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

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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

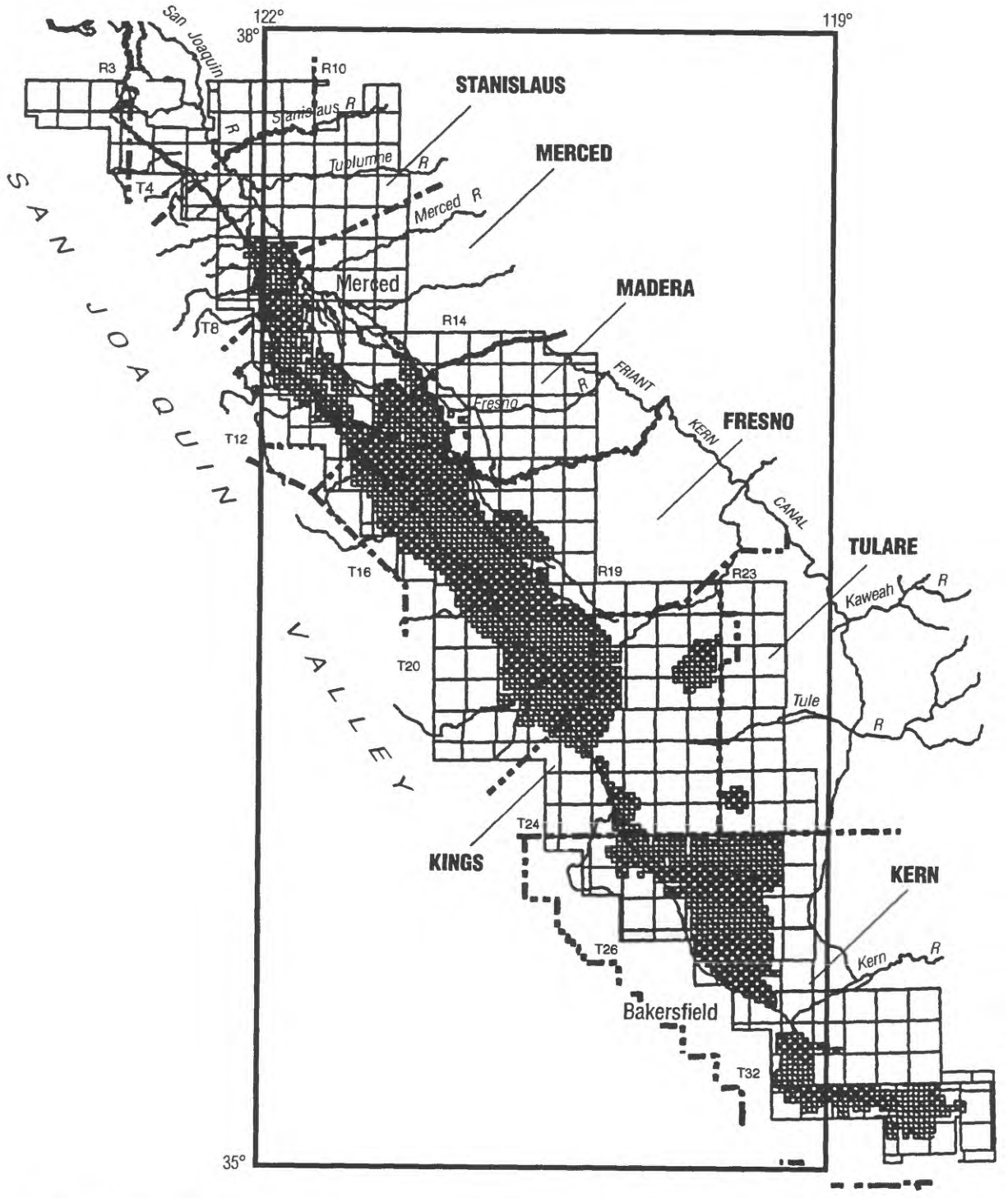

Figure 1. Sections within the study area for which data were available for 1984.

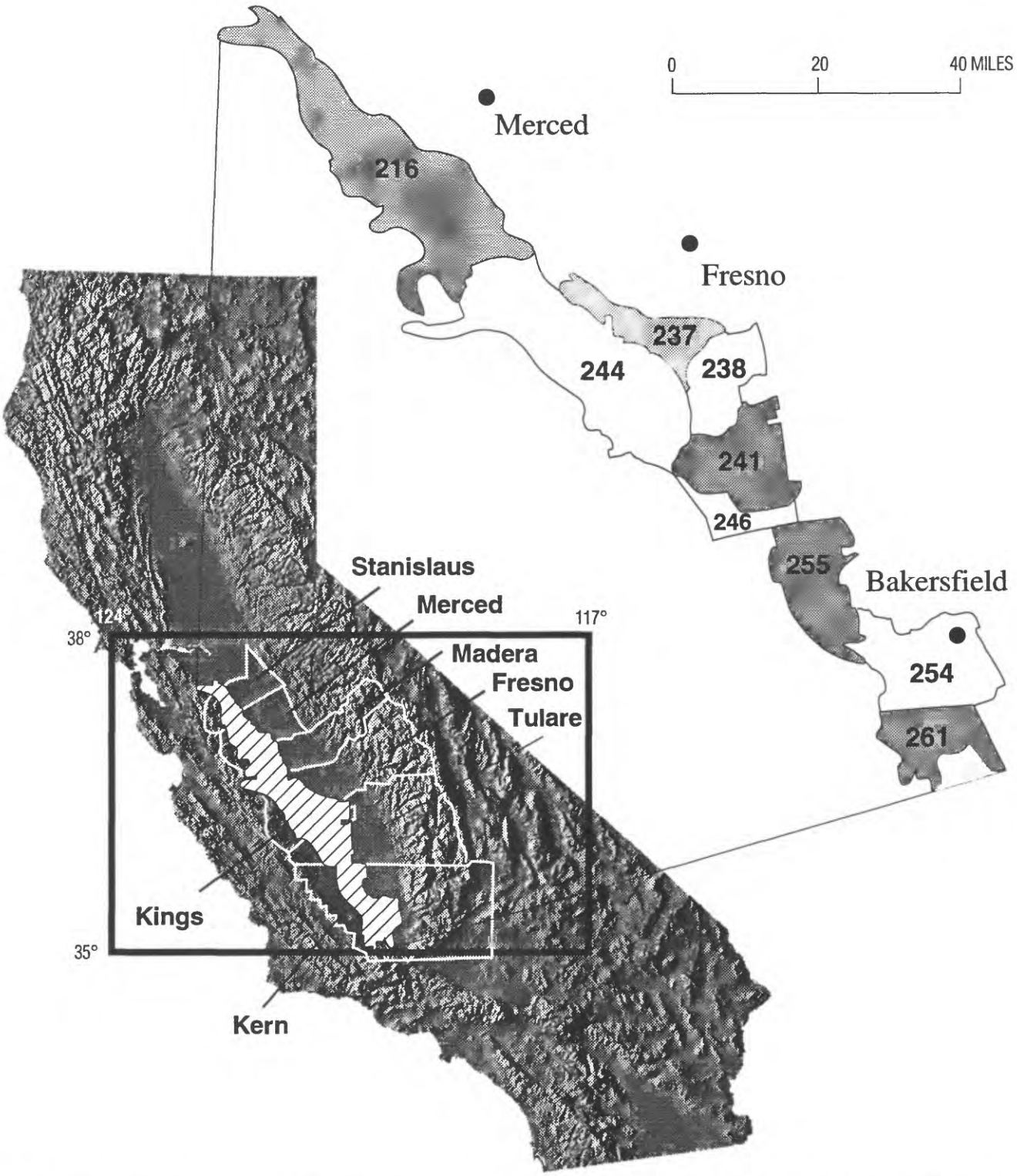

Figure 2. Detailed analysis unit (DAU) boundaries. (DAUs are the smallest areas used by the California Department of Water Resources for aggregation of water use related data.)

Table 1. List of water districts, format of provided records, and years data are available (see tables 2, 3, and 4)

[CC, canal company; CWD, commercial water district; ID, irrigation district; IWD, irrigation water district; WD, water district; WSD, water storage district. Years are calendar years]

Water district	Photocopy or original files (years)	Other format (years)	Notes
Alpaugh ID	80,84		
Angiola WD			No usable data provided
Atwell Island WD			Data incomplete
Broadview WD	76,80,84		
Buena Vista WSD	76,80	84	Computer output [1]
Centinella WD	76,80,84		
Central California ID	84		
Corcoran ID			No usable data provided
Davis WD	76,80,84		
Dudley Ridge WD	76,80,84		
Eaglefield WD	76,80,84		
Firebaugh CC	76,80,84		
Foothill WD	76,80,84		
Fresno Slough WD	80,84		
Grasslands WD			No usable data provided
Hacienda WD			No usable data provided
Henry Miller WD	76,80,84		
James ID	80,84		(2)
Kern Delta WD			Unable to contact
Kings County CC			No usable data provided
Kings County WD			No usable data provided
Laguna ID			No usable data provided
Laguna WD	80,84		
Lakeside IWD	80,84		
Lost Hills WD	76,80,84		
Melaga WD			No usable data provided
Mercy Springs WD	76,80,84		
Mustang WD	76,80,84		
Orestimba WD	76,80,84		
Oroloma WD	80,84		
Pacheco WD	76,80,84		
Panoche WD	80	84	(1)
Quinto WD	76,80,84		
Riverdale ID			Unable to contact
Romero WD	76,80,84		
Salado WD	76,80,84		
Salyer WD			Unable to contact
San Luis CC			(2, 3)
San Luis WD	80,84		
Santa Nella CWD			Unable to contact
Santa Rita WD			Unable to contact
Semitropic WSD	76,80,84		
Stratford ID			Unable to contact
Sunflower WD	76,80,84		
Traction Ranch WD			Unable to contact
Tranquillity ID	76,80	84	Computer output [1]
Tulare Lake Basin WSD			No usable data provided
Upper San Jose WD			Unable to contact
Westlands WD	80	[4]76,84	
Wheeler Ridge-Maricopa WSD	76,80,84		
Widren WD	76,80,84		

[1] Paper copy provided.
[2] Original files microfilmed by U.S. Geological Survey personnel at water-district office.
[3] Data not in usable format.
[4] Microfilm provided for 1976; computer tape provided for 1984.

Table 2. Summary of deliveries and irrigated acres

[CC, canal company; ID, irrigation district; IWD, irrigation water district; WD, water district; WSD, water storage district; acre-ft, acre-foot. Years are calendar years]

Water district	Year	Deliveries (acre-ft)	Irrigated acres	Water district	Year	Deliveries (acre-ft)	Irrigated acres
Alpaugh ID	80	11,684.52	6,200.50	Mustang WD	80	14,938.00	4,142.00
Alpaugh ID	84	16,626.26	6,812.50	Mustang WD	84	21,720.10	4,218.30
Broadview WD	76	28,710.00	9,019.00	Orestimba WD	76	23,902.00	5,688.00
Broadview WD	80	26,663.50	8,871.00	Orestimba WD	80	19,045.00	6,102.00
Broadview WD	84	18,004.30	8,711.00	Orestimba WD	84	17,176.60	5,694.50
Buena Vista WSD	76	20,964.40	42,128.50	Oroloma WD	80	5,479.00	1,014.40
Buena Vista WSD	80	74,333.80	41,760.00	Oroloma WD	84	4,607.24	1,014.40
Buena Vista WSD	84	75,860.59	40,986.00	Pacheco WD	76	19,491.96	6,478.00
Centinella WD	76	3,675.00	816.00	Pacheco WD	80	13,538.87	5,261.00
Centinella WD	80	1,841.00	746.00	Pacheco WD	84	15,821.92	4,519.99
Centinella WD	84	1,805.00	684.00	Panoche WD	80	100,993.00	30,655.01
Central California ID	84	452,123.40	153,393.30	Panoche WD	84	105,823.16	31,774.04
Davis WD	76	5,936.00	1,365.00	Quinto WD	76	8,835.00	2,087.00
Davis WD	80	4,270.00	1,178.00	Quinto WD	80	6,800.00	2,136.00
Davis WD	84	4,214.00	1,113.00	Quinto WD	84	9,610.00	2,367.00
Dudley Ridge WD	76	72,632.36	26,699.00	Romero WD	76	6,240.00	1,327.00
Dudley Ridge WD	80	80,360.34	23,544.00	Romero WD	80	3,849.00	1,093.00
Dudley Ridge WD	84	64,606.47	19,814.00	Romero WD	84	4,834.40	918.00
Eaglefield WD	76	4,204.00	1,589.00	Salado WD	76	12,705.90	3,277.00
Eaglefield WD	80	3,734.00	1,340.00	Salado WD	80	8,643.00	3,209.00
Eaglefield WD	84	4,281.00	1,549.36	Salado WD	84	7,024.50	2,992.80
Firebaugh CC	76	62,057.20	15,889.00	San Luis WD	80	123,356.00	52,777.00
Firebaugh CC	80	59,670.70	13,723.00	San Luis WD	84	155,099.01	53,035.63
Firebaugh CC	84	56,577.90	20,090.60	Semitropic	76	59,374.15	115,052.00
Foothill WD	76	10,750.00	3,028.00	Semitropic	80	165,817.51	140,622.00
Foothill WD	80	10,618.00	3,342.00	Semitropic	84	197,806.82	217,900.00
Foothill WD	84	15,150.60	3,601.00	Sunflower WD	76	18,879.00	3,306.00
Fresno Slough WD	80	4,484.26	1,199.00	Sunflower WD	80	13,952.00	4,192.00
Fresno Slough WD	84	508.56	1,161.00	Sunflower WD	84	21,256.60	4,048.70
Henry Miller WD	76	67,563.30	30,425.00	Tranquillity ID	76	26,323.92	10,552.00
Henry Miller WD	80	50,402.87	30,087.00	Tranquillity ID	80	23,346.28	9,391.00
Henry Miller WD	84	64,685.54	27,040.00	Tranquillity ID	84	36,903.29	8,902.00
James ID	80	22,842.10	11,316.00	Westlands WD	76	984,452.39	460,409.00
James ID	84	40,066.13	15,456.00	Westlands WD	80	1,098,585.26	560,781.00
Laguna WD	80	798.75	355.00	Westlands WD	84	1,382,697.75	547,588.00
Laguna WD	84	2,191.00	307.00	Wheeler Ridge-Maricopa WSD	76	228,461.26	108,643.00
Lakeside IWD	80	50,661.85	32,637.00	Wheeler Ridge-Maricopa WSD	80	226,020.87	113,118.00
Lakeside IWD	84	58,398.46	33,088.00	Wheeler Ridge-Maricopa WSD	84	225,012.97	119,380.00
Lost Hills WD	76	86,233.00	50,152.00	Widren WD	76	2,876.40	765.00
Lost Hills WD	80	122,380.00	57,970.00	Widren WD	80	1,545.30	765.00
Lost Hills WD	84	147,991.00	53,155.00	Widren WD	84	7,860.38	662.00
Mercy Springs WD	76	11,994.00	2,958.00				
Mercy Springs WD	80	13,921.00	2,865.00				
Mercy Springs WD	84	11,212.90	2,162.40				
Mustang WD	76	17,890.00	4,175.00				

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.

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 determined using equation 2.

$$Dt = (At1 * R1 * X) + (At2 * R2 * X) + (Atn * Rn * X) \quad (1)$$

$$Ds = (As1 * R1 * X) + (As2 * R2 * X) + (Asn * Rn * X) \quad (2)$$

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 areawide 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 determine 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."

TABL1256	EXE	7148
TABLE3	EXE	43975
TABLE4	EXE	183228
LH113C	EXE	36964
IRRIG	BAT	255
HEADER3		1022
HEADER4		1499
REPORT	TXT	16550

Figure 3. Files contained on the diskette.

A **SELECTION OF DRIVE**

(1) DRIVE C:
(2) DRIVE D:
(3) EXIT

B **SELECTION OF FILE(S)**

(1) TABLES 1,2,5, AND 6
(2) TABLE 3 (DELIVERIES)
(3) TABLE 4 (CROPS)
(4) EXIT

Figure 4. Menus to select drive and files.

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 4*A* 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 4*B* 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 ap-

propriate 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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