IRRIGATION WATER SUPPLY AND DEMAND DATA FOR 1976, 1980, AND 1984 FOR THE WESTERN SAN JOAQUIN VALLEY, CALIFORNIA

By William E. Templin, Thomas C. Haltom, and others

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Conversion Factors

Multiply	By	To obtain
	AREA	
acres	43,560	square feet
	4,047	square meters
	0.001562	square miles
	0.4047	hectare
	FLOW	
thousand acre-ft/yr	0.8921	million gallons per day

IRRIGATION WATER SUPPLY AND DEMAND DATA FOR 1976, 1980, AND 1984 FOR THE WESTERN SAN JOAQUIN VALLEY, CALIFORNIA

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Abstract

This report presents the irrigation water supply and demand data for 1976, 1980, and 1984 for 32 water districts in the western San Joaquin Valley, California. Available data are totaled for each water district for those three years. The complete data base is given by water district for each township, range, and section in the rectangular system for the subdivision of public lands. These data were compiled for use in a ground-water-flow model, compilation of a water-budget, and use by the San Joaquin Valley Drainage Program in a study of water management in the western San Joaquin Valley, California. The data are presented in a computer-readable format to improve data utilization and to condense the information so that it can be more readily distributed to users.

INTRODUCTION

Data were compiled in cooperation with the San Joaquin Valley Drainage Program for irrigation water supply, water demand, and related information for the years 1976, 1980, and 1984 for the western San Joaquin Valley, California. Table 1 is a summary of water districts surveyed and years of available data for these water districts. In this report, data are compiled for each of 32 water districts by year (tables 2 and 3). The complete data base is given, by water district, for each township, range, and section in the rectangular system for the subdivision of public lands (tables 3 and 4). This report was compiled to make these data available to the public. These data were compiled for use in a ground-water-flow model (Belitz and Heimes, 1990), estimation of a water budget (Gronberg and Belitz, 1992), and for use by the San Joaquin Valley Drainage Program (1989) in the study of water management in the western San Joaquin Valley, California. The study area is in the western part of the San Joaquin Valley, and is bounded on the west by the Coast Range and includes the western parts of Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties. The study area extends from 40 miles northwest of the city of Merced to 25 miles south of the city of Bakersfield. The sections within the study area for which data are available for 1984 are shown in figure 1. Detailed analysis units (DAU), designated by the California Department of Water Resources on the basis of similarities in water supply and water-use characteristics (California Department of Water Resources,1982) are shown in figure 2.

Volumes of water delivered within the study area by water district and crop acreage were compiled from water district records. Annual crop water requirements (CWR), or unit-applied water averages by region were obtained from the California Department of Water Resources, San Joaquin Valley District, Fresno, California. Each CWR was used with the appropriate crop acreages to estimate crop water demands (tables 5 and 6).

For convenience, tables 1 and 2 are duplicated in this text. They are also included on the diskettes accompanying this report. Because of bulk, tables 3 through 6 are contained only on diskettes. The diskettes require an IBM-compatible microcomputer with the MS-DOS operating system. Presenting data in this computer-readable format improves the ease of utilizing the data and condenses the information so that it can be easily distributed to users.

The authors wish to thank the many individuals and water districts for their cooperation in the compilation of the information used in this report. Much

assistance in the data collection and compilation efforts was received from Alysa M. Fisher, Deborah H. Horner, Joelle L. Wilkes, and Lisa L. Zaffran, former U.S. Geological Survey student assistants. Terry Erlewine (California Department of Water Resources, San Joaquin District, Fresno, California) was especially helpful in providing regional estimates of crop water requirements and related information from the California Department of Water Resources Surface Water Allocation Model.

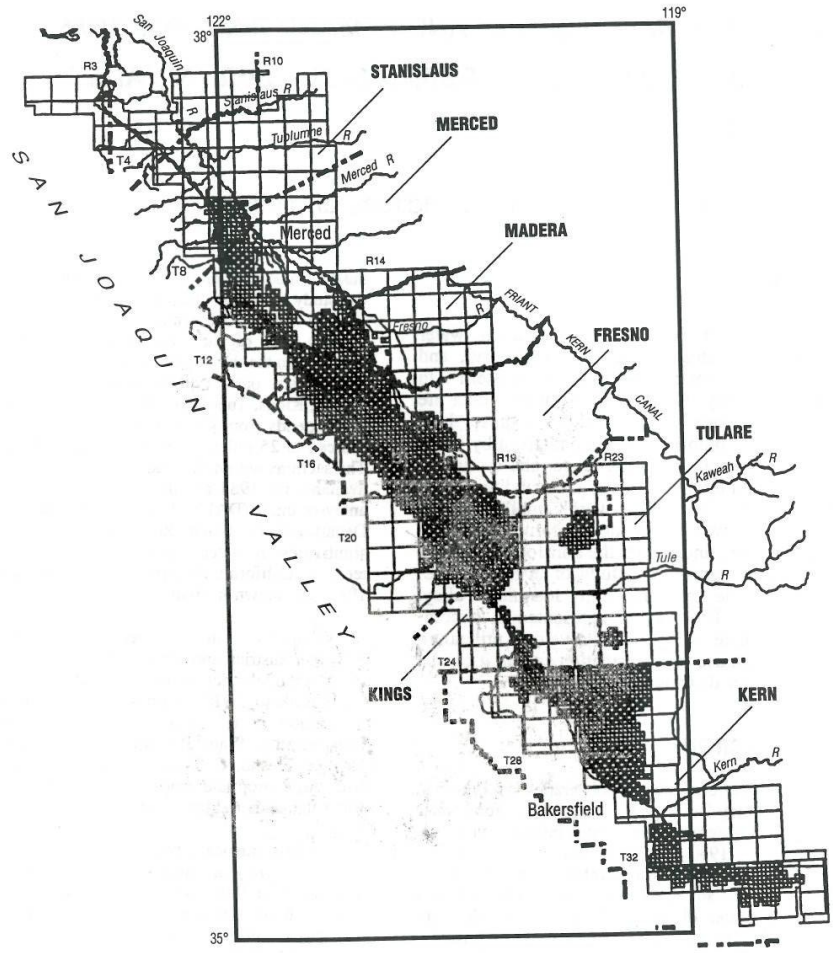

Figure 1. Sections within the study area for which data were available for 1984.

Figure 2. Detailed analysis unit (DAU) boundaries. (DAUs are the smallest areas used by the California Department of Water Resources for aggregation of water use related data.)

METHODS OF DATA COLLECTION

The standard approach for collecting and synthesizing the water-use and crop information was to contact each water district to determine how much needed information they had and the format and storage media they used. Then, the best approach for automating the available information was determined. Ideally, this information included water-delivery records (organized by grower and diversion location) and a map showing the water-supply delivery system and locations of the last point at which metered (or estimated) delivery volumes were recorded. Collected data were combined to reflect the quantity of water delivered and the acreage of crops grown within a geographic area (township, range, and section).

The level of detail of available crop acreage and water-delivery data varies among water districts. Some water districts record only the total acreage of crops grown each year; others record the acreage in each field. Water-delivery information also varies. Many districts keep daily or monthly water-delivery data for each field or geographic section; other districts record only the quantity of water delivered monthly to each grower.

Growers in many parts of the study area commonly transfer water from section to section using ditches, pipelines, and canals, as needed. Therefore, reliable relations between quantity of water delivered to diversion gates and the sections irrigated from each diversion were often difficult to establish. California Department of Water Resources land-use maps and water-district ownership maps (if available) were used to approximate distribution of annual water-delivery totals to fields within a district's area. When a single field covered more than one geographic section, the water demand was distributed proportional to the area of that crop within each section.

If only the total annual water delivered by the water district was known, (eq. 1 and 2) water deliveries to individual fields or geographic sections were estimated. Equation 1 was used to estimate a district average delivery per acre for each crop. Given total acreage of each crop within each section, total water deliveries for a section then were deter- mined using equation 2.

$$Dt = (At1 * R1 * X) + (At2 * R2 * X) + (Atn * R2 * X) \quad (1)$$
$$Ds = (As1 * R1 * X) + (As2 * R2 * X) + (Asn * R2 * X) \quad (2)$$

where

Dt is total annual water deliveries for a water district, in acre-ft,
At1 is total acres for crop 1,
At2 is total acres for crop 2,
Atn is total acres for crop n (3...),
R1 is theoretical CWR for crop 1,
R2 is theoretical CWR for crop 2,
Rn is theoretical CWR for crop n (3...),
X is adjustment to theoretical CWR for district water deliveries,
Ds is total annual water deliveries for a section, in acre-feet,
As1 is acres in a section for crop 1,
As2 is acres in a section for crop 2, and
Asn is acres in a section for crop n (3...).

Total crop water demand was based on annual area wide averages of unit applied water by crop (CWR) and crop acreages (California Department of Water Resources, 1986, p. 21). This was calculated by multiplying the CWR for the specific year and geographic location of the water district by the appropriate crop acreage. The total calculated water demand for the geographic sections then was verified against the total water supply reported by the water district.

Each water district receiving Central Valley Project water is required by the U.S. Bureau of Reclamation to keep annual totals for each irrigated crop. Some water districts meet this requirement with annual crop maps showing the location of each grower's fields and acreage, as well as types of crops grown. For the majority of the water districts, how- ever, less detailed records are kept. For this study, acreage of crops grown was estimated by analyzing each water district's records.

Data files were checked for data-entry errors and compared with the annual totals reported by the water districts, the California Department of Water Resources, and the U.S. Bureau of Reclamation. The data were entered into ARC/INFO, a geographic information system used by the U.S. Geological Survey and others (Templin, 1986).

The quality-control goal for compiled data was to be within 5 percent of the total reported by each water district. The totals compiled for this study usually are near 100-percent agreement with annual totals reported by water districts. If a water district receives water only from the California Department of Water Resources or the U.S. Bureau of Reclamation, the yearly crop distribution and water-delivery totals from these agencies were used as a check to deter- mine the accuracy of the compiled totals. Most discrepancies between water district and State (or Federal) agency water-supply totals were attributed to variations in meters and meter-maintenance practices or recycling water.

COMPRESSION-DECOMPRESSION PROGRAM

The compression-decompression program "LHarc" is the program used to compress the data files into self-extracting libraries. The LHarc program and documentation may be obtained by copying LH113C.EXE to any directory on either the hard disk or a diskette, typing 'LH113C', and pressing the enter key. There is enough room on the irrigation diskette for the program and documentation, which require approximately 2.5 megabytes.

There are two methods to decompress the IRRIG.EXE file. The "menu method" requires a version of MS-DOS more recent than 2.0, and the "DOS method" is used for versions 2.0 or earlier. Figure 3 lists all files contained on the diskette.

The compression-decompression program, LHarc, is copyrighted by Haruyasu Yoshizaki. Permission to copy is granted freely, provided that all copies contain the statement, "Copyright by Haruyasu Yoshizaki."

MENU METHOD

To implement the decompression program, place the diskette in drive A:, attach to A:, type 'IRRIG', and press the enter key. The menu shown in figure 4A will appear. REPLY.COM is a program borrowed from Wolverton (1986) that operates the menu. When either drive C: or D: is selected, the menu shown in figure 4B will appear. By selecting choices from both menus, each group of files may be placed on either or both drives in any convenient combination.

Decompressing the self-extracting files will create an IRRIG directory on the drive(s). This directory will contain the decompressed table files totaling 2,500,000 bytes of disk space.

DOS METHOD

Files can be decompressed and placed in any drive having sufficient free space by copying the appropriate filename.EXE to a subdirectory of that drive and then executing by typing the file name. For example, if the table files are to be placed in a subdirectory named IRRIG on the D: drive, copy the file IRRIG.EXE to D:\IRRIG;

attach to that directory; type 'IRRIG', and press the enter key. Computer instructions contained within IRRIG.EXE will cause the decompression of this file and place decompressed files into D:\IRRIG.

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Belitz, Kenneth, and Heimes, F.J., 1990, Character and evolution of the ground-water flow system in the central part of the western San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper 2348, 28 p.

California Department of Water Resources, 1982, The hydrologic-economic model of the San Joaquin Valley: California Department of Water Resources Bulletin 214, 177 p.

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TABLE 1.--LIST OF WATER DISTRICTS

ALPAUGH ID
ANGIOLA WD
ATWELL ISLAND WD
BROADVIEW WD
BUENA VISTA WSD
CENTINELLA WD
CENTRAL CALIFORNIA ID
CORCORAN ID
DAVIS WD
DUDLEY RIDGE WD
EAGLEFIELD WD
FIREBAUGH CC
FOOTHILL WD
FRESNO SLOUGH WD
GRASSLANDS WD
HACIENDA WD
HENRY MILLER WD
JAMES ID
KINGS COUNTY CC
KINGS COUNTY WD
LAGUNA ID
LAGUNA WD
LAKESIDE IWD
LOST HILLS
MELAGA WD
MERCY SPRINGS WD
MUSTANG WD
ORESTIMBA WD
OROLOMA WD
PACHECO WD
PANOCHE WD
QUINTO WD
ROMERO WD
SALADO WD
SAN LUIS CC
SAN LUIS WD
SEMITROPIC WSD
SUNFLOWER WD
TRANQUILLITY ID
TULARE LAKE BASIN WSD
WESTLANDS WD
WHEELER RIDGE-MARICOPA
WIDREN WD

Table 2. Summary of deliveries and irrigated acres.

Water district	Year	Deliveries (acre-feet)	Irrigated acres
Alpaugh ID	1980	11,684.52	6,200.50
Alpaugh ID	1984	16,626.26	6,812.50
Broadview WD	1976	28,710.00	9,019.00
Broadview WD	1980	26,663.50	8,871.00
Broadview WD	1984	18,004.30	8,711.00
Buena Vista WSD	1976	20,964.40	42,128.50
Buena Vista WSD	1980	74,333.80	41,760.00
Buena Vista WSD	1984	75,860.59	40,986.00
Centinella WD	1976	3,675.00	816.00
Centinella WD	1980	1,841.00	746.00
Centinella WD	1984	1,805.00	684.00
Central California ID	1984	452,123.40	153,393.30
Davis WD	1976	5,936.00	1,365.00
Davis WD	1980	4,270.00	1,178.00
Davis WD	1984	4,214.00	1,113.00
Dudley Ridge WD	1976	72,632.36	26,699.00
Dudley Ridge WD	1980	80,360.34	23,544.00
Dudley Ridge WD	1984	64,606.47	19,814.00
Eaglefield WD	1976	4,204.00	1,589.00
Eaglefield WD	1980	3,734.00	1,340.00
Eaglefield WD	1984	4,281.00	1,549.36
Firebaugh CC	1976	62,057.20	15,889.00
Firebaugh CC	1980	59,670.70	13,723.00
Firebaugh CC	1984	56,577.90	20,090.60
Foothill WD	1976	10,750.00	3,028.00
Foothill WD	1980	10,618.00	3,342.00
Foothill WD	1984	15,150.60	3,601.00
Fresno Slough WD	1980	4,484.26	1,199.00
Fresno Slough WD	1984	508.56	1,161.00
Henry Miller WD	1976	67,563.30	30,425.00
Henry Miller WD	1980	50,402.87	30,087.00
Henry Miller WD	1984	64,685.54	27,040.00
James ID	1980	22,842.10	11,316.00
James ID	1984	40,066.13	15,456.00
Laguna WD	1980	798.75	355.00
Laguna WD	1984	2,191.00	307.00
Lakeside IWD	1980	50,661.85	32,637.00
Lakeside IWD	1984	58,398.46	33,088.00
Lost Hills WD	1976	86,233.00	50,152.00
Lost Hills WD	1980	122,380.00	57,970.00
Lost Hills WD	1984	147,991.00	53,155.00
Mercy Springs WD	1976	11,994.00	2,958.00
Mercy Springs WD	1980	13,921.00	2,865.00
Mercy Springs WD	1984	11,212.90	2,162.40
Mustang WD	1976	17,890.00	4,175.00
Mustang WD	1980	14,938.00	4,142.00
Mustang WD	1984	21,720.10	4,218.30
Orestimba WD	1976	23,902.00	5,688.00
Orestimba WD	1980	19,045.00	6,102.00

Table 3. Data file of surface-water deliveries by water district (WD), year, location, and amount of water supplied

[NDEC, number of decimal places; C, character; I, integer; N, numeric; SEM, southeast quadrant Mount Diablo Meridian; NWS, northwest quadrant San Bernardino Meridian; CC, canal company; ID, irrigation district; IWD, irrigation water district; WSD, water storage district]

Column	Item name	Item description	Width	Output	Type	NDEC
1	District	Water district name	14	14	C	
15	Year	Water year	4	4	I	
19	TRSEC	Township, Range, and Section	6	6	I	
31	Mer	Quadrant and Meridian	3	3	C	
34	ACFT	Acre-feet of surface water	12	12	N	

District	Year	TRSEC	Mer	ACFT
Alpaugh ID	1980	232302	SEM	29.84
Alpaugh ID	1980	232321	SEM	81.94
Alpaugh ID	1980	232322	SEM	407.09
Alpaugh ID	1980	232326	SEM	1191.91
Alpaugh ID	1980	232327	SEM	1192.20
Alpaugh ID	1980	232328	SEM	997.38
Alpaugh ID	1980	232329	SEM	883.00
Alpaugh ID	1980	232330	SEM	320.90
Alpaugh ID	1980	232331	SEM	361.05
Alpaugh ID	1980	232332	SEM	943.63
Alpaugh ID	1980	232333	SEM	1149.21
Alpaugh ID	1980	232334	SEM	1002.29
Alpaugh ID	1980	232335	SEM	921.10
Alpaugh ID	1980	242302	SEM	650.10
Alpaugh ID	1980	242303	SEM	865.21
Alpaugh ID	1980	242304	SEM	548.02
Alpaugh ID	1980	242310	SEM	139.65
Alpaugh ID	1984	232320	SEM	8.48
Alpaugh ID	1984	232321	SEM	358.95
Alpaugh ID	1984	232322	SEM	505.28
Alpaugh ID	1984	232326	SEM	1540.24
Alpaugh ID	1984	232327	SEM	1486.69
Alpaugh ID	1984	232328	SEM	1476.90
Alpaugh ID	1984	232329	SEM	1102.30
Alpaugh ID	1984	232330	SEM	697.18
Alpaugh ID	1984	232331	SEM	866.52
Alpaugh ID	1984	232332	SEM	1003.27
Alpaugh ID	1984	232333	SEM	1159.08
Alpaugh ID	1984	232334	SEM	1188.29
Alpaugh ID	1984	232335	SEM	1638.30
Alpaugh ID	1984	242302	SEM	1187.41
Alpaugh ID	1984	242303	SEM	1240.39
Alpaugh ID	1984	242304	SEM	837.61
Alpaugh ID	1984	242305	SEM	115.20
Alpaugh ID	1984	242310	SEM	214.17

Table 5.--Crop codes.

[For use with table 4]

CODE	CROP
10	truck crops
10a	asparagus
10a1	vegetables
10aa	canning tomatoes
10ab	parsnips, turnips
10ad	home gardens
10ae	garlic
10ag	parsely
10ah	red beets
10ai	tomatoes
10al	all vegetables
10b	beans (cover crop), blackeye beans, green beans
10e	broccoli
10f	cauliflower
10g	cucumbers
10h	carrots, seed carrots
10i	celery
10j	corn
10k	cabbage
10l	eggplant
10m	lettuce, seed lettuce
10n	cantaloupes
10p	honeydews
10r	melons, watermelons
10t	onions
10y	squash
10z	spinach
11	fruits
11a	apples
11b	apricots, cherries
11c	avocados
11e	olives
11f	peaches
11g	pears
11h	prunes
11i	plums
11j	persimmons
11k	pomegranates
11l	nectarines
11n	figs
11p	kiwi
12a	oranges, tangerines
12c	lemons
12d	grapefruit
14a	table grapes
14b	raisin grapes
14c	vine seeds, vineyards, wine grapes
18	cotton, cottonseed

Table 6. Crop water requirements (CWR), in acre-feet/acre, by detailed analysis unit (DAU) (figure 1).

[For crop codes, see table 5. Code modifiers: xx, a single CWR was used for all member crops except those specifically modified by a given alpha modifier; subt, sub-tropical fruits]

DAU	Crop code	CWR 1976	CWR 1980	CWR 1984
216	10xx	1.31	0.94	1.67
216	6xx	1.95	1.34	2.11
216	11xx	3.02	2.29	3.02
216	subt	2.39	1.71	2.44
216	10ah	2.38	1.70	2.49
216	10ai	2.37	1.61	2.28
216	10r	1.29	0.71	1.44
216	14c	1.99	1.51	2.43
216	18	2.78	1.94	2.73
216	1a	3.44	2.99	4.00
216	2	3.46	2.78	3.94
216	27a	2.13	1.40	2.25
216	5	3.90	3.41	4.18
216	6a	1.78	1.29	2.02
216	6b	1.99	1.55	2.32
216	6e	1.22	0.55	1.15
216	6h	1.50	1.02	1.75
216	6s	2.68	2.04	2.78
216	a2	1.61	1.27	2.00
237	6e	1.07	0.73	1.22
237	5	3.90	3.46	4.18
237	18	2.74	2.26	2.93
237	6s	2.68	2.25	2.95
237	10ah	2.33	1.95	2.70
237	6b	2.00	1.80	2.32
237	6h	1.39	1.22	1.92
237	10r	1.26	0.93	1.63
237	10ai	2.37	1.82	2.44
237	2	3.35	3.08	4.05
237	a2	1.57	1.42	2.12
237	1a	3.32	3.10	4.01
237	27a	2.09	1.73	2.45
237	14c	1.90	1.78	2.45
237	6xx	1.92	1.57	2.27
237	10xx	1.31	1.03	1.73
237	11xx	2.89	2.61	3.31
238	6e	1.03	0.70	1.22
238	5	3.85	3.48	4.18
238	18	2.66	2.21	2.97
238	6s	2.62	2.21	2.95
238	6h	1.95	1.76	2.32
238	6a	1.78	1.48	2.18
238	10xx	1.26	1.01	1.85
238	6xx	1.85	1.52	2.26
238	2	3.34	3.04	3.78
238	1a	3.32	3.10	3.84
238	27a	2.01	1.68	2.45

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