22
1995	0.80	4.81	4.91	4.90	0	0	0	0	0	0	0	5.19	20.61
1996	4.43	2.53	7.20	2.71	0	0	0	0	0	0	0	6.51	23.37
1997	4.48	4.83	4.98	2.66	0	0	0	0	0	0	0	3.95	20.89
1998	0.80	4.73	4.86	2.61	0	0	0	0	0	0	0	5.30	18.29
1999	3.73	4.85	5.81	1.73	0	0	0	0	0	0	0	5.33	21.45
2000	2.91	2.49	8.83	0.89	0	0	0	0	0	0	0	6.22	21.34
2001	3.71	0.84	6.46	3.27	0	0	0	0	0	0	0	6.63	20.92
AVG	2.46	3.42	6.32	3.29	0	0	0	0	0	0	0	5.34	20.82

BERMUDA GRASS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.52	4.15	4.86	9.09	9.69	12.03	11.02	8.31	8.68	5.29	3.45	3.32	81.40
1990	3.26	3.42	4.18	7.25	10.76	10.34	9.13	9.93	7.29	3.51	3.41	3.27	75.74
1991	0.58	2.76	4.14	7.25	10.48	8.35	9.27	8.72	5.93	7.08	3.39	0.00	67.94
1992	1.12	2.20	3.52	5.59	9.15	9.95	9.57	7.55	7.31	6.41	3.34	0.00	65.69
1993	0.00	1.81	5.19	7.24	9.04	10.19	9.92	9.49	7.40	7.20	2.79	0.60	70.88
1994	3.39	3.43	3.58	7.24	7.49	11.65	11.00	8.31	9.19	4.62	3.37	2.10	75.37
1995	1.11	3.42	3.52	8.07	10.78	7.81	11.77	7.56	9.47	5.21	3.35	3.23	75.29
1996	1.12	3.99	5.18	8.80	8.44	11.59	11.03	8.49	6.87	7.28	3.41	3.32	79.52
1997	0.59	6.18	3.60	7.91	8.94	10.20	10.99	8.43	6.68	4.82	3.45	2.15	73.93
1998	1.69	1.56	5.34	5.60	9.20	8.47	10.93	9.55	9.08	3.56	3.44	3.33	71.75
1999	1.72	3.45	5.84	4.99	11.18	7.67	9.86	9.37	7.27	5.55	3.37	1.57	71.82
2000	3.33	1.83	7.05	7.54	7.67	11.66	8.98	7.67	7.49	7.02	3.28	0.00	73.52
2001	3.14	3.35	3.50	7.24	10.01	9.18	9.62	9.47	7.50	5.43	3.35	1.52	73.32
AVG	1.74	3.19	4.58	7.22	9.45	9.93	10.24	8.68	7.70	5.61	3.34	1.88	73.55

BERMUDA GRASS, SEED
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.24	3.67	4.17	7.59	7.99	4.04	9.22	9.39	6.45	3.90	3.63	1.64	62.92
1990	3.48	1.94	4.14	4.59	9.31	4.04	8.80	7.83	6.34	3.78	3.57	1.25	59.05
1991	2.23	2.99	0.76	6.96	7.81	4.00	8.38	7.82	3.87	4.53	3.65	0.00	52.98
1992	2.87	0.65	1.27	6.35	6.03	4.04	8.79	7.92	5.68	4.24	2.95	0.63	51.44
1993	0.00	0.00	4.40	5.94	7.81	3.94	8.87	8.02	7.79	3.75	1.71	1.89	54.12
1994	3.46	2.36	1.49	6.35	7.89	4.03	9.08	9.80	5.30	3.74	3.60	0.00	57.09
1995	1.19	3.62	2.49	5.92	7.87	4.02	9.28	7.91	7.07	3.93	3.61	0.00	56.90
1996	3.40	3.58	3.89	5.91	9.84	4.08	8.85	11.46	3.87	3.95	3.63	3.50	65.94
1997	0.00	3.63	4.13	5.92	7.90	3.99	8.71	9.80	5.20	3.64	0.64	2.93	56.47
1998	0.61	1.88	3.19	4.49	7.79	3.94	8.88	9.95	5.28	3.89	3.56	0.64	54.10
1999	2.84	3.60	3.86	3.87	7.84	3.92	9.19	7.89	3.83	4.60	3.66	1.86	56.97
2000	1.64	3.62	2.16	7.75	8.05	3.98	8.74	8.03	5.20	4.26	3.56	0.00	56.99
2001	3.46	3.54	0.66	7.00	7.88	3.97	8.77	7.95	5.33	4.36	3.64	0.65	57.22
AVG	2.03	2.70	2.82	6.05	8.00	4.00	8.89	8.75	5.48	4.04	3.18	1.15	57.09

CORN, FIELD
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	4.37	0.94	5.43	11.49	0.00	0	0	0	0	0	0	0	22.23
1990	6.40	0.00	5.38	11.25	5.74	0.00	0	0	0	0	0	0	28.76
1991	0.00	0.92	4.32	6.68	11.24	2.67	0	0	0	0	0	0	25.84
1992	0.00	0.00	2.79	5.59	11.12	5.62	0	0	0	0	0	0	25.13
1993	0.00	0.00	0.00	11.28	5.73	0.00	0	0	0	0	0	0	17.01
1994	5.62	0.00	5.34	5.66	11.39	0.00	0	0	0	0	0	0	28.02
1995	0.00	0.00	5.40	11.35	8.71	0.00	0	0	0	0	0	0	25.45
1996	2.93	2.70	5.56	8.67	11.76	0.00	0	0	0	0	0	0	31.62
1997	2.97	2.78	5.47	5.57	11.36	0.00	0	0	0	0	0	0	28.14
1998	0.00	0.00	2.84	10.01	6.70	0.00	0	0	0	0	0	0	19.54
1999	4.23	0.93	5.48	5.62	7.70	0.00	0	0	0	0	0	0	23.96
2000	3.81	1.81	5.44	6.65	10.29	0.00	0	0	0	0	0	0	27.99
2001	1.73	3.38	5.50	5.61	8.76	0.00	0	0	0	0	0	0	24.98
AVG	2.47	1.04	4.53	8.11	8.50	0.64	0	0	0	0	0	0	25.28

COTTON
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	5.68	0.00	2.83	9.81	13.59	12.18	0	0	0	0	44.09
1990	0	0	6.29	0.00	0.95	6.13	11.19	13.08	0	0	0	0	37.64
1991	0	0	1.93	1.04	2.31	6.99	11.86	11.25	0	0	0	0	35.38
1992	0	0	0.00	0.00	0.91	7.65	13.22	14.23	0	0	0	0	36.01
1993	0	0	0.00	0.00	1.82	8.07	13.86	13.83	0	0	0	0	37.58
1994	0	0	3.64	0.56	2.30	6.84	10.98	13.65	0	0	0	0	37.97
1995	0	0	0.00	1.62	2.62	7.99	11.20	14.66	0	0	0	0	38.09
1996	0	0	6.50	0.00	2.82	8.02	13.44	14.81	0	0	0	0	45.58
1997	0	0	5.96	0.00	1.82	7.54	12.17	14.52	0	0	0	0	42.02
1998	0	0	0.00	0.86	1.73	5.32	11.19	13.93	0	0	0	0	33.03
1999	0	0	6.35	0.00	0.00	6.19	9.81	11.92	0	0	0	0	34.25
2000	0	0	6.39	0.00	0.00	6.08	10.17	11.40	0	0	0	0	34.03
2001	0	0	0.00	2.37	1.66	5.05	8.29	14.24	0	0	0	0	31.60
AVG	0	0	3.29	0.50	1.67	7.05	11.61	13.36	0	0	0	0	37.48

KLEIN GRASS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.09	4.03	6.49	7.59	11.44	11.75	7.86	10.86	8.09	5.23	3.40	1.13	78.95
1990	3.52	3.33	5.81	7.35	9.69	9.50	9.64	9.18	7.37	3.53	3.36	3.29	75.55
1991	0.58	2.74	4.14	6.61	8.11	10.52	7.55	9.97	6.68	5.47	3.34	1.53	67.22
1992	0.00	3.41	1.85	7.29	7.40	10.15	8.84	9.30	7.33	3.50	3.33	0.00	62.40
1993	1.11	1.19	5.73	7.36	8.92	10.04	9.76	9.34	7.43	6.98	1.17	2.15	71.18
1994	3.14	3.37	3.49	7.31	7.52	11.59	9.31	8.94	7.25	7.01	3.36	0.00	72.29
1995	0.00	3.34	7.03	7.49	7.43	9.78	9.59	11.42	7.45	4.84	3.36	2.12	73.84
1996	3.19	3.45	4.71	7.22	10.18	9.83	10.74	10.11	6.76	7.14	3.39	1.77	78.49
1997	2.04	4.62	3.51	7.15	11.27	8.47	10.71	9.85	4.94	6.31	3.33	0.59	72.78
1998	3.22	0.00	5.31	5.98	8.75	8.42	10.69	9.95	7.30	4.80	3.36	2.15	69.91
1999	3.45	3.43	5.31	6.59	8.24	8.97	10.09	7.55	7.35	5.45	3.34	2.70	72.45
2000	3.25	1.85	5.71	7.52	8.81	10.19	8.97	7.61	7.36	6.91	3.31	0.00	71.49
2001	3.10	3.37	3.48	7.24	9.53	9.45	9.71	9.31	7.34	4.75	3.35	0.60	71.22
AVG	2.13	2.93	4.81	7.13	9.02	9.90	9.50	9.49	7.13	5.53	3.18	1.39	72.14

RYE GRASS & SEED
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	3.08	6.58	7.03	0	0	0	0	0	5.81	3.12	3.04	28.66
1990	2.92	3.10	5.32	6.85	0	0	0	0	0	0.00	4.59	3.04	25.82
1991	0.00	3.09	3.21	6.78	0	0	0	0	0	5.46	0.00	2.42	20.95
1992	0.52	3.12	1.67	3.32	0	0	0	0	0	5.33	0.00	1.06	15.01
1993	0.00	1.09	5.25	4.52	0	0	0	0	0	5.69	0.00	3.02	19.56
1994	2.92	3.14	3.25	6.75	0	0	0	0	0	5.59	3.03	0.00	24.68
1995	1.04	3.09	5.41	3.35	0	0	0	0	0	5.65	3.05	3.04	24.62
1996	2.95	3.12	3.22	4.55	0	0	0	0	0	5.73	3.12	3.01	25.70
1997	1.63	3.12	4.75	5.14	0	0	0	0	0	4.20	1.59	1.39	21.81
1998	2.89	0.56	4.36	3.94	0	0	0	0	0	5.42	1.61	1.42	20.21
1999	2.90	3.13	6.42	3.43	0	0	0	0	0	4.98	3.03	0.00	23.89
2000	2.92	3.10	4.88	6.74	0	0	0	0	0	5.37	0.00	3.00	26.02
2001	2.89	3.12	3.29	6.67	0	0	0	0	0	5.64	3.13	0.00	24.74
AVG	1.81	2.76	4.43	5.31	0	0	0	0	0	4.99	2.02	1.88	23.20

SUDAN GRASS, NOV-OCT, KC AVERAGE CUTTING EFFECT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	3.17	6.46	7.10	10.80	8.70	9.82	9.89	7.59	0.00	4.98	3.00	71.50
1990	2.94	3.18	3.27	7.29	9.99	9.63	8.47	9.27	5.26	1.47	4.61	2.98	68.36
1991	0.00	3.12	3.20	6.81	9.22	8.33	8.72	7.58	6.10	0.59	5.03	0.00	58.69
1992	2.36	1.67	2.00	6.72	6.80	8.94	9.58	10.05	6.77	0.00	4.31	0.00	59.18
1993	0.00	1.10	5.33	6.82	8.34	9.57	9.26	8.85	6.88	1.15	5.00	1.97	64.26
1994	1.00	3.05	5.37	6.77	8.16	9.57	8.48	8.71	6.85	0.00	5.20	0.00	63.16
1995	1.52	3.15	4.78	6.84	8.76	8.85	9.18	10.09	7.55	0.00	5.02	2.99	68.74
1996	1.54	3.13	4.76	6.96	10.66	9.08	9.97	9.59	6.76	1.12	4.80	3.02	71.37
1997	1.58	4.58	3.34	8.52	7.13	10.74	8.99	8.92	5.02	0.00	5.09	0.53	64.43
1998	2.39	1.63	3.27	6.72	7.55	10.05	10.77	7.15	6.92	0.61	5.06	2.99	65.11
1999	1.59	3.14	4.76	6.78	8.77	7.11	10.78	7.11	6.79	0.00	4.98	3.12	64.94
2000	1.56	3.09	4.70	7.02	8.88	10.20	7.75	8.46	6.77	1.55	4.44	3.01	67.42
2001	0.00	3.09	6.52	5.23	8.62	9.12	8.76	8.91	6.89	0.00	4.94	0.55	62.63
AVG	1.27	2.85	4.44	6.89	8.74	9.22	9.27	8.81	6.63	0.50	4.88	1.86	65.37

SUDAN GRASS, APR-OCT, KC AVERAGE CUTTING EFFECT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	4.40	7.18	11.11	10.81	9.98	7.36	0.00	0	0	50.84
1990	0	0	0	4.75	7.00	11.06	7.74	8.87	6.80	0.00	0	0	46.21
1991	0	0	0	3.62	6.97	7.71	10.12	7.02	6.81	1.63	0	0	43.87
1992	0	0	0	0.00	6.88	8.98	8.96	10.63	6.65	0.00	0	0	42.10
1993	0	0	0	0.00	6.87	10.99	9.12	9.09	6.93	1.62	0	0	44.62
1994	0	0	0	3.52	6.83	8.94	10.96	8.44	6.93	0.00	0	0	45.61
1995	0	0	0	3.20	6.87	10.81	7.20	10.77	7.02	0.00	0	0	45.87
1996	0	0	0	4.93	7.06	10.84	11.03	8.46	8.61	0.00	0	0	50.93
1997	0	0	0	4.03	6.88	10.88	8.80	9.04	5.19	1.18	0	0	46.00
1998	0	0	0	1.76	6.68	9.56	10.80	8.46	6.92	1.59	0	0	45.77
1999	0	0	0	3.94	7.10	9.19	8.86	8.87	6.18	0.63	0	0	44.76
2000	0	0	0	4.69	6.90	10.84	8.34	8.66	6.95	0.59	0	0	46.97
2001	0	0	0	4.45	6.86	9.04	9.96	9.22	6.84	0.00	0	0	46.38
AVG	0	0	0	3.33	6.93	10.00	9.44	9.04	6.86	0.56	0	0	46.15

SUDAN GRASS, MAY-AUG, KC AVERAGE CUTTING EFFECT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	4.62	8.51	9.70	0.00	0	0	0	0	22.82
1990	0	0	0	0	5.37	7.12	10.87	0.00	0	0	0	0	23.36
1991	0	0	0	0	3.37	7.00	10.57	0.00	0	0	0	0	20.93
1992	0	0	0	0	0.00	7.09	10.88	0.00	0	0	0	0	17.97
1993	0	0	0	0	0.00	7.12	11.12	0.00	0	0	0	0	18.24
1994	0	0	0	0	4.20	7.25	10.74	0.00	0	0	0	0	22.18
1995	0	0	0	0	3.42	7.23	10.61	0.00	0	0	0	0	21.26
1996	0	0	0	0	5.17	7.24	10.92	0.00	0	0	0	0	23.33
1997	0	0	0	0	4.78	7.23	10.93	0.00	0	0	0	0	22.94
1998	0	0	0	0	1.69	7.18	11.00	0.00	0	0	0	0	19.88
1999	0	0	0	0	4.54	7.03	10.74	0.00	0	0	0	0	22.30
2000	0	0	0	0	4.70	7.03	10.85	0.00	0	0	0	0	22.58
2001	0	0	0	0	4.92	7.28	10.72	0.00	0	0	0	0	22.92
AVG	0	0	0	0	3.60	7.25	10.74	0.00	0	0	0	0	21.59

SUGAR BEETS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.30	4.62	9.67	7.10	9.81	0.00	0	0	6.13	0.00	4.48	2.09	46.20
1990	2.28	4.57	7.79	6.49	9.90	0.00	0	0	0	5.40	0.00	0.00	36.43
1991	4.36	4.62	4.59	7.95	7.47	0.00	0	0	0	6.66	0.00	0.00	35.66
1992	4.31	0.00	4.59	7.32	7.18	0.00	0	0	6.87	0.00	0.00	0.00	30.26
1993	0.00	4.60	4.81	9.63	6.57	0.00	0	0	7.00	0.00	0.00	4.48	37.09
1994	2.86	1.56	7.79	6.58	8.12	0.00	0	0	6.29	0.00	0.00	4.43	37.62
1995	0.00	4.70	4.68	9.71	7.54	0.00	0	0	6.27	0.00	0.00	4.52	37.42
1996	4.36	2.44	6.96	7.43	10.08	0.00	0	0	6.46	0.00	4.49	4.43	46.64
1997	0.00	4.54	9.46	7.52	4.95	0.00	0	0	6.28	0.00	0.00	4.51	37.26
1998	0.79	3.71	4.62	7.40	8.13	0.00	0	0	6.42	0.00	4.47	0.00	35.53
1999	4.38	4.65	7.16	7.12	7.47	2.29	0	0	6.10	0.00	2.37	2.12	43.66
2000	4.26	4.58	4.72	9.71	7.53	0.00	0	0	6.31	0.00	0.00	4.46	41.58
2001	4.35	2.42	6.89	5.70	8.96	0.00	0	0	6.63	3.21	0.82	4.45	43.43
AVG	2.64	3.62	6.44	7.67	7.98	0.18	0	0	5.44	1.18	1.28	2.73	39.14

WHEAT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	6.13	0.00	11.45	5.91	0.00	0.00	0	0	0	0	0	0.00	23.49
1990	6.51	0.93	9.69	5.40	5.65	0.00	0	0	0	0	0	0.00	28.17
1991	6.28	0.00	5.18	10.80	5.56	0.00	0	0	0	0	0	0.00	27.82
1992	5.01	0.00	5.20	6.43	1.86	0.00	0	0	0	0	0	0.00	18.50
1993	2.81	0.00	7.11	6.41	4.51	0.00	0	0	0	0	0	0.00	20.84
1994	6.28	0.94	5.22	9.97	0.00	0.00	0	0	0	0	0	0.00	22.41
1995	6.70	5.22	5.30	5.42	2.96	0.00	0	0	0	0	0	0.00	25.60
1996	6.83	5.05	5.35	10.88	0.00	0.00	0	0	0	0	0	0.00	28.10
1997	7.00	5.20	5.40	8.32	0.00	0.00	0	0	0	0	0	0.00	25.92
1998	5.41	0.00	5.20	8.28	5.44	0.00	0	0	0	0	0	0.00	24.34
1999	6.48	5.20	5.29	5.46	5.44	0.00	0	0	0	0	0	0.00	27.86
2000	6.39	2.76	5.22	7.95	5.55	0.00	0	0	0	0	0	0.00	27.86
2001	6.44	0.00	5.10	10.91	5.53	0.00	0	0	0	0	0	0.00	27.98
AVG	6.02	1.95	6.21	7.86	3.27	0.00	0	0	0	0	0	0.00	25.30

MISCELLANEOUS FIELD CROPS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.89	4.36	6.87	9.16	8.54	11.18	11.08	9.70	8.69	5.14	4.59	1.05	82.25
1990	3.06	3.69	5.90	7.43	9.32	10.41	11.06	7.80	6.78	5.87	3.62	1.44	76.37
1991	1.59	3.09	4.74	6.73	8.96	9.61	9.94	7.04	6.78	6.71	3.17	0.00	68.35
1992	2.91	2.65	2.25	6.84	6.91	10.76	10.61	8.80	7.99	5.26	2.50	0.54	68.00
1993	0.00	1.67	4.86	8.10	7.70	10.98	10.84	8.99	8.13	6.61	2.06	3.05	72.99
1994	2.95	3.21	3.17	6.85	10.78	8.91	11.20	8.48	8.47	5.02	3.09	1.98	74.11
1995	1.00	3.24	6.58	7.01	7.74	10.96	10.20	9.00	8.75	6.45	3.04	0.00	73.96
1996	3.23	3.71	5.90	8.91	9.65	8.79	10.98	11.06	6.99	6.61	3.22	2.52	81.55
1997	3.00	3.25	6.62	5.34	10.67	9.66	11.09	10.08	5.28	4.85	3.11	1.60	74.55
1998	3.15	0.57	5.93	5.23	9.28	9.12	10.53	10.65	6.88	6.58	3.10	1.47	72.48
1999	3.15	3.17	5.05	6.68	9.02	9.53	10.33	9.12	6.82	5.41	4.20	0.00	72.48
2000	3.42	3.16	6.46	7.62	8.36	10.83	10.83	7.24	8.21	5.36	3.10	1.06	75.64
2001	2.93	3.11	5.49	5.24	10.04	10.79	7.77	10.11	6.92	6.44	3.08	1.66	73.56
AVG	2.48	2.99	5.37	7.01	9.00	10.12	10.50	9.08	7.44	5.87	3.22	1.26	74.33

ARTICHOKES
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.72	4.61	6.17	6.65	10.16	13.21	4.07	0	4.81	2.96	5.76	1.79	62.90
1990	3.56	4.17	6.09	7.07	9.93	10.25	6.83	0	3.55	3.02	4.78	2.78	62.04
1991	0.92	4.18	4.52	6.31	9.83	9.01	6.76	0	3.85	2.97	5.67	0.00	54.05
1992	2.64	2.98	2.92	6.27	8.20	11.60	4.04	0	4.79	2.88	4.16	0.95	51.42
1993	0.00	2.85	3.99	9.45	10.03	10.18	5.63	0	4.07	2.93	2.91	4.06	56.11
1994	3.14	2.86	4.54	8.93	8.66	10.04	6.96	0	3.73	2.92	5.73	0.00	57.52
1995	1.42	4.22	4.52	9.55	8.26	11.37	4.09	0	4.85	3.02	5.70	0.94	57.94
1996	4.48	3.00	6.07	8.21	10.00	10.29	6.86	0	4.50	3.10	5.78	2.80	65.09
1997	2.72	2.86	5.99	7.80	9.91	10.10	6.77	0	4.20	2.98	4.37	1.28	58.95
1998	2.58	1.48	5.85	6.31	9.67	10.90	6.27	0	3.50	3.03	5.59	2.77	57.93
1999	2.75	2.92	5.96	6.48	8.24	10.51	6.03	0	4.12	3.08	5.67	2.80	58.56
2000	2.66	2.87	4.56	9.74	9.86	10.45	4.72	0	4.28	2.97	2.84	2.73	57.68
2001	2.64	3.40	5.37	6.93	9.98	9.99	6.10	0	7.33	5.98	2.86	2.80	63.36
AVG	2.48	3.26	5.12	7.67	9.44	10.61	5.78	0	4.43	3.22	4.76	1.98	58.73

BROCCILI
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.314	0.305	0	0	0	0	0	0	2.018	0.000	2.079	3.409	10.125
1990	2.699	0.000	0	0	0	0	0	0	0.000	0.000	1.296	2.792	6.787
1991	1.995	0.000	0	0	0	0	0	0	0.000	0.000	0.000	0.000	1.995
1992	0.000	0.000	0	0	0	0	0	0	0.000	2.083	0.000	0.700	2.783
1993	0.344	2.112	0	0	0	0	0	0	0.000	2.068	0.000	2.000	6.524
1994	3.901	1.395	0	0	0	0	0	0	0.000	0.748	2.003	2.069	10.115
1995	1.042	1.017	0	0	0	0	0	0	0.761	0.374	2.019	2.020	7.234
1996	4.065	0.000	0	0	0	0	0	0	0.000	0.738	1.304	2.717	8.824
1997	3.338	0.000	0	0	0	0	0	0	0.000	0.000	2.001	2.034	7.373
1998	1.941	0.000	0	0	0	0	0	0	0.000	0.714	2.044	2.111	6.811
1999	4.022	0.000	0	0	0	0	0	0	0.000	0.364	1.679	2.405	8.470
2000	3.640	0.381	0	0	0	0	0	0	0.000	0.791	0.921	1.050	6.782
2001	3.975	2.097	0.000	0	0	0	0	0	0.000	3.688	2.132	4.052	15.944
AVG	2.560	0.562	0.000	0	0	0	0	0	0.214	0.890	1.344	2.105	7.674

CABBAGE, ALL
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.69	1.78	0.00	0	0	0	0	0	2.45	0.00	1.78	2.59	11.28
1990	3.47	0.97	0.00	0	0	0	0	0	0.42	0.86	1.72	1.79	9.23
1991	1.71	3.78	0.00	0	0	0	0	0	0.00	1.83	1.47	0.32	9.11
1992	2.32	3.24	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	5.56
1993	0.00	0.00	0.00	0	0	0	0	0	3.49	0.00	1.72	1.78	7.00
1994	3.45	1.88	0.00	0	0	0	0	0	0.00	1.92	0.00	1.71	8.95
1995	0.91	3.79	1.88	0	0	0	0	0	1.98	0.62	2.59	1.71	13.47
1996	3.51	0.32	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	3.84
1997	5.27	3.59	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	8.86
1998	5.04	0.91	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	5.96
1999	5.23	3.54	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	8.77
2000	5.31	3.45	0.00	0	0	0	0	0	0.00	0.00	0.00	0.00	8.75
2001	5.37	3.58	0.00	0	0	0	0	0	0.00	1.77	3.62	1.75	16.08
AVG	3.41	2.37	0.14	0	0	0	0	0	0.64	0.54	0.99	0.90	8.99

CARROTS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.12	4.72	5.61	7.88	2.14	0	0	0	0	0.00	2.69	2.18	27.35
1990	2.10	3.77	0.00	10.79	0.00	0	0	0	0	0.00	2.41	1.04	20.11
1991	1.13	4.61	0.00	9.86	0.00	0	0	0	0	5.28	1.79	0.39	23.05
1992	2.05	2.28	0.00	9.06	0.00	0	0	0	0	2.26	0.00	2.12	17.77
1993	0.00	2.27	0.00	8.12	0	0	0	0	0	3.78	0.00	2.20	16.38
1994	4.18	2.29	0.00	5.36	0	0	0	0	0	2.84	0.00	2.14	16.81
1995	0.73	3.80	0.00	7.98	0	0	0	0	0	0.75	1.38	2.15	16.79
1996	2.92	3.84	0.00	8.13	0	0	0	0	0	2.22	0.00	2.21	19.32
1997	2.88	3.77	0.00	8.04	0	0	0	0	0	1.22	1.00	2.17	19.08
1998	3.38	2.31	0.00	7.56	0	0	0	0	0	2.77	0.00	2.19	18.21
1999	5.30	3.54	0.00	7.65	0	0	0	0	0	2.45	0.00	2.15	21.09
2000	4.25	2.77	0.00	8.04	0	0	0	0	0	3.42	0.00	2.15	20.63
2001	3.16	3.37	0.00	7.86	0	0	0	0	0	3.23	2.29	2.63	22.54
AVG	2.63	3.33	0.43	8.18	0.17	0	0	0	0	2.33	0.89	1.98	19.93

CAULIFLOWER
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.14	0.00	0	0	0	0	0	0	2.13	0.99	2.85	3.05	10.15
1990	0.76	0.00	0	0	0	0	0	0	0.30	0.69	1.51	2.96	6.22
1991	3.47	1.61	0	0	0	0	0	0	0.00	0.00	1.49	0.00	6.57
1992	3.75	1.83	0	0	0	0	0	0	0.00	0.00	1.45	1.24	8.27
1993	2.06	1.50	0	0	0	0	0	0	0.00	0.53	0.95	3.04	8.08
1994	3.88	0.00	0	0	0	0	0	0	0.00	0.00	2.03	1.50	7.41
1995	3.55	0.00	0	0	0	0	0	0	0.00	0.50	0.95	2.01	7.01
1996	4.70	3.21	0	0	0	0	0	0	1.47	0.28	1.50	3.03	14.19
1997	2.96	0.00	0	0	0	0	0	0	0.00	0.51	1.47	2.47	7.40
1998	2.17	0.00	0	0	0	0	0	0	0.00	0.00	2.26	2.80	7.23
1999	3.16	0.00	0	0	0	0	0	0	0.00	0.00	2.93	2.25	8.33
2000	2.94	0.00	0	0	0	0	0	0	0.00	1.22	1.48	2.27	7.90
2001	2.91	0.00	0	0	0	0	0	0	0.00	1.63	2.52	1.99	9.04
AVG	2.88	0.63	0	0	0	0	0	0	0.30	0.49	1.80	2.20	8.29

CORN, EAR
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	3.481	1.659	5.036	10.203	10.775	0.000	0	0	0	0	0	0	31.155
1990	5.999	0.000	8.062	6.715	10.392	0.000	0	0	0	0	0	0	31.168
1991	0.857	0.000	4.768	9.166	8.528	2.732	0	0	0	0	0	0	26.051
1992	2.181	1.605	0.850	10.021	8.011	7.846	0.000	0	0	0	0	0	30.514
1993	0.000	0.000	0.000	10.068	10.381	1.790	0	0	0	0	0	0	22.239
1994	3.659	0.000	6.579	8.166	10.390	0.000	0	0	0	0	0	0	28.794
1995	1.715	0.000	5.671	10.254	10.301	0.000	0	0	0	0	0	0	27.940
1996	6.267	0.000	4.838	10.150	12.542	3.453	0	0	0	0	0	0	37.250
1997	2.882	2.220	4.902	7.636	10.487	0.000	0	0	0	0	0	0	28.127
1998	0.000	1.631	4.776	8.187	7.886	0.000	0	0	0	0	0	0	22.481
1999	5.582	0.000	4.811	7.645	10.484	0.000	0	0	0	0	0	0	28.522
2000	2.289	2.432	4.936	10.391	10.416	0.000	0	0	0	0	0	0	30.464
2001	1.608	2.980	4.898	6.732	10.495	0.000	0	0	0	0	0	0	26.713
AVG	2.809	0.964	4.625	8.872	10.084	1.217	0.000	0	0	0	0	0	28.571

Not corrected

LETTUCE, ALL
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.22	2.48	0.0	0	0	0	0	0	0	1.30	2.55	0.76	8.30
1990	1.59	3.60	0.00	0	0	0	0	0	0	0.00	2.56	1.60	9.35
1991	1.18	2.65	0	0	0	0	0	0	0	0.00	2.43	1.26	7.52
1992	1.16	1.26	0	0	0	0	0	0	0	0.00	1.82	1.04	5.28
1993	0.00	1.72	0	0	0	0	0	0	0	1.25	2.08	1.42	6.47
1994	2.35	0.89	0	0	0	0	0	0	0	0.00	2.52	1.20	6.96
1995	0.22	2.47	0	0	0	0	0	0	0	0.43	1.46	2.24	6.82
1996	1.85	2.08	0	0	0	0	0	0	0	0.48	2.06	2.21	8.67
1997	1.92	1.64	0	0	0	0	0	0	0	0.00	1.93	1.76	7.25
1998	1.33	0.44	0	0	0	0	0	0	0	0.44	1.43	2.33	5.97
1999	1.33	3.76	1.46	0	0	0	0	0	0	0.22	1.66	2.08	10.50
2000	2.10	2.01	0	0	0	0	0	0	0	0.00	0.00	3.26	7.37
2001	0.00	0.00	0.00	0	0	0	0	0	0	3.33	0.00	0.00	3.33
AVG	1.25	1.92	0.11	0	0	0	0	0	0	0.57	1.73	1.63	7.22

CANTLOUPE, FALL
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	0	0	0	0.00	1.75	3.66	3.62	1.23	10.25
1990	0	0	0	0	0	0	0	0.68	3.87	5.61	0.00	0.00	10.17
1991	0	0	0	0	0	0	0	0.00	2.00	5.66	0.00	0.00	7.65
1992	0	0	0	0	0	0	0	0.00	7.83	0.00	0.00	0.00	7.83
1993	0	0	0	0	0	0	0	0	0.00	0.00	0.00	3.57	3.57
1994	0	0	0	0	0	0	0	0	0.00	3.05	0.69	3.51	7.24
1995	0	0	0	0	0	0	0	0	0.00	0.00	3.63	3.56	7.19
1996	0	0	0	0	0	0	0	0.00	1.32	6.16	2.95	0.63	11.07
1997	0	0	0	0	0	0	0	0.00	0.00	3.68	1.24	2.33	7.25
1998	0	0	0	0	0	0	0	0.00	0.00	3.68	3.57	0.00	7.25
1999	0	0	0	0	0	0	0	0.00	0.00	3.73	3.59	1.90	9.22
2000	0	0	0	0	0	0	0	0.00	0.00	3.70	2.91	0.64	7.25
2001	0	0	0	0	0	0	0	0.00	3.01	2.38	1.93	3.60	10.92
AVG	0.00	0	0	0	0	0	0	0.05	1.52	3.18	1.86	1.61	8.22

CANTLOUPE, SPRING
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0.00	0.00	7.96	8.34	0.00	0	0	0	0	0	0	16.30
1990	0	0.00	0.00	3.86	8.27	8.94	0	0	0	0	0	0	21.06
1991	0	0.00	0.00	3.80	7.99	8.05	0	0	0	0	0	0	19.84
1992	0	0.00	0.00	3.90	6.17	1.90	0	0	0	0	0	0	11.98
1993	0	0.00	0.00	3.94	8.08	4.15	0	0	0	0	0	0	16.17
1994	0	0.00	0.00	4.47	7.37	8.14	0	0	0	0	0	0	19.98
1995	0	0.00	0.00	3.91	7.99	4.10	0	0	0	0	0	0	15.99
1996	0	0.00	0.00	3.91	7.99	4.10	0	0	0	0	0	0	21.32
1997	0	1.24	0.66	5.69	8.34	5.39	0	0	0	0	0	0	18.07
1998	0	0.64	0.00	5.15	6.69	5.59	0	0	0	0	0	0	15.94
1999	0	0.00	0.00	3.93	7.90	4.10	0	0	0	0	0	0	17.98
2000	0	0.00	0.65	5.11	8.16	4.06	0	0	0	0	0	0	18.24
2001	0	0.00	0.00	3.79	8.08	6.37	0	0	0	0	0	0	17.67
AVG	0	0.00	0.15	0.23	4.57	7.79	5.00	0	0	0	0	0	17.73

MELONS, SPRINGS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	1.28	6.50	8.31	8.12	0.00	0	0	0	0	0	0	24.21
1990	0	0.00	3.78	8.14	9.86	8.22	0	0	0	0	0	0	30.00
1991	0	0.71	0.00	7.85	9.95	8.79	0	0	0	0	0	0	27.31
1992	0	0.00	0.00	7.86	6.12	1.92	0	0	0	0	0	0	15.90
1993	0	0.00	0.00	7.91	9.71	6.78	0	0	0	0	0	0	24.40
1994	0	0.00	1.99	7.97	8.19	6.10	0	0	0	0	0	0	24.25
1995	0	0.00	1.31	8.71	8.18	6.17	0	0	0	0	0	0	24.36
1996	0	1.44	4.49	8.08	8.51	8.13	0	0	0	0	0	0	30.64
1997	0	0.00	3.82	6.07	10.18	3.97	0	0	0	0	0	0	24.04
1998	0	0.00	2.01	7.20	8.90	4.01	0	0	0	0	0	0	22.12
1999	0	0.00	3.73	6.10	10.00	4.11	0	0	0	0	0	0	23.94
2000	0	1.46	2.04	8.08	10.85	4.18	0	0	0	0	0	0	26.62
2001	0	1.26	1.77	7.94	10.42	4.06	0	0	0	0	0	0	25.45
AVG	0	0.47	2.42	7.71	9.15	5.11	0.00	0	0	0	0	0	24.86

MELONS, FALL
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	0	0	0	0	0	0	0	5.70	5.17	5.44	0.64	16.95
1990	0	0	0	0	0	0	0	0	7.87	3.82	3.73	0.00	15.43
1991	0	0	0	0	0	0	0	0	3.93	3.77	3.62	0.00	11.33
1992	0	0	0	0	0	0	0.00	0	8.01	3.94	0.00	0.00	11.95
1993	0	0	0	0	0	0	0	0	0.00	0.00	0.00	3.58	3.58
1994	0	0	0	0	0	0	0	0	0.00	3.71	3.72	2.90	10.32
1995	0	0	0	0	0	0	0	0	0.00	3.80	3.58	0.00	7.38
1996	0	0	0	0	0	0	0	0	3.93	7.83	3.68	0.00	15.43
1997	0	0	0	0	0	0	0	0	0.00	5.11	3.66	2.34	11.11
1998	0	0	0	0	0	0	0	0	0.00	3.87	3.68	3.65	11.21
1999	0	0	0	0	0	0	0	0	0.00	5.23	3.61	2.34	11.17
2000	0	0	0	0	0	0	0	0	1.29	3.77	3.64	2.31	11.00
2001	0	0	0	0	0	0	0	0	1.28	3.79	3.68	3.60	12.35
AVG	0	0	0	0	0	0	0.00	0	2.46	4.14	3.24	1.64	11.48

WATERMELON, ALL
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	1.26	6.35	8.10	9.79	0.00	0	0	0	0	0	0	25.49
1990	2.67	0.00	3.79	7.97	9.80	6.82	0	0	0	0	0	0	31.05
1991	0.00	0.00	1.94	7.77	8.22	8.25	0	0	0	0	0	0	26.18
1992	0.00	0.00	0.00	7.80	7.99	0.76	0	0	0	0	0	0	16.55
1993	0.00	0.00	0.00	7.85	8.24	8.42	0	0	0	0	0	0	24.51
1994	0.00	0.00	3.69	7.93	8.12	8.46	0	0	0	0	0	0	28.21
1995	0.00	1.96	5.66	8.05	8.21	4.15	0	0	0	0	0	0	28.03
1996	2.15	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	2.15
1997	0.00	7.67	3.83	6.03	10.22	4.15	0	0	0	0	0	0	31.89
1998	0.00	0.00	1.94	7.82	8.04	4.86	0	0	0	0	0	0	22.66
1999	0.00	3.19	3.78	6.03	8.10	6.02	0	0	0	0	0	0	27.12
2000	0.00	1.25	3.90	6.87	10.17	4.18	0	0	0	0	0	0	26.36
2001	0.00	1.60	3.69	6.40	9.77	6.73	0	0	0	0	0	0	28.19
AVG	0.37	1.30	2.97	6.82	8.21	4.83	0.00	0	0	0	0	0	24.49

ONIONS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.58	3.64	3.38	0.00	0.00	0.00	0	0	0	0.00	0.00	3.97	12.57
1990	2.14	3.93	6.49	7.44	8.82	0.00	0	0	0	0.00	0.44	0.86	30.12
1991	0.83	3.11	4.70	7.32	8.07	2.07	0	0	0	1.59	0.74	0.15	28.59
1992	1.78	2.98	3.14	7.10	6.96	0.00	0	0	0	1.70	0.90	0.32	24.86
1993	0.93	2.48	6.20	7.39	5.69	0.00	0	0	0	1.88	0.00	1.37	25.93
1994	2.27	3.02	6.12	6.62	7.04	0.00	0	0	0	1.48	0.91	0.31	27.78
1995	0.92	4.44	4.92	8.19	7.17	0.00	0	0	0	1.79	0.89	0.93	29.24
1996	2.83	3.85	6.38	7.57	7.73	0.00	0	0	0	2.05	0.88	1.18	32.47
1997	3.92	3.98	6.21	7.51	7.10	0.00	0	0	0	0.00	0.96	0.90	30.57
1998	3.80	1.64	5.39	6.56	7.29	0.00	0	0	0	1.24	0.90	1.07	27.89
1999	3.89	4.36	5.53	6.83	6.94	0.00	0	0	0	1.07	0.89	0.94	30.46
2000	2.25	3.83	5.26	8.46	8.07	0.00	0	0	0	1.02	0.88	0.88	30.64
2001	2.24	3.61	4.83	7.95	7.09	0.00	0	0	0	1.77	0.00	0.00	27.49
AVG	2.26	3.45	5.27	6.84	6.77	0.16	0	0	0	1.20	0.65	0.99	27.58

POTATOES
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.91	5.23	7.62	2.29	0	0	0	0	0	0.00	3.67	2.16	22.86
1990	3.75	4.13	5.76	2.32	0	0	0	0	0	0	0.00	0.00	15.96
1991	1.38	3.20	5.09	4.09	0	0	0	0	0	0	1.76	1.18	16.70
1992	2.95	2.12	0.00	0.00	0	0	0	0	0	0	0	0.00	5.06
1993	0.00	3.24	6.02	5.88	0.00	0	0	0	0	0	0	2.74	17.88
1994	1.69	3.14	5.30	4.94	0	0	0	0	0	0	0	0.68	15.75
1995	0.75	4.02	6.27	2.63	0	0	0	0	0	0	0	0.80	14.47
1996	2.59	3.63	6.77	2.27	0	0	0	0	0	0	0	2.19	17.44
1997	2.37	3.93	7.30	0.95	0	0	0	0	0	0	0	0.26	14.81
1998	2.56	2.43	4.41	1.69	0	0	0	0	0	0	0	2.68	13.77
1999	2.22	4.06	6.34	1.12	0	0	0	0	0	0	0	2.12	15.86
2000	1.67	4.86	5.33	2.53	0	0	0	0	0	0	0	1.46	15.86
2001	2.13	3.90	5.14	1.78	0	0	0	0	0	0	0	3.41	16.36
AVG	2.00	3.68	5.49	2.50	0.00	0	0	0	0	0.00	0.42	1.51	15.60

TOMATOES
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.53	2.56	6.76	8.08	10.96	0.00	0	0	0	0	0	0	30.89
1990	3.70	2.06	6.97	7.66	10.74	10.57	0.00	0	0	0	0	0	41.70
1991	0.00	2.42	3.57	7.50	10.43	5.77	0	0	0	0	0	0	29.69
1992	0.00	1.68	2.63	7.24	9.10	3.80	0	0	0	0	0	0	24.45
1993	0.00	0.00	4.52	8.78	10.44	7.41	0	0	0	0	0	0	31.15
1994	2.26	0.40	5.60	8.24	10.14	5.91	0.00	0	0	0	0	0	32.55
1995	0.76	2.10	4.52	9.21	10.47	8.89	0.00	0	0	0	0	0	35.95
1996	3.40	2.15	4.70	10.16	11.11	6.77	0	0	0	0	0	0	38.28
1997	2.60	2.09	4.68	8.89	11.11	4.97	0	0	0	0	0	0	34.35
1998	0.00	1.08	4.53	7.41	9.31	6.30	0	0	0	0	0	0	28.63
1999	2.86	2.17	4.53	7.35	10.39	5.01	0	0	0	0	0	0	32.30
2000	2.72	1.14	5.56	9.13	10.77	5.47	0	0	0	0	0	0	34.78
2001	2.61	2.03	4.64	7.91	10.29	5.42	0	0	0	0	0	0	32.89
AVG	1.80	1.68	4.86	8.27	10.40	5.87	0.00	0	0	0	0	0	32.89

MISCELLANEOUS VEGETABLES & VEGETABLE SEEDS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	3.98	4.59	10.15	10.19	8.78	0	0	0	0	0	0	37.70
1990	0	5.06	3.80	8.61	11.85	8.31	0	0	0	0	0	0	37.63
1991	0	0.73	3.75	8.17	8.94	7.37	0	0	0	0	0	0	28.97
1992	0	0.00	3.77	8.04	8.30	8.22	0	0	0	0	0	0	28.34
1993	0	0.00	3.92	8.18	10.51	8.64	0	0	0	0	0	0	31.25
1994	0	1.78	3.78	9.22	10.85	8.50	0	0	0	0	0	0	34.13
1995	0	0.00	5.07	8.81	10.09	8.41	0	0	0	0	0	0	32.37
1996	0	3.95	3.90	9.67	11.36	9.89	0	0	0	0	0	0	38.77
1997	0	0.69	5.18	8.80	10.26	8.47	0	0	0	0	0	0	33.40
1998	0	0.00	5.02	7.90	9.01	8.21	0	0	0	0	0	0	30.15
1999	0	1.92	5.55	6.11	11.83	8.32	0	0	0	0	0	0	33.72
2000	0	0.79	5.23	8.06	12.57	8.38	0	0	0	0	0	0	35.03
2001	0	0.00	6.26	6.12	11.79	8.38	0	0	0	0	0	0	32.55
AVG	0	1.45	4.60	8.30	10.58	8.45	0	0	0	0	0	0	33.38

MISCELANEOUS GARDEN CROPS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0	3.98	4.59	10.15	10.19	8.78	0	0	0	0	0	0	37.70
1990	0	5.06	3.80	8.61	11.85	8.31	0	0	0	0	0	0	37.63
1991	0	0.73	3.75	8.17	8.94	7.37	0	0	0	0	0	0	28.97
1992	0	0.00	3.77	8.04	8.30	8.22	0	0	0	0	0	0	28.34
1993	0	0.00	3.92	8.18	10.51	8.64	0	0	0	0	0	0	31.25
1994	0	1.78	3.78	9.22	10.85	8.50	0	0	0	0	0	0	34.13
1995	0	0.00	5.07	8.81	10.09	8.41	0	0	0	0	0	0	32.37
1996	0	3.95	3.90	9.67	11.36	9.89	0	0	0	0	0	0	38.77
1997	0	0.69	5.18	8.80	10.26	8.47	0	0	0	0	0	0	33.40
1998	0	0.00	5.02	7.90	9.01	8.21	0	0	0	0	0	0	30.15
1999	0	1.92	5.55	6.11	11.83	8.32	0	0	0	0	0	0	33.72
2000	0	0.79	5.23	8.06	12.57	8.38	0	0	0	0	0	0	35.03
2001	0	0.00	6.26	6.12	11.79	8.38	0	0	0	0	0	0	32.55
AVG	0	1.45	4.60	8.30	10.58	8.45	0	0	0	0	0	0	33.38

ASPARAGUS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.00	5.18	5.25	5.66	11.34	10.27	9.24	7.42	3.39	1.75	3.22	62.71
1990	0.00	1.77	3.38	5.47	8.51	8.19	8.70	8.21	7.27	3.33	1.77	1.08	57.68
1991	2.22	0.00	1.80	3.43	10.87	5.60	11.06	5.56	5.40	5.31	0.00	5.49	56.74
1992	0.00	0.00	0.00	5.31	5.43	8.57	9.40	10.05	5.40	5.13	0.00	0.00	49.29
1993	0.00	0.00	0.00	5.29	8.49	10.27	9.17	8.51	8.03	5.22	0.00	0.00	54.98
1994	1.66	3.25	0.00	5.23	8.36	8.16	11.26	8.02	7.34	3.36	1.81	0.89	59.34
1995	0.00	0.00	4.22	5.48	6.52	11.35	7.53	9.23	7.28	3.40	1.77	2.74	59.52
1996	0.85	1.80	3.36	5.37	7.58	11.37	9.15	7.46	8.00	5.25	0.00	2.90	63.09
1997	0.00	2.35	2.74	5.43	8.18	8.75	11.40	8.20	2.93	5.23	0.00	2.69	57.90
1998	1.66	0.91	0.00	5.33	7.34	9.36	11.13	5.51	7.33	3.49	1.78	3.51	57.34
1999	0.00	1.76	3.34	5.18	7.45	9.25	7.58	9.12	7.23	0.94	4.12	0.90	56.86
2000	0.00	4.15	0.94	5.38	7.51	9.23	10.24	8.53	5.41	5.22	0.00	2.31	58.91
2001	1.68	0.91	0.00	5.26	11.08	5.59	11.10	7.56	7.97	2.77	2.38	1.02	57.32
AVG	0.62	1.30	1.92	5.19	7.92	9.00	9.85	8.09	6.69	4.00	1.18	2.06	57.82

CITRUS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.75	3.64	4.64	4.63	5.79	4.89	8.88	5.65	4.82	4.68	3.66	0.00	52.04
1990	2.81	1.56	4.53	4.72	5.71	7.14	6.52	5.61	4.68	2.15	4.43	0.00	49.85
1991	2.21	2.08	1.59	3.01	7.09	4.74	7.03	4.77	4.61	4.55	4.42	0.00	46.11
1992	0.00	0.00	2.36	4.68	4.67	4.90	7.12	7.34	4.67	2.13	2.33	0.00	40.20
1993	0.00	0.00	4.56	2.48	7.08	4.89	7.40	7.07	4.71	4.56	0.00	3.56	46.31
1994	0.83	0.00	4.52	4.68	4.78	4.87	9.77	4.87	4.69	4.62	3.63	0.00	47.25
1995	0.00	0.80	4.51	4.72	4.73	6.56	7.19	5.73	6.40	3.04	3.64	0.00	47.31
1996	2.23	2.06	4.56	4.69	7.32	4.89	7.18	7.49	4.68	3.83	2.88	1.53	53.31
1997	0.77	3.67	2.98	2.43	8.59	5.82	4.88	8.89	2.43	4.56	2.07	0.00	47.08
1998	2.28	0.00	4.54	3.07	6.48	4.88	5.79	8.73	4.68	2.98	1.57	0.00	45.00
1999	4.40	0.00	4.50	4.68	4.72	6.54	5.72	7.01	4.68	2.41	3.57	0.78	49.00
2000	1.95	2.36	3.72	5.54	4.75	4.83	8.82	4.81	4.70	4.51	0.78	1.52	48.28
2001	1.95	2.38	2.12	4.67	5.65	6.48	4.85	7.98	6.34	2.11	2.34	0.00	46.86
AVG	1.55	1.43	3.78	4.15	5.95	5.49	7.01	6.61	4.78	3.55	2.72	0.57	47.58

DATES
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.00	7.13	7.21	7.39	14.94	7.51	13.21	7.19	6.95	0.00	1.20	72.73
1990	3.36	2.35	4.52	7.14	9.80	8.62	10.86	7.20	7.07	3.71	5.67	1.22	71.53
1991	0.00	0.00	3.19	7.17	11.05	7.25	10.82	7.35	7.04	6.96	0.00	0.00	60.84
1992	0.00	2.38	1.28	7.01	7.11	10.94	8.73	9.75	7.14	3.30	3.61	3.11	64.35
1993	0.00	0.00	0.00	7.12	9.87	12.13	7.43	13.24	7.02	4.49	3.63	0.00	64.94
1994	0.00	0.00	6.89	7.15	7.22	10.79	11.21	7.28	10.46	2.41	4.47	0.00	67.88
1995	2.27	0.00	4.59	7.19	9.76	8.55	10.74	9.89	7.19	6.99	0.00	4.37	71.53
1996	2.26	0.00	3.70	7.19	10.87	8.77	13.50	7.34	7.22	6.98	2.35	4.43	74.61
1997	0.00	0.00	7.01	3.83	10.71	10.07	8.53	10.63	7.12	2.43	4.54	0.00	64.87
1998	2.32	0.00	4.52	3.75	10.53	11.21	7.44	10.87	7.19	3.77	5.63	1.22	68.45
1999	0.00	0.00	6.95	7.26	7.11	7.36	11.17	10.69	7.06	2.43	4.45	2.36	66.84
2000	0.00	1.20	5.66	7.12	8.55	10.77	9.79	7.43	7.16	6.91	1.21	2.37	68.18
2001	3.18	0.00	3.75	4.58	9.81	10.68	8.56	9.72	7.13	5.65	4.44	0.00	67.49
AVG	1.03	0.46	4.55	6.44	9.22	10.16	9.71	9.59	7.38	4.84	3.08	1.56	68.02

DUCK PONDS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.00	0.00	0.00	0	0	0	6.79	0.00	3.76	3.60	1.62	15.77
1990	1.81	3.60	3.75	1.74	0	0	0	0.68	1.31	2.42	3.69	1.25	20.24
1991	2.22	1.27	2.39	3.81	0	0	0	0.00	1.29	3.70	2.37	0.00	17.05
1992	2.77	0.67	1.29	0.70	0	0	0	3.22	0.00	3.71	1.66	1.86	15.87
1993	0.00	0.00	3.68	2.05	0	0	0	1.97	1.27	3.69	2.33	1.24	16.22
1994	2.23	3.63	1.29	2.41	0	0	0	1.30	2.42	3.71	1.24	2.32	20.55
1995	0.00	1.91	3.71	1.79	0	0	0	1.49	2.40	3.65	1.93	1.63	18.51
1996	3.41	1.96	3.08	3.80	0	0	0	0.00	2.40	4.95	0.65	2.92	23.18
1997	0.61	3.62	3.68	1.29	0	0	0	2.56	0.00	3.75	1.28	2.29	19.08
1998	1.18	0.66	2.99	1.96	0	0	0	1.77	1.96	2.44	2.95	1.87	17.77
1999	2.19	1.28	3.75	3.75	0	0	0	0.00	0.65	3.75	2.91	3.49	21.77
2000	0.62	2.93	1.95	3.82	0	0	0	0.00	1.75	3.67	1.93	2.29	18.96
2001	1.19	3.59	1.74	2.00	0	0	0	1.72	5.82	3.63	0.00	3.51	23.22
AVG	1.40	1.93	2.56	2.24	0	0	0	1.65	1.64	3.60	2.04	2.02	19.09

FISH FARMS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	1.29	1.96	4.04	5.12	9.25	10.36	11.18	10.72	8.76	6.27	3.95	2.78	75.69
1990	1.31	2.80	3.02	4.95	8.31	8.95	11.48	8.92	8.57	5.02	4.11	2.68	70.11
1991	1.25	1.36	2.41	4.80	6.36	9.66	9.79	9.64	7.19	5.95	4.10	0.47	62.97
1992	1.28	0.96	1.93	4.23	6.45	9.77	10.77	9.61	8.13	4.47	3.85	1.34	62.78
1993	0.00	0.73	3.65	4.78	7.11	10.09	11.04	10.25	8.75	6.54	2.92	2.74	68.58
1994	1.26	2.22	2.27	4.88	6.79	10.90	10.43	10.25	8.23	5.50	3.53	1.62	67.87
1995	1.04	1.59	3.53	4.95	7.21	9.90	11.71	10.32	8.65	5.04	4.39	2.69	71.00
1996	1.33	2.10	2.99	5.74	8.73	10.18	10.84	10.96	7.97	6.13	4.50	2.77	74.24
1997	1.30	2.21	3.71	4.27	7.85	10.07	11.03	10.15	5.82	6.26	3.60	1.98	68.24
1998	1.50	0.47	2.95	4.09	6.89	9.88	11.56	10.60	7.74	6.04	3.37	2.70	67.78
1999	1.53	2.60	3.21	3.84	7.60	9.62	10.09	9.63	7.12	6.56	3.66	2.82	68.28
2000	1.27	2.14	2.99	4.91	9.11	9.18	10.33	9.41	7.92	5.04	3.54	2.69	68.52
2001	1.32	2.13	2.97	4.91	7.30	9.63	10.22	9.78	7.89	5.47	4.35	2.13	68.09
AVG	1.21	1.79	3.05	4.73	7.61	9.86	10.80	10.02	7.90	5.71	3.84	2.26	68.78

JOJOBA
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.00	3.71	3.79	4.60	5.41	5.81	4.60	3.89	3.07	2.33	1.22	38.43
1990	0.00	0.00	3.68	3.79	3.90	4.59	7.14	2.50	3.80	3.68	1.22	0.63	34.93
1991	0.00	0.00	1.69	3.75	3.88	4.59	5.27	5.60	3.74	0.65	2.92	0.00	32.09
1992	0.00	0.00	0.00	2.02	3.75	5.80	4.65	3.87	3.80	3.06	2.30	0.00	29.23
1993	0.00	0.00	0.00	3.70	5.22	6.51	3.94	3.96	3.83	3.76	2.94	0.62	34.49
1994	0.00	0.00	2.99	2.02	5.66	4.69	3.94	7.04	3.74	1.90	1.71	0.00	33.69
1995	0.00	0.00	1.97	3.85	3.85	5.80	6.10	3.93	3.81	3.76	1.66	0.00	34.72
1996	1.79	0.00	3.08	3.85	4.69	3.94	7.12	4.64	3.82	3.04	0.64	2.90	39.50
1997	0.00	0.00	1.95	3.71	5.68	4.75	5.28	5.68	2.00	1.76	1.91	0.00	32.71
1998	1.60	0.00	1.94	2.49	5.21	3.99	5.86	3.95	4.49	3.04	1.86	0.00	34.43
1999	0.00	1.66	1.90	3.85	3.88	3.92	5.97	5.69	1.94	3.72	1.65	0.00	34.17
2000	1.79	0.00	1.68	5.12	4.62	3.98	5.28	5.59	3.74	1.89	1.67	0.00	35.37
2001	0.64	1.21	1.71	3.75	3.87	5.98	3.95	5.66	3.81	1.96	2.92	0.65	36.12
AVG	0.45	0.22	2.02	3.52	4.52	5.92	5.41	4.82	3.57	2.71	1.98	0.46	34.61

PASTURE, PERMANENT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	0.83	4.80	9.00	6.03	10.28	9.07	5.88	8.93	4.77	3.00	1.58	64.18
1990	0.00	0.83	4.72	7.17	6.70	10.15	5.92	9.10	5.69	3.84	3.03	0.00	57.15
1991	1.59	0.82	2.21	7.31	7.24	5.85	9.10	7.46	7.19	4.68	0.00	0.00	53.45
1992	0.00	0.00	4.68	4.85	4.94	10.13	[illegible]	8.99	5.74	3.87	2.96	1.58	53.70
1993	0.00	0.00	3.89	5.72	6.69	8.34	10.10	5.05	9.74	4.62	0.00	1.58	55.74
1994	3.01	0.00	4.72	4.93	4.93	10.06	9.11	5.88	8.90	4.70	0.83	0.00	57.07
1995	0.00	1.60	3.02	8.97	5.86	9.13	7.63	7.21	9.81	4.67	0.00	0.82	58.72
1996	3.75	0.00	4.73	4.90	10.07	7.65	7.48	10.09	6.57	4.83	3.01	1.60	64.67
1997	0.00	3.02	4.76	4.95	6.66	10.11	8.32	6.66	4.96	4.80	2.15	0.82	57.22
1998	1.58	0.00	4.67	4.87	5.84	9.13	6.01	9.08	5.76	4.72	3.78	0.83	56.26
1999	1.52	2.16	4.69	4.91	5.81	9.99	6.70	8.17	4.85	6.39	0.00	2.96	58.16
2000	1.72	0.00	4.72	5.75	9.10	5.91	9.16	7.65	7.15	2.49	3.77	0.82	58.23
2001	0.00	2.13	4.74	4.83	7.46	9.11	5.79	9.80	4.84	4.75	3.79	0.83	58.17
AVG	1.01	0.88	4.33	6.01	6.72	9.91	[illegible]	7.77	6.93	4.55	2.03	1.03	57.90

PEACHES & MIXED FRUIT
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.00	4.68	3.83	8.17	7.44	6.22	11.45	7.24	6.21	4.85	3.77	1.98	65.84
1990	0.00	3.75	2.04	6.00	7.28	11.35	7.23	6.12	5.99	4.78	3.74	0.00	58.28
1991	1.89	1.04	2.71	6.00	6.14	7.32	8.34	8.90	5.91	3.10	2.67	0.00	54.01
1992	0.00	0.00	3.07	6.10	6.07	6.19	9.08	7.29	5.96	4.85	0.00	1.95	50.55
1993	0.96	0.00	2.82	3.18	12.35	6.15	6.25	12.20	5.98	4.86	1.03	0.00	55.78
1994	2.55	2.99	0.00	6.01	6.09	12.54	6.15	9.07	6.02	3.08	4.73	0.00	59.23
1995	0.00	1.03	4.78	6.12	7.28	6.23	11.27	5.92	7.18	4.86	1.03	4.62	60.32
1996	0.00	1.06	4.75	5.98	7.28	11.31	6.21	9.46	5.98	5.93	2.70	0.00	60.66
1997	2.85	2.71	3.14	6.01	6.21	9.13	9.49	6.12	6.06	2.74	3.06	0.00	57.53
1998	2.58	0.00	3.09	5.88	5.98	7.24	11.29	6.16	6.04	5.97	0.00	5.72	59.94
1999	0.00	0.00	5.83	6.01	6.10	6.13	9.35	6.06	6.04	5.93	2.71	0.00	54.15
2000	3.01	0.00	5.82	6.02	6.16	6.21	12.53	6.12	6.04	4.75	1.04	1.97	59.66
2001	2.54	1.05	2.04	6.00	9.00	7.25	8.31	6.21	6.12	5.89	2.64	1.02	58.07
AVG	1.26	1.41	3.38	5.96	7.18	7.94	9.00	7.45	6.12	4.74	2.24	1.33	58.00

MISCELLANEOUS PERMANENT CROPS
IRRIGATION WATER REQUIRMENT
IMPERIAL IRRIGATION DISTRICT
(ac-in / ac)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	0.62	2.95	3.72	4.47	11.48	8.33	8.37	8.12	8.10	3.87	3.62	1.68	65.31
1990	1.87	1.68	3.76	5.89	8.10	8.13	8.30	8.06	6.48	3.68	3.62	0.00	59.56
1991	1.76	1.68	1.96	5.63	8.06	8.05	8.06	8.03	3.83	4.40	2.97	0.00	54.42
1992	1.59	1.94	0.00	3.93	7.86	8.19	8.96	7.24	7.70	3.63	2.30	0.00	53.34
1993	0.00	0.00	3.69	3.86	8.10	8.24	8.33	9.55	6.46	5.08	2.32	0.00	55.63
1994	3.74	0.00	3.69	3.88	8.02	8.16	10.19	8.18	6.04	3.81	3.67	1.23	60.60
1995	0.00	1.64	3.69	4.62	7.88	8.33	9.67	8.06	7.11	3.81	3.65	0.64	59.09
1996	1.85	1.91	3.69	5.73	9.70	8.22	8.29	8.18	7.82	3.82	3.72	0.63	63.57
1997	3.26	0.65	3.70	5.18	8.08	8.30	10.24	8.09	3.92	4.47	2.95	0.63	59.48
1998	1.25	1.63	1.94	5.64	6.08	8.91	8.34	10.04	5.36	5.52	1.89	2.32	58.91
1999	1.19	2.34	1.94	6.82	6.16	8.12	8.13	8.01	6.44	3.79	3.61	1.24	57.78
2000	2.17	1.24	3.72	4.53	8.14	8.25	8.35	7.33	7.80	3.69	3.62	0.00	58.85
2001	1.92	1.69	3.67	3.82	8.04	8.20	9.52	8.04	6.36	5.06	2.32	1.24	59.90
AVG	1.63	1.49	3.01	4.92	8.13	8.27	8.83	8.23	6.42	4.20	3.10	0.74	58.96

APPENDIX C

TABLE 7.1 CALCULATIONS

IMPERIAL IRRIGATION DISTRICT ANNUAL WATER USE ASSESSMENT

Summary for updating Table 7.1 (Jensen and Walter, 1997)

Row	Description	IID Variable	Units	Year 1994	1995	1996	1997	1998	1999	2000	2001	Avg 97-01 Average
2												
3												
4												
5												
6	Description											
7	EHL Canal (Inflow to Drop 1)	2	ac-ft				3,072,298	3,007,425	2,990,128	3,017,273	2,992,161	3,015,857
8	Operationa Trans - AAC losses	3	ac-ft				207,429	220,389	278,745	257,050	228,179	238,358
9	Canal spill	4	ac-ft				64,562	78,300	136,519	114,791	86,338	96,102
10	Delivery to Agr	5	ac-ft				2,718,840	2,662,289	2,622,407	2,642,254	2,626,730	2,654,504
11	Crop ET	6	ac-ft				1,882,239	1,724,826	1,845,504	1,879,843	1,839,108	1,834,304
12	Leachwater	7	ac-ft				216,411	194,128	200,294	196,629	194,455	200,383
13	Tailwater	8	ac-ft				631,211	764,221	586,964	575,931	605,182	632,702
14	Excess leach & tailwater	9	ac-ft									
15	Total (7+8+9)	10	ac-ft				847,623	958,350	787,257	772,559	799,637	833,085
16	Total loss (3+4+10)	11	ac-ft				1,119,614	1,257,039	1,202,521	1,144,401	1,114,154	1,167,546
17	Loss as % of Inflow	12					36%	42%	40%	38%	37%	**38.7%**
18	Other calculations											
19	Net flow to the Sea from IID						1,059,683	1,033,726	1,008,969	1,030,501	1,053,518	1,037,279
20	Net flow to the Sea f 1994-1996			1,024,614	1,063,056	1,056,095						Avg 94-96 1,047,922

APPENDIX D

WATER BALANCE SPREADSHEET

IMPERIAL IRRIGATION DISTRICT ANNUAL WATER USE ASSESSMENT

Data Sources are described below

Row	Description	IID Variable	Method or source	Units	1987	1988	1989	1990	1991	1992	Year 1993	1994	1995	1996	1997	1998	1999	2000	2001	Avg 87-97 Average	Avg 89-01 Average
7	MEASURED INFLOW TO STUDY AREA:																				
8	AA Canal, Pilot Knob	A1	IID Water Control	ac-ft	3,090,563	3,278,629	3,376,801	3,419,700	3,211,124	2,878,366	3,084,856	3,368,805	3,391,421	3,485,724	3,491,908	3,434,889	3,418,185	3,450,836	3,409,584		
9	Outflow to Coachella Canal	-A6	IID Water Control	ac-ft	320,303	324,751	351,264	359,402	307,826	297,484	307,026	325,565	320,760	330,751	324,033	329,805	330,157	335,466	319,819	3,909	
10	IID Deliveries from Coachella C		WST & NRCE (1)	ac-ft	4,000	4,000	4,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	3,909	3,909	3,909	3,909	3,909	
11	IID Deliveries from AAC above EHL		WST & NRCE	ac-ft	3,000	3,000	3,000	3,000	6,000	4,000	3,000	2,000	2,000	2,000	500	2,864	2,864	2,864	2,864	2,864	
12	Surface Inflow from Mexico	E5	IID Water Control	ac-ft	252,920	228,954	155,322	135,081	132,726	144,887	192,099	147,004	149,995	119,659	162,101	176,328	176,859	159,208	146,417		
13	Precipitation		Avg. CIMIS 41, 68 & 87	inches	*2.70*	*1.57*	*1.30*	*1.82*	*3.50*	*6.14*	*5.38*	*2.57*	*2.11*	*0.80*	*3.26*	*2.87*	*1.83*	*1.05*	*0.54*		
14	Rainfall, calculated volume		Precip/12 x 656,308 ac	ac-ft	147,689	85,867	71,100	99,540	191,423	335,810	294,244	140,559	115,400	43,754	178,296	156,967	100,087	57,427	29,534		
15																					
16	ESTIMATED ADJUSTMENTS, AND OTHER INFLOWS TO STUDY AREA:																				
17	Seepage between PK and EHL	-A2		ac-ft	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200		
18	Evaporation, between PK and EHL (756 ac)		R52/12*756*R114	ac-ft	5,021	4,857	5,223	4,895	4,501	4,506	4,816	4,782	4,872	5,111	4,877	4,705	4,735	4,743	4,649		
19	Other Surface Inflows (Mesa storm flow;	B8	Regr used for 1997-01/2	ac-ft	3,000	1,739	1,244	2,767	5,400	8,111	9,500	1,322	936	355	3,927	4,821	1,832	890	0		
20	Subsurface Inflows	E13		ac-ft	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000		
21																					
22	TOTAL MEASURED AND ESTIMATED INFLOWS:																				
23	Total Inflow		R8-R9+R10-R11+R12+R14-R17-R18+R19+R20	ac-ft	3,095,628	3,192,380	3,174,780	3,218,581	3,152,145	2,988,984	3,195,655	3,254,953	3,259,900	3,241,430	3,436,622	3,365,540	3,290,906	3,254,595	3,168,112		
24																					
25	MEASURED OUTFLOW FROM STUDY AREA:																				
26	Alamo River Outflow to Sea	E2	IID Water Control	ac-ft	512,200	558,687	593,664	617,866	594,126	546,043	617,025	641,071	646,167	640,974	651,914	633,092	622,178	640,122	652,646		
27	New River Outflow to Sea	E3	IID Water Control	ac-ft	493,152	486,940	431,426	430,510	410,629	396,595	460,296	443,064	472,866	436,389	486,704	493,395	493,066	484,046	482,236		
28	Direct Outflow to Sea	E4	IID Water Control	ac-ft	99,262	100,053	96,109	91,068	88,341	80,734	88,589	108,805	115,134	118,746	107,093	108,387	94,414	106,238	105,053		
29	Total Measured Outflow		R26+R27+R28	ac-ft	1,104,614	1,147,680	1,121,201	1,139,464	1,093,096	1,023,372	1,165,910	1,192,940	1,233,987	1,196,109	1,245,711	1,234,875	1,209,660	1,210,404	1,219,935		
30																					
31	TOTAL WATER CONSUMPTION AS RESIDUAL OF MEASURED FLOWS:																				
32	Change in Storage		Assume = 0 annually	ac-ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
33	Total Inflow+Storage Chge-Total Outflow		R23-R29+R32	ac-ft	1,991,014	2,044,700	2,053,579	2,079,127	2,059,049	1,963,612	2,029,745	2,062,013	2,025,913	2,045,321	2,190,911	2,130,665	2,081,246	2,044,192	1,968,177		
34																					
35	NON-AGR IRRIGATION WATER USES:																				
36	Municipal	C4	IID Water Control	ac-ft	39,257	38,617	39,073	39,039	38,636	40,678	41,680	43,500	45,000	46,500	49,192	48,432	49,152	52,194	53,058		
37	Industrial	C5	IID Water Control (3)	ac-ft	7,421	6,820	9,414	13,808	14,971	14,980	15,120	16,500	16,500	18,000	20,125	21,363	22,602	23,640	25,079		
38	Feedlots	C6	IID Water Control	ac-ft	6,853	6,801	6,968	7,225	7,417	6,301	6,500	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000		
39	Other uses	C7	IID Water Control	ac-ft	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415	10,415		
40	Total non-agr uses	C3	SUM(R36:R39)		63,946	62,253	65,890	70,287	71,439	72,372	73,815	77,415	78,915	81,915	86,732	87,210	89,169	93,449	95,552		
41																					
42	ACREAGES USED IN IID STUDY AREA ANNUAL WATER BALANCE:																				
43	Agriculture	B2	(4)	ac	486,456	486,476	486,565	485,863	482,833	480,567	480,270	477,705	478,515	477,615	478,158	476,691	476,851	476,364	475,284		
44	Rivers & Drain Vegetation		WST & NRCE	ac	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424	11,424		
45	Canals & Reservors		WST & NRCE	ac	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401	3,401		
46	Rivers and Drains Water surfaces		WST & NRCE	ac	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357	2,357		
47	Non-agriculture areas		656,308-SUM(R43:R46)	ac	152,668	152,648	152,559	153,261	156,291	158,557	158,854	161,419	160,809	161,509	160,968	162,433	162,473	162,760	163,840		
48																					
49	ESTIMATED TOTAL WATER CONSUMPTION ON AGRICULTURAL LAND BY WATER BALANCE:																				
50	Total water consumption, water balance		R33	ac-ft	1,991,014	2,044,700	2,053,579	2,079,127	2,059,049	1,963,612	2,029,745	2,062,013	2,025,913	2,045,321	2,190,911	2,130,665	2,081,246	2,044,192	1,968,177		
51	Total non-agr deliveries		R40	ac-ft	63,946	62,253	65,890	70,287	71,439	72,372	73,915	77,415	78,915	81,915	86,732	87,210	89,169	93,449	95,552		76.2
52	Reference ET, ASCE ETosz		ASCE Std Equation (5)	inches	*79.7*	*77.1*	*82.9*	*77.7*	*71.45*	*71.53*	*78.64*	*75.91*	*77.3*	*81.1*	*77.4*	*74.7*	*75.2*	*75.3*	*73.9*		
53	ET, Drains & Rivers Phreatophytes	-Est	R44*(R52/12)*R113	ac-ft	83,462	80,739	86,613	81,387	74,822	74,908	80,046	79,493	80,990	84,949	81,074	78,205	78,706	78,833	77,283		
54	Canals & Reservoir Evaporation	-Est	R45*(R52/12)*R114	ac-ft	22,568	21,851	23,495	22,022	20,250	20,273	21,684	21,514	21,919	22,991	21,942	21,166	21,302	21,336	20,916		
55	Drains & Rivers Evaporation	-Est	R46*(R52/12)*R115	ac-ft	15,854	15,144	16,283	15,262	14,034	14,050	15,014	14,910	15,191	15,933	15,207	14,668	14,763	14,788	14,496		
56	Total water consumption on agr land, W-bal		R50-R51-sum(R53:R55)		1,805,383	1,884,713	1,861,098	1,890,189	1,878,504	1,782,011	1,839,104	1,868,680	1,828,887	1,839,533	1,985,857	1,929,418	1,877,306	1,835,787	1,759,930		
57																					
58	CALCULATED CROP ET AND IRRIGATION WATER CONSUMPTION ON AGRICULTURAL LAND:																				
59	Total water consumption on agr land		CropET Model	ac-ft	########	*1,831,252*	1,832,569	1,943,510	1,797,958	1,621,466	1,836,431	1,929,389	1,942,656	2,008,097	1,959,775	1,901,563	1,903,364	1,923,560	1,899,018	1,884,558	
60	Irrigation water consumption on agr land		CropET Model	ac-ft	########	*1,798,689*	1,798,169	1,835,312	1,722,839	1,462,648	1,594,940	1,851,241	1,829,214	1,973,508	1,882,239	1,724,826	1,845,504	1,879,843	1,839,108	1,783,030	
61	*1987 & 1988 from J_W (1997)*																				
62	Irrig water requirement per acre, weighted average		CropET Model	ac-in/ac			46.45	44.89	41.04	35.73	41.23	44.23	42.56	46.00	43.61	41.48	45.40	47.34	48.28	43.71	
63	Crop ET, ETc, per acre, weighted average		CropET Model	ac-in/ac			47.34	47.53	42.85	41.11	47.30	46.10	45.24	46.82	45.43	45.68	46.83	48.45	49.77	46.19	
64	Ratio, calculated ETc/water balance ETc		R59/R56	- -			0.985	1.028	0.957	0.910	0.999	1.032	1.062	1.092	0.987	0.966	1.014	1.048	1.079	1.014	
65																					
66	ESTIMATING LEACHING REQUIREMENT AND TAILWATER:																				
67	Relative salinity of the Colorado River water		USGS				0.82	0.87	0.96	0.96	0.93	0.94	0.98	0.98	0.97	0.88	0.81	0.83	0.80	0.80	
68	Estimated leaching requirement, normal salinity			CL				0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124	0.124		
69	Estimated water needed for leaching		R67xR68xR60 **	ac-ft	208,555	222,928	193,986	218,478	202,950	161,753	185,906	224,963	217,750	237,374	205,390	173,242	189,939	186,460	182,440		
70	Irrigation water delivered to farms	C2		ac-ft	2,322,174	2,493,452	2,577,082	2,610,625	2,448,721	2,106,398	2,330,539	2,575,371	2,580,788	2,711,983	2,718,840	2,662,289	2,622,407	2,642,254	2,626,730		
71	Estimated tailwater		R70-R60-R69	ac-ft	430,693	471,835	584,927	556,837	522,932	541,997	549,693	499,187	533,824	501,081	631,211	764,221	586,964	575,931	605,182		
72	Tailwater, percent of water delivered		R71/R70	%	19%	19%	23%	21%	21%	26%	24%	19%	21%	18%	23%	29%	22%	22%	23%		22.5%
73	Estimated water used for leaching, 0 9 x LR + 0 05 x TW			ac-ft	209,244	224,227	203,834	224,470	208,802	172,678	194,800	227,425	222,666	238,690	218,411	194,128	200,294	196,629	194,455		
74	** J-W (1997) used a LR = 0 1235, or CL = 0 141 Estimated water for leaching values for 1987 and 1988 were corrected by 0 124/0 141 = 0 879																				

No TW Corrected

	IID Variable	Method or source	Units	1987	1988	1989	1990	1991	1992	Year 1993	1994	1995	1996	1997	1998	1999	2000	2001	Avg 87-97 Average	Avg 89-01 Average
IRRIGATION PERFORMANCE PARAMETERS:																				
Transportation losses	Total	USBR & IID	ac-ft	370,134	383,556	369,380	366,967	371,377	369,334	362,762	374,019	393,649	325,945	308,508	319,294	377,680	355,993	327,028		
Seepage between PK and EHL	-A2	R17		94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200	94,200		
Evaporation, between PK and EHL (756 ac)		R18		5,021	4,857	5,223	4,895	4,501	4,506	4,816	4,782	4,872	5,111	4,877	4,705	4,735	4,743	4,649		
Seepage, AAC		USBR & IID		14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104	14,104		
Seepage, main canals		USBR & IID		86,750	86,624	86,624	85,679	85,070	85,070	85,070	85,070	85,070	85,070	85,070	85,070	85,070	85,070	85,070		
Seepage, concrete laterals		USBR & IID		9,060	9,071	9,098	9,715	10,395	11,075	11,500	11,750	11,750	11,750	11,750	11,750	11,750	11,750	11,750		
Seepage, earthen laterals		USBR & IID		28,792	28,659	28,522	22,654	17,206	12,482	11,035	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000		
Main canal spills		USBR & IID		6,173	6,649	5,811	7,179	7,463	4,241	3,337	3,199	3,919	3,773	1,488	680	2,174	1,015	4,233		
Canals & Reservoir Evaporation		R54		22,588	21,851	23,495	22,022	20,250	20,273	21,664	21,514	21,919	22,991	21,942	21,166	21,302	21,336	20,916		
Lateral spills		USBR & IID		103,446	117,542	102,305	108,519	118,188	143,383	117,056	129,399	147,814	78,947	63,074	77,620	134,345	113,778	82,105		
Conveyance efficiency		(R8-R9-R78)/(R8-R9)	%	86.6%	87.0%	87.8%	88.0%	87.2%	84.9%	86.9%	87.7%	87.2%	89.7%	90.3%	89.7%	87.8%	88.6%	89.4%		88.1%
On-farm irrigation efficiency		(R60 ÷ R73)/R70	%	81.5%	81.1%	77.7%	78.9%	78.9%	74.8%	76.8%	80.7%	79.5%	81.6%	77.2%	72.1%	78.0%	78.8%	77.4%		77.8%
Overall system efficiency		R66 x R69	%	70.6%	70.6%	68.2%	69.4%	68.8%	63.5%	66.8%	70.8%	69.3%	73.1%	69.7%	64.7%	68.5%	69.8%	69.2%		68.8%
Fraction of irrig water consumed on agr land		R60/R70	- -	0.72	0.72	0.70	0.70	0.70	0.67	0.68	0.72	0.71	0.73	0.69	0.65	0.70	0.71	0.70		0.697
OVERALL DISPOSITION OF COLORADO RIVER WATER:																				
Irrigation water supply		R8-R9-R17-R40	ac-ft	2,812,114	2,797,425	2,865,447	2,895,811	2,737,859	2,412,310	2,609,713	2,871,435	2,897,526	2,978,858	2,986,943	2,923,874	2,904,649	2,927,521	2,900,213		
Irrigation water consumed on agricultural land		R60	ac-ft	1,882,726	1,798,869	1,798,169	1,835,312	1,722,839	1,402,646	1,594,940	1,851,241	1,829,214	1,973,506	1,882,239	1,724,826	1,845,504	1,879,843	1,839,106		
Irrig water evap & used by phreatophytes		R53+R54+R55	ac-ft	121,705	117,734	126,591	118,651	109,107	109,229	116,727	115,917	116,101	123,873	116,223	114,039	114,772	114,955	112,695		
Irrig water evap consumed by non-agric		R40	ac-ft	63,946	62,253	65,890	70,287	71,439	72,372	73,915	77,415	78,915	81,915	86,732	87,210	89,159	93,449	95,552		
Irrigation water flowing to the Salton Sea		R94-R95-R96-R97	ac-ft	743,738	818,749	874,797	871,562	834,275	828,081	824,132	826,862	871,296	799,562	899,749	997,798	855,204	839,273	852,858		
Net flow to the Sea from IID		R29-R12--R19-R20	ac-ft	826,694	896,967	944,635	961,616	934,970	852,374	944,311	1,024,614	1,053,056	1,056,095	1,059,883	1,033,726	1,006,969	1,030,508	1,053,518		
Other information:																				
AAC at PK - Coachella C + irrig from C Canal		R8-R9+R10	ac-ft	2,774,260	2,957,678	3,029,537	3,083,296	2,907,296	2,582,882	2,781,828	3,047,050	3,074,841	3,156,973	3,171,875	3,109,193	3,091,927	3,119,079	3,093,874		
Water supply per acre		R102/R43	ac-ft/ac	5.70	6.08	6.23	6.30	6.02	5.37	5.79	6.38	6.43	6.61	6.63	6.52	6.49	6.55	6.51		6.30
Tailwater per acre		R71/R43	ac-ft/ac	0.89	0.97	1.20	1.15	1.06	1.13	1.14	1.04	1.12	1.05	1.32	1.60	1.23	1.21	1.27		
Ratio, Agr delivery/Pilot Kn		R70/R8	- -	0.751	0.761	0.763	0.763	0.763	0.732	0.755	0.765	0.761	0.778	0.779	0.775	0.767	0.766	0.770		
EHL Canal		R8-R9+R10-R11-R17-R109	ac-ft	2,672,039	2,855,821	2,927,114	2,981,203	2,802,587	2,480,176	2,679,812	2,946,066	2,973,569	3,057,662	3,072,298	3,007,425	2,990,128	3,017,273	2,992,161		
Estimated evaporation, AAC, area = 756 ac		R18	ac-ft	5,021	4,857	5,223	4,895	4,501	4,506	4,816	4,782	4,872	5,111	4,877	4,705	4,735	4,743	4,649		
EHL/agr area		R108/R43	ac-ft/ac	5.49	5.67	6.02	6.09	5.80	5.16	5.58	6.17	6.21	6.40	6.43	6.31	6.27	6.33	6.30		6.06
Ratio, Agr delivery/EHL		R70/R108	- -	0.869	0.873	0.880	0.882	0.874	0.849	0.870	0.874	0.868	0.887	0.885	0.885	0.877	0.876	0.878		
Evaporation and phreatophyte coefficients:																				
ET coefficient, Drains & Rivers Phreatophytes			- -	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1		
Evaporation coefficient, canals & reservoirs			- -	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Evaporation coefficient, drains & rivers			- -	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Alamo at Int'l border		USBR & IID	ac-ft										1,078	1,788	1,478	1,715	2,072	1,830		
New River at Int'l border		USBR & IID	ac-ft										119,659	182,101	178,328	178,859	159,206	148,417		
Total			ac-ft	252,920	226,954	155,322	135,081	132,728	144,887	192,099	147,004	149,995	120,737	163,889	177,606	180,574	161,278	148,047		
Total net flow to the Sea		R29-R118	ac-ft	851,694	918,726	965,879	1,004,383	980,370	876,485	973,811	1,045,936	1,063,992	1,075,372	1,081,822	1,057,089	1,029,066	1,049,126	1,071,686		
Main and lateral spills		R85+R87	ac-ft	109,619	124,191	106,116	113,698	125,851	147,624	120,393	132,596	151,733	62,720	84,582	78,300	136,519	114,791	86,338		
Precipitation Avg. CIMIS 41, 68 & 87		R13/12	feet	0.225	0.131	0.108	0.152	0.292	0.512	0.448	0.214	0.176	0.067	0.272	0.239	0.153	0.068	0.045		
ETo(rr) per acre		R82/12, except 87 & 88	ac-ft/ac	3.46	3.70	3.87	3.74	3.42	2.98	3.44	3.69	3.56	3.83	3.83	3.46	3.78	3.94	4.02		
Other information and depths per acre:																				
IID Net flow to the Sea		R29-R12	ac-ft	851,694	918,726	965,879	1,004,383	980,370	876,485	973,811	1,045,936	1,063,992	1,076,450	1,083,610	1,058,547	1,030,801	1,051,198	1,073,518		
EHL minus deliveries to non-agr uses		R108-R40	ac-ft	2,808,093	2,793,568	2,861,224	2,880,916	2,731,158	2,407,804	2,605,897	2,868,853	2,894,654	2,975,747	2,985,566	2,920,214	2,900,980	2,923,823	2,896,609		
EHL per acre (minus non-agr use)		R127/R43	ac-ft/ac	5.36	5.74	5.88	5.95	5.66	5.01	5.43	6.01	6.05	6.23	6.24	6.13	6.09	6.14	6.09		5.92
ETo(rr) per acre		R123	ac-ft/ac	3.46	3.70	3.87	3.74	3.42	2.98	3.44	3.69	3.55	3.83	3.83	3.46	3.78	3.94	4.02		3.64
Vertical Leach water/acre		R69/R43	ac-ft/ac	0.43	0.46	0.40	0.45	0.42	0.34	0.39	0.47	0.46	0.50	0.43	0.36	0.40	0.39	0.38		0.41
Tailwater per acre		R104	ac-ft/ac	0.89	0.97	1.20	1.15	1.06	1.13	1.14	1.04	1.12	1.05	1.32	1.60	1.23	1.21	1.27		1.20
Main canal and lateral seepage, spills and evap		SUM(R82:R86)/R43	ac-ft/ac			0.32	0.30	0.29	0.26	0.28	0.28	0.28	0.26	0.27	0.27	0.27	0.27	0.28		0.28
ET by phreatophytes		R96/R43	ac-ft/ac			0.26	0.24	0.23	0.23	0.24	0.24	0.25	0.26	0.25	0.24	0.24	0.24	0.24		0.24
Residual		R128-SUM(R129:R133)	ac-ft/ac			-0.17	0.07	0.22	0.06	-0.06	0.29	0.41	0.31	0.34	0.19	0.16	0.08	-0.10		0.14
Percent of EHL per acre		R134/R128				-2.8%	1.1%	3.8%	1.3%	-1.1%	4.8%	6.7%	5.0%	5.5%	3.2%	2.6%	1.3%	-1.6%		2.3%
Total cropped agr acres			ac	455,718	460,985	462,955	467,899	467,283	458,857	460,619	457,787	458,471	460,812	460,706	461,061	459,562	461,514	453,183		
EHL per harvested acre (minus non-agr use)		R127/R136	ac-ft/ac	5.72	6.06	6.18	6.16	5.64	5.25	5.66	6.27	6.31	6.46	6.48	6.33	6.31	6.34	6.39		
AAC at PK - CC + irrig from C Canal/harv crop ac		R102/R106	ac-ft/ac	6.09	6.42	6.54	6.55	6.22	5.63	6.04	6.66	6.71	6.86	6.86	6.74	6.73	6.78	6.83		
Salton Sea:																				
Observed elevation			ft	-227.8	-227.9	-228.0	-228.4	-228.5	-228.5	-228.2	-227.8	-227.4	-227.4	-228.0	-227.9	-227.9	-228.1	-228.2		-228.0
Estimated Sea Level Jan1987 = -227.8			ft	-227.8	-228.1	-228.1	-228.6	-228.7	-228.4	-228.2	-227.8	-227.5	-227.2	-228.0	-228.0	-227.9	-228.0	-228.2		-228.0

Footnotes:

1. Deliveries for 1998-2001 was estimated as the average for years 1987-1997
2. Regression of storm flow v annual precipitation
3. Estimated for 1998-2001 based on regression of 1987-1997 data
4. From IID, total farmable area that includes leached and fallowed lands minus 2,636 acres not in the basin (WST)
5. Weighted average CIMIS-41 x 0.47 + CIMIS-68 x 0.18 + CIMIS-87 x 0.35 Data for 1987-1988 from WST Table A2-6

APPENDIX E

REVIEW OF THE NRCE (2002) REPORT

REVIEW OF NRCE (2002) REPORT

INTRODUCTION

The first section of the Natural Resources Consulting Engineers, Inc. report consists of **The Written Testimony of Dr. Woldezon Mesghina**. On page 11, the report states:

> *Our conclusions about the difficulties of salt leaching in IID are in accord with the majority of professional literature about agriculture in IID. To the extent we differ from some critics of IID, such as Dr. Marvin Jensen, it is good cause. As explained in Appendix 9 of our Water Use Report, Dr. Jensen made certain assumptions that did not account for leaching in medium and heavy cracking soils and changes in irrigation water salinity, which ultimately negated his conclusions.*

Studies of the change in irrigation water salinity at the leading edge were just getting underway at the time of the Jensen (1995) and Jensen and Walter (1997) reports and data from those had not yet been published. Contrary to the above statement, we assumed that tailwater accounted for 5% of the leaching due to horizontal leaching. We used the estimated leaching requirement (LR) based on the long-term average salinity of the Colorado River. We could have decreased the LR during the period 1987-1991 because of the lower salinity of the Colorado River water due to very high runoff in 1983-1984. The net effect would have been insignificant as our primary conclusion concerned the increase in tailwater during the study period. The increase in tailwater could not be justified as due to changes in Colorado River salinity.

Another main conclusion of the Jensen and Walter (1997) report was that the fraction of irrigation water, or consumptive use coefficient, decreased from 1987 to 1996. This conclusion was substantiated by the IID Water Study Team (page ES-1,WST, 1998). The WST stated that **some** of this decrease was necessary to offset the increase Colorado River salinity. Thus, the main conclusions stated in the Jensen (1995) and Jensen and Walter (1997) reports are still valid.

As will be shown later, the data examples, assumptions made, and calculations presented in the NRCE report are so flawed and misleading that the report absolutely does show that the conclusions by Jensen (1995) and Jensen and Walter (1997) reports are negated. Actually, some parts of the NRCE report support the conclusion of Jensen and Walter. Other studies conducted on heavy soils (fine-textured) in the Imperial Valley showing that with improved irrigation water management, tailwater could be reduced to about 5% were not mentioned in the report.

NRCE SALINITY CALCULATIONS

All of the calculations leading to estimated on-farm irrigation efficiency estimates are flawed because of errors and erroneous assumptions that were used in calculating the magnitude of the benefits of tailwater for horizontal leaching. Only a few examples will be presented to show that all calculations for estimating leaching requirements and actual soil leaching are incorrect.

A. The Horizontal Leaching Concept

Basically, the horizontal leaching concept is primarily a **leading edge phenomenon**. Horizontal leaching occurs when surface-irrigating soils that have cracked because of substantial soil water depletion. As the wetting front advances over the soil, water flows ahead of the front in the cracks due to the hydraulic gradient from the elevation of the water on the soil to the level of water in the cracks. The water flowing in the cracks dissolves the salt that has accumulated on the surface of the cracks and as the wetting front advances, the water with increased salinity mixes with the water on the surface. After surface runoff begins, the hydraulic gradient in the cracks soon approaches that of the water surface essentially parallel to the land surface. As the soil surrounding the cracks absorbs water, the soil swells and the cracks close and the horizontal flow greatly decreases due to the smaller hydraulic gradient and decreasing flow area.

Thus, the increase in salinity of tailwater above that of the irrigation water delivered at the head end can be expected to decrease rapidly within one to two hours after runoff begins. Rhoades et al. (1997) in their study measured surface water salinity at points 0.25, 0.5, 0.75 distances from the head to the tail end of the field. Root zone salinity was also measured from the head to the tail end. As expected, the soil salinity increased from the head to the tail end due to previous irrigation practices and perhaps cumulative effects of horizontal movement of salts. Only salinity of the surface water at the tail end was reported. These were measured at the leading edge, and 5, 15 and 30 minutes after the leading edge passed. The salinity decreased rapidly in the first five minutes and more slowly thereafter. Unfortunately, measurements were not continued beyond 30 minutes and flow volumes with time were not measured to enable computing the quantity of salt contained in the tailwater. The salinity of the tailwater was about 0.5 dS/m greater than irrigation water at the head end 30 minutes after runoff began on the heavy soils. The increases were small for the March irrigation, but higher for the July and August irrigations apparently due to drier soils and enlarged soil cracks. The increase in salinity of tailwater was much less on for the medium and light soils.

Projecting the average rate of decrease in tailwater salinity based on the average 5-, 15- and 30-minute values indicated that the salinity of the tailwater would approach that of irrigation water at the head end in one to two hours. Therefore, the benefit of tailwater for horizontal leaching would likely decrease to near zero in two hours or less after runoff began.

B. NRCE Horizontal Leaching Calculations

In Section IV, NRCE first reviews 1985-1990 IID studies related to tailwater. This was a period of time when Colorado River salinity had decreased due to high runoff years of 1983-1984 and was increasing back to near-normal conditions as shown in Table II-1 The data presented in Table IV-1 are reproduced below in Tables C-1 to show the first errors in the NRCE analyses.

Table C-1. *Table IV-2, Inflow and Outflow of Irrigation Water and Water Qualities.*

Soil Type	Water Delivered (ac-ft)	Tailwater (ac-ft)	Delivered Water Salinity (mg/L)	Tailwater Salinity (mg/L)	Crops Grown
Silty clay	3,182	677	618	819	Field crops
Silty clay	5,322	746	618	852	Field crops
Silty clay	3,042	1,234	618	884	Field crops & vegetables
Si clay/ clay loam	2,615	350	618	689	Primarily field crops & some vegetables
Sandy loam	2,681	567	618	657	Primarily vegetables & some field crops

Table C-2. *Table IV-3, Total salts introduced and removed by tailwater..*

Soil Type	Total Salts Introduced (tons)	Total Salts Removed (tons)	Total Salts Remaining in Soil+Removed by Vertical Leaching (tons)	% of Tailwater	% of Salts Removed by Tailwater
Silty clay	2,674	754	1,920	21	28
Silty clay	4,473	864	3,609	14	19
Silty clay	2,557	1,484	1,073	41	58
Si clay/ clay loam	2,198	328	1,870	13	15
Sandy loam	2,253	506	1,747	21	23

The NRCE report then states that the weighted average of about 32% of the total salt introduced was removed or leached by lateral flow of tailwater, and that the weighted average of the tailwater that leaches salt is about 23% of the delivered water. It also states that 23% of the delivered water is laterally removing 32% of the introduced salts by the irrigation water to the irrigated fields. At first glance, the numbers look right, but the rationale is wrong. Not taken into account in the tailwater salts are the salts that were in the irrigation water. The correct analysis is summarized in Table C-3. Of the total 11,546 ac-ft delivered 2,667, or 23% became tailwater. Of the total salts added "to the soil" in the irrigation water (7,469 tons), 869 tons or 11.6% of that added to the soil was removed by tailwater—**not 32%**! NRCE's initial calculation of leaching by tailwater is off by a factor of **2.8**.

Table C-3. *Summary of total salts in irrigation water and tailwater for the three heavy soils..*

Soil Type	Total Salts Introduced (tons)	Total Salts in tailwater (tons)	Total Salts in irrigation water runoff (tons)	Net salt removed from soil (tons)	% of salts removed from soil by tailwater
Silty clay	9,704	3,101	2,233	869	**11.6**

Table C-4. *Table IV-4, Summary of irrigation data for seven irrigation evaluations on fields with heavy and medium soils.*

	Water balance data		Salt balance data	
	Average depth (inches)	Average %	Avg. EC of water, dS/m	Average %
Total irrigation depth	4.37	- -	0.99	100
Stored in root zone	3.43	78.5	(0.99)	47.9
Tailwater runoff	0.74	17.0	1.30	22.3
Deep percolation (tilewater)	0.20	4.5	6.56	29.8
Irrigation efficiency *	- -	83.0	- -	- -

* The irrigation efficiency assumes that all the deep percolation is used for leaching excess salts below the root zone.

The major error in Table IV-4 is that the EC of tailwater that is due to leaching of salts from the soil should be only the increase in EC above that of irrigation water, or 0.31 instead of 1.3. Instead of the tailwater runoff salt balance percentage of 22.3%, it should be only 5.3% The value of 22.3% is off by a factor greater than 4! Instead of tailwater accounting for 43% of the salts leached from the soil (43% is the salts leaving the field of which 76% is in the irrigation water applied), tailwater accounts for only 15% of the salts leached from the soil. Instead of 3.4% of the headgate delivery used for horizontal leaching, only 0.8% was used. Therefore, tailwater improves the calculated efficiency from 83 to 83.8% and not to 86% as claimed. Furthermore, the effectiveness of vertical leaching is about 20 times greater than horizontal leaching using data from Table IV-4. Therefore, horizontal leaching is a highly inefficient use of irrigation water.

Because of serious errors in NRCE's calculation of tailwater used for leaching, the comparison of on-farm leaching estimates shown in Fig. V12 and the estimates of tailwater not used for leaching in Fig. V-13 are not valid. NRCE's estimates of tailwater not used for leaching shown in Fig. V-13 are in error. Likewise, because of errors in leaching estimates by the WST, the lower values shown for the WST are also in error. The NRCE study does not invalid the Jensen and Jensen-Walter reports as claimed.

The NRCE report states that it reviewed over 100 applicable professional and applicable publications. However, in its summary on page VIII-3, it states that the estimated average leaching requirement was about 13% of the irrigation water delivered. For decades, professional publications always base the leaching requirement on the water consumed in evapotranspiration. Therefore, if the LR was estimated to be 13% of the water delivered, based on data presented, (Table IV-10 and Page IV-28), the estimated LR would be 16% of irrigation water consumed. This illustrates that the NRCE not only contains serious errors but presents misleading statements.

NRCE's OMISSION OF ALTERNATIVE IRRIGATION IMPROVEMENT STUDIES

A primary focus of the NRCE report appeared to be on justifying high tailwater percentages and even suggesting that even more tailwater would be beneficial. Not considered, using corrected values, is that vertical leaching is about 20 times more effective per ac-ft of water used.

A serious deficiency in the NRCE report is the omission of other recent studies on heavy soils in the Imperial Valley that show optional methods of improving irrigation water management. On cracking, heavy textured soils, the intake rate decreases rapidly after the cracks fill with water so that very little water is infiltrated after the first few hours of applying water. Therefore, there is little benefit from holding water on these soils more than a few hours. Data in Appendix 7 indicated runoff occurred on Fields 1 and 2 for about nine hours. Recent studies such as those by Bali et al. (2001) and Grismer and Bali (2001) that show tailwater can be reduced to less than 5% with little loss in crop yields using a simple volume balance model to determine the irrigation cutoff time or distance water has advanced as developed by Grismer and Tod (1994).

CONCLUSIONS

The NRCE report focused on estimating leaching benefits of horizontal leaching and attempting to justify the use of large volumes of tailwater for leaching. Because of serious errors in the calculations and assumptions made, all such leaching estimates are invalid. Therefore, the NRCE does not negate the conclusions of Jensen (1995) and Jensen and Walter (1997) reports as stated on page 11. Rather, because the estimates of ET are very close to those by Jensen and Jensen-Walter and by the WST, if the errors in calculating the magnitude of horizontal leaching per unit of irrigation water applied are corrected, the NRCE reports support the estimates of tailwater that is not used for leaching by Jensen and Walter (1997).

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