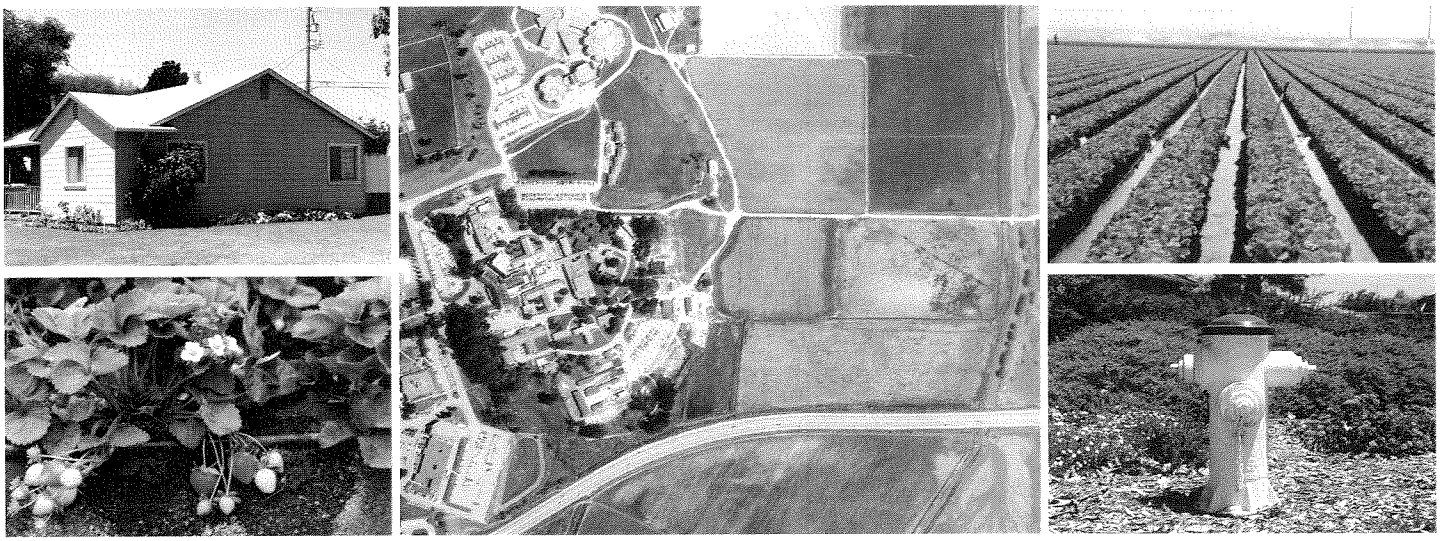

Summary Report:

1995 Ground Water Extraction Data and Agricultural Water Conservation Practices

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If you would like more information regarding the Monterey County Water Resources Agency Water Conservation Programs, or the Ground Water Extraction Reporting Program, please contact the Conservation staff at (408) 755-4860.

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Overview of the Extraction Reporting Program

In February, 1993, the Monterey County Board of Supervisors adopted Ordinance No. 3663 which required water suppliers within Zones 2, 2A and 2B to report water use information for ground water extraction facilities and service connections. Ordinance No. 3717, which replaced Ordinance No. 3663, was adopted in October, 1993; it modified certain other requirements in the old ordinance but kept the ground water extraction reporting requirements in place for ground water extraction facilities with a discharge pipe having an inside diameter of at least 3 inches.

The Monterey County Water Resources Agency (MCWRA) has collected ground water extraction data from well operators for water reporting years beginning November 1 and ending October 31, starting with the 1992-1993 water reporting year. The information received from the over 400 well operators in the above-referenced zones of the Salinas Valley is entered into the Ground water Extraction Management System (GEMS), a computer database maintained by the MCWRA. The intent of the ground water extraction reporting program is to provide for the accurate documentation and annual measurement of the ground water extracted from Zones 2, 2A and 2B of the Salinas Valley Ground Water Basin each year.

The MCWRA also requires the annual submittal of Agricultural Water Conservation Plans, which outline the water conservation practices that are adopted each year and planned for the next year by growers in the Salinas Valley.

The purpose of this report is to summarize the data obtained from the ground water extraction reporting program for the period of November 1, 1994, through October 31, 1995. The agricultural water conservation practices implemented by Salinas Valley farmers are summarized, and reference evapotranspiration data from the California Irrigation Management Information System (CIMIS) are presented. With this information, this report is intended to present a picture of current water pumping within the Salinas Valley, including agricultural water conservation improvements which are being implemented to reduce total water applied.

Explanation of Reporting Methods

The ground water extraction reporting program enables water users to report water pumpage by three different measuring methods, utilizing calculations based on flowmeter, electrical meter, or hour meter data. The MCWRA requires pump efficiency testing and calibration of meters in order to ensure the accuracy of the data reported. The summary of water pumpage presented in this report is compiled from data generated from all three reporting methods.

Disclaimer Regarding Quality of Data

While the MCWRA has made every effort to ensure the accuracy of the data presented in this report, it should be acknowledged that the data is submitted by the individual reporting parties and is not verified by the MCWRA. In addition, the accuracy of the reporting methods may not be 100 percent reliable at all times.

The MCWRA did not receive ground water extraction reports from approximately two percent of the wells in the Salinas Valley for the 1994-1995 water reporting year.

Notes Regarding Report Format

Ground water extraction data is presented in this report by measurement in acre-feet. One acre-foot is equal to 325,851 gallons.

Ground Water Extraction Data Summary

The MCWRA has designated subareas of the Salinas Valley Ground Water Basin whose boundaries are drawn where discernible changes occur in the hydrogeologic conditions. These boundaries are shown in Figure 1.

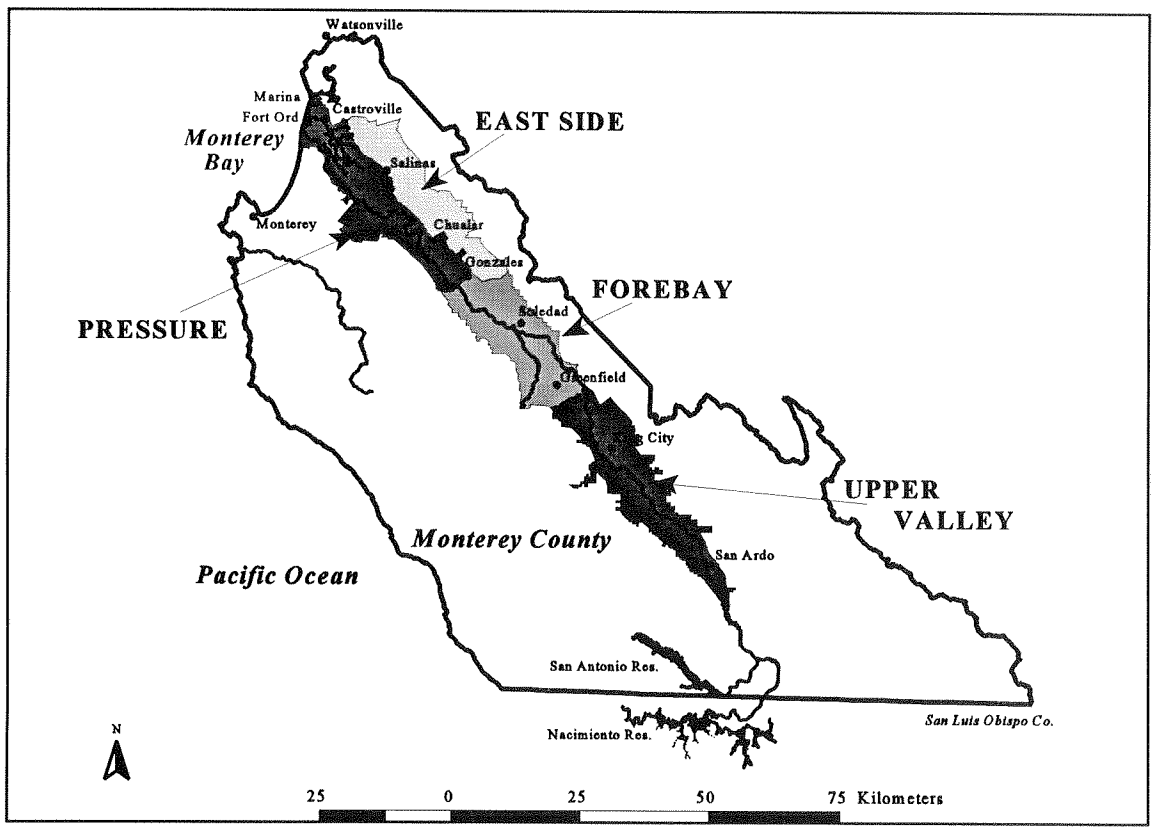

Figure 1. Salinas Valley Subareas

Summary of Methods Used for Extraction Reporting

The distribution of methods used for extraction reporting for the period of November 1, 1994, to October 31, 1995, is shown in Table 1; a percentage distribution by volume is shown in Figure 2.

Table 1. Total extraction data by reporting method

REPORTING METHOD	ACRE-FEET PER REPORTING METHOD	WELLS PER REPORTING METHOD
FLOWMETER	294,635	1,179
ELECTRICAL METER	208,868	661
HOUR METER	1,009	11
TOTAL	**504,512**	**1,851**

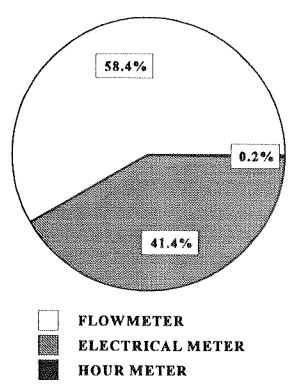

Figure 2. Percentage by volume of methods used for extraction reporting

Ground Water Extraction Data Summary

Total Extraction Data by Subarea and Type of Use

The total ground water extractions from Zones 2, 2A and 2B for the period of November 1, 1994, through October 31, 1995, are summarized by subarea and (1) type of use (agricultural and urban) in Table 2, and (2) percentage in Figure 3.

Table 2. Total extraction data by subarea and type of use

SUBAREA	AG PUMPING (ACRE-FEET)	URBAN PUMPING (ACRE-FEET)	TOTAL (ACRE-FEET)
PRESSURE	105,741	30,738	136,479
EAST SIDE	84,589	2,907	87,496
FOREBAY	133,226	3,994	137,220
UPPER VALLEY	139,072	4,245	143,317
TOTAL	**462,628**	**41,884**	**504,512**

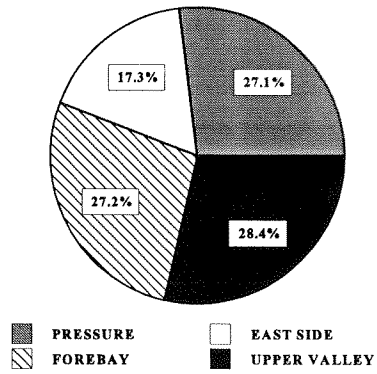

Figure 3. Percentage of total extractions by subarea

Urban Extraction Data by City or Area

The total ground water extractions attributed to urban (residential, commercial, industrial, and governmental) pumping for the period of November 1, 1994, through October 31, 1995, are summarized by city or area in Table 3.

Table 3. Urban extraction data by city or area

CITY OR AREA	URBAN PUMPING (ACRE-FEET)	PERCENTAGE OF TOTAL
CASTROVILLE	823	2.0%
CHUALAR	118	0.3%
FORT ORD[1]	2,802	6.7%
GONZALES	1,174	2.8%
GREENFIELD	1,349	3.2%
KING CITY	3,981	9.5%
MARINA COAST WATER DISTRICT	2,018	4.8%
SALINAS	20,667	49.3%
SAN ARDO	123	0.3%
SAN LUCAS	53	0.1%
SOLEDAD	2,562	6.1%
OTHER UNINCORPORATED AREAS	6,214	14.9%
TOTAL	**41,884**	**100.0%**

[1] The data reflect extractions that occurred subsequent to the closing of the military base and prior to the opening of California State University Monterey Bay.

Agricultural Ground Water Extraction Summary

Average Net Physical Acres Served per Extraction Facility

Table 4 presents the average number of net physical farming acres served per ground water well used for agricultural irrigation purposes in 1995.

Table 4. Average net physical acres served per extraction facility by subarea

SUBAREA	AVERAGE ACRES PER WELL
PRESSURE	92
EAST SIDE	102
FOREBAY	120
UPPER VALLEY	91
AVERAGE	**101**

Summary of Reported Unit Agricultural Water Pumped

Table 5 and Figure 4 present the average acre-feet / acre (unit water pumped) by subarea, calculated using the reported acreage and agricultural water pumped for the period of November 1, 1994, through October 31, 1995. The data used for Table 5 and Figure 4 represent a subset of the totals shown in Table 2, since not all agricultural extraction data were submitted with acreage information.

Table 5. Reported unit agricultural water pumped by subarea

SUBAREA	UNIT WATER PUMPED (ACRE-FEET / ACRE)
PRESSURE	2.25
EAST SIDE	2.20
FOREBAY	2.66
UPPER VALLEY	3.44
OVERALL AVE.	**2.63**

Please note that during the 1994-1995 water reporting year, the 1995 floods affected the number of acres in production and the amount of water needed for irrigation. Even during a normal rain year, pumping rates will vary by crop type and location.

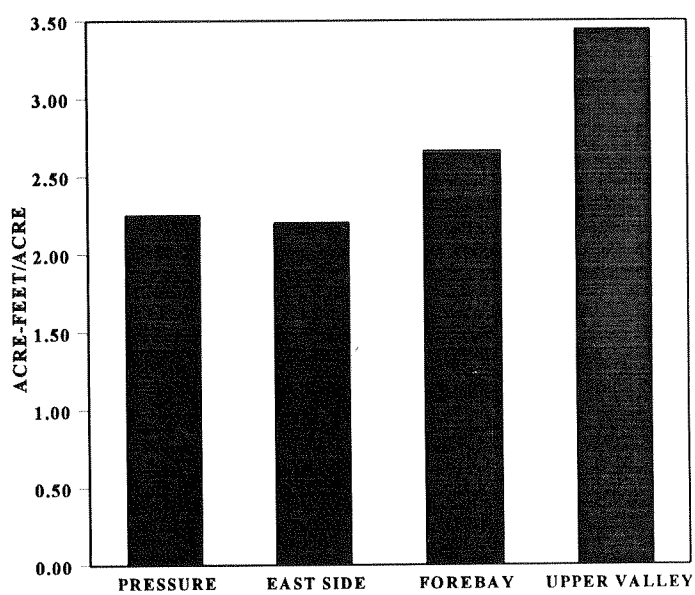

Figure 4. Reported unit agricultural water pumped by subarea.

Summary of Irrigation Methods

The Agricultural Water Conservation Plans include information about how many acres are irrigated with each type of irrigation method, by crop category. This information shows the changing trends in irrigation methods in the Salinas Valley. Tables 6 and 7 show the distribution of irrigation methods by crop type for 1993 and 1996, respectively.

This information shows a trend of decreased acreage in combined sprinkler & furrow and solid set sprinkler irrigation and increased acreage in drip irrigation, in both vegetable crops and vineyards, from 1993 to 1996.

Table 6. 1993 distribution of irrigation methods by crop type

1993	FURROW (ACRES)	SPRINKLER & FURROW (ACRES)	HAND MOVE SPRINKLERS (ACRES)	SOLID SET SPRINKLERS (ACRES)	LINEAR MOVE (ACRES)	DRIP (ACRES)	OTHER[2] (ACRES)	TOTAL (ACRES)
VEGETABLES	2,349	84,060	30,764	6,607	3,827	3,682	0	131,289
FIELD CROPS	575	2,173	2,236	90	50	48	0	5,172
BERRIES	1	0	0	0	0	4,158	0	4,159
GRAPES	261	0	0	13,347	0	15,976	0	29,584
TREE CROPS	0	0	122	251	0	1,216	10	1,599
FORAGE	41	202	1,327	0	48	0	189	1,807
TOTAL	**3,227**	**86,435**	**34,449**	**20,295**	**3,925**	**25,080**	**199**	**173,610**

Table 7. 1996 distribution of irrigation methods by crop type

1996	FURROW (ACRES)	SPRINKLER & FURROW (ACRES)	HAND MOVE SPRINKLERS (ACRES)	SOLID SET SPRINKLERS (ACRES)	LINEAR MOVE (ACRES)	DRIP (ACRES)	OTHER[2] (ACRES)	TOTAL (ACRES)
VEGETABLES	4,209	77,925	33,160	6,434	4,093	6,546	0	132,367
FIELD CROPS	529	740	1,358	310	39	422	0	3,398
BERRIES	0	0	0	0	0	4,374	0	4,374
GRAPES	0	0	0	8,155	0	21,240	0	29,395
TREE CROPS	0	0	12	131	0	1,195	0	1,338
FORAGE	186	690	249	20	0	0	1,141	2,286
TOTAL	**4,924**	**79,355**	**34,779**	**15,050**	**4,132**	**33,777**	**1,141**	**173,158**

[2] "Other" may include different combinations of irrigation systems or areas that were not irrigated.

Agricultural Water Conservation Practices

For the past six years, Salinas Valley growers have submitted water conservation plans to the MCWRA. Table 8 shows the number of acres, by year, on which selected practices have been implemented.

Table 8. Agricultural water conservation practices implemented from 1991 through 1996

WATER CONSERVATION PRACTICES	1991 ACRES	1992 ACRES	1993 ACRES	1994 ACRES	1995 ACRES	1996 ACRES
12 MONTHS SET ASIDE	4,705	4,810	6,586	6,096	5,064	3,123
SUMMER FALLOW/OTHER FALLOW	1,480	6,546	5,953	4,081	6,486	6,208
FLOWMETERS	31,702	26,404	39,206	127,971	122,054	126,031
TIME CLOCK/PRESSURE SWITCH	131,237	131,237	142,162	134,985	121,645	137,297
SOIL MOISTURE SENSORS	39,549	39,549	51,348	43,883	43,188	51,428
PRE-IRRIGATION REDUCTION	92,865	112,290	117,899	108,454	104,937	99,429
REDUCED SPRINKLER SPACING	64,613	72,226	81,736	74,409	75,451	78,925
SPRINKLER IMPROVEMENTS	70,035	97,233	104,160	107,626	102,053	116,809
OFF-WIND IRRIGATION	100,274	109,050	115,984	101,765	94,810	113,381
LEAKAGE REDUCTION	96,672	109,589	117,455	112,135	110,973	119,727
MICRO IRRIGATION SYSTEM	18,120	22,952	24,408	25,506	29,307	37,991
SURGE FLOW IRRIGATION	9,334	18,230	22,588	37,866	15,202	19,772
TAILWATER RETURN SYSTEM	20,357	25,034	21,020	20,994	15,101	22,707
LAND LEVELING/GRADING	55,186	60,563	59,413	58,963	57,749	64,164
TOTAL NET FARMING ACRES[3]	**174,892**	**178,251**	**173,610**	**179,313**	**161,574**	**173,158**

Evaluation of MCWRA Programs

The 1996 Agricultural Water Conservation Plans requested feedback regarding use and quality of the MCWRA's CIMIS and Mobile Lab Programs.

CIMIS Program

The California Irrigation Management Information System (CIMIS) is a network of weather stations which is used to estimate reference evapotranspiration. The MCWRA cooperates with the California Department of Water Resources in this effort, by expanding the program to cover the Salinas Valley. Additional information about the CIMIS program is provided on page 8. Of the 235 growers who submitted Agricultural Water Conservation Plans, 54 (23%) stated they had used the MCWRA's CIMIS Program, and 102 (43%) stated they would like more information.

Mobile Lab Program

The MCWRA operates a Mobile Lab program to provide on-farm technical assistance. Through this voluntary program, MCWRA staff evaluate irrigation systems and provide recommendations for improvements to distribution uniformity and overall efficiency of the system, as well as suggestions for irrigation planning. Of the 235 growers who submitted Agricultural Water Conservation Plans, 45 (19%) stated they had used the Mobile Lab Program, and 87 (37%) indicated they would like more information.

[3] Since different practices may be applied to the same acreage, the acreage cannot be totaled.

Capital Investment in Agricultural Water Conservation Practices

As presented in Table 8, the Agricultural Water Conservation Plans include information regarding how water conservation practices have been applied to farming operations in the Salinas Valley (by acre). These practices range from significant capital investments to recurring operational considerations. The implementation of these water conservation practices represents a significant financial investment by the agricultural community in long-term conservation measures. Table 9 estimates the investment in agricultural water conservation practices implemented since 1991.

Table 9. Capital investment in agricultural water conservation practices since 1991

CAPITAL IMPROVEMENTS	AVERAGE COST / ACRE ($/ACRE)[4]	CAPITAL INVESTMENT ($)
FLOWMETERS	40	3,773,160
SOIL MOISTURE SENSORS	10	118,790
TIME CLOCK/PRESSURE SWITCH	2	12,120
MICRO IRRIGATION SYSTEM	1,200	23,845,200
TAILWATER RETURN SYSTEM	200	470,000
SUBTOTAL	-	**28,219,270**
ON-GOING PRACTICES		
12 MONTHS SET ASIDE	700	21,268,800
SUMMER FALLOW/OTHER FALLOW	300	9,226,200
REDUCED SPRINKLER SPACING	75	33,552,000
OFF-WIND IRRIGATION	25	15,881,600
LEAKAGE REDUCTION	10	6,665,510
LAND LEVELING/GRADING	70	24,922,660
SUBTOTAL	-	**111,516,770**
CAPITAL IMPROVEMENTS / ON-GOING PRACTICES		
SPRINKLER IMPROVEMENTS	15	8,968,740
SURGE FLOW IRRIGATION	5	614,960
SUBTOTAL	-	**9,583,700**
TOTAL		**149,319,740**

The assumption of "1 well per 100 acres" was made for FLOWMETERS, SOIL MOISTURE SENSORS, and TIME CLOCK/PRESSURE SWITCH in the calculation of Average Cost / Acre.

Capital investment is calculated as follows:

Capital Improvements

Capital Investment = (1996 acres - 1991 acres) x Average Cost / Acre

On-Going Practices and Capital Improvements / On-Going Practices

Capital Investment = (sum of 1991 through 1996 acres) x Average Cost / Acre

[4] These estimates were developed with the consensus of the Monterey County Water Resources Agency Agricultural Water Conservation Committee (July 1996).

CIMIS Data Summary

The California Irrigation Management Information System (CIMIS) is a network of automated weather stations located throughout California. In the Salinas Valley, CIMIS is a cooperative program of the California Department of Water Resources (DWR) and the MCWRA. The primary function of CIMIS is to provide information to improve water management through efficient irrigation management practices. Weather data including solar radiation, air temperature, relative humidity, wind speed, wind direction, soil temperature and rainfall are collected from each station in the network and transferred to a central computer in Sacramento. After being analyzed for accuracy, the data are used to estimate reference evapotranspiration (ET_o). ET_o is a standard measure of the evaporative power of the atmosphere. ET_o represents the theoretical water use of a four to seven inch tall cool season grass that is not water stressed. ET_o must be factored with a "crop coefficient" (K_c) to estimate crop water use.

Two original DWR CIMIS stations near Salinas and Castroville have been in operation since the 1980's. In 1993, in cooperation with DWR, the MCWRA expanded the coverage of the CIMIS system in the Salinas Valley to provide improved data coverage for the varied micro-climatic regions in the valley. There are presently six CIMIS stations located in the Salinas Valley. The data from these stations provides insight about the relative water demands throughout the valley. In addition to normal and unusual monthly variations, these three years of data reveal several distinct climatic regions and zones of transition between them that are closer to the coast than previously believed.

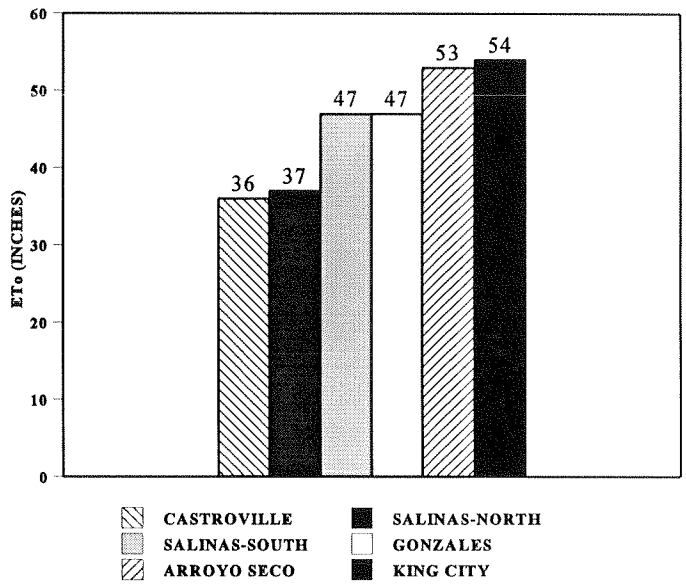

Figure 5. Average annual ET_o for rain years 1993 through 1996

Note: Rain year is from July 1 to June 30

Weather data throughout California are available to the public in hourly, daily, weekly and monthly formats via computer modem. Additionally, the MCWRA provides a toll-free telephone recording (1-800-4-U-CIMIS) of the ET_o and rainfall data for the six Salinas Valley stations. This "real time" data from CIMIS provides growers with the means to more precisely calculate irrigation needs.

The largest change in ET_o occurs just south of the city of Salinas, where the summer fog frequently clears early in the day, resulting in higher evaporative conditions than only a few miles further north.

Table 10. Description of Salinas Valley CIMIS stations

STATION NUMBER	STATION NAME	DISTANCE FROM COAST (MILES)
19	CASTROVILLE	1
116	SALINAS - NORTH	7
89	SALINAS - SOUTH	17
115	GONZALES	24
114	ARROYO SECO	40
113	KING CITY - OASIS RD	60

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