WESTLANDS WATER DISTRICT

Water Management Plan

2012

4/19/2013

Water Management Plan Update meets Federal (United States Bureau of Reclamation) Central Valley Project and California (Department of Water Resources) Water Conservation Act of 2009 (SBx7-7) requirements.

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Table of Contents

List of Tables

List of Figures

Common Abbreviations

Ac	-	Acre
AF	-	Acre-Foot
AW	-	Applied Water
Bureau	-	United States Bureau of Reclamation
CC	-	Coalinga Canal
cfs	-	Cubic-feet per Second
CIMIS	-	California Irrigation Management Information System
CP	-	Cultural Practices
CVP	-	Central Valley Project
CWR	-	Crop Water Requirement
DD1	-	Westland Water District Distribution District One

DD2	-	Westland Water District Distribution District Two
DU	-	Distribution Uniformity
DWR	-	California Department of Water Resources
EC	-	Electrical Conductively
EISIP	-	Enhanced Irrigation System Improvement Program
EP	-	Effective Precipitation
ET	-	Evapotranspiration
ETAW	-	Evapotranspiration from Applied Water
EWMPs	-	Efficient Water Management Practices
gpm	-	Gallons per minute
ISIP	-	Irrigation System Improvement Program
IMIS	-	Irrigation Management Information System
IMS	-	Irrigation Management Service
kWh	-	Kilowatt Hour
LRD	-	Leaching Requirement Depth
M&I	-	Municipal and Industrial
ML	-	Minor Losses
O&M	-	Operation and Maintenance
Project	-	See CVP
RRA	-	Reclamation Reform Act of 1982
SAE	-	Seasonal Application Efficiency
SAM	-	Salinity Assessment and Monitoring
SJREC	-	San Joaquin River Exchange Contract
SLC	-	San Luis Canal
SLD	-	San Luis Drain
SLDMWA	-	San Luis Delta Mendota Water Authority
SLU	-	San Luis Unit
TLBWSD	-	Tulare Lake Basin Water Storage District
USBR	-	United States Bureau of Reclamation
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
WCP	-	Water Conservation Program
WD	-	Water District
WMIP	-	Water Management Information Program
WRCD	-	Westside Resource Conservation District

Introduction

This Plan was prepared to satisfy requirements of the Agricultural Water Management Planning Act (California Water Code Sections 10800, et seq.), the Reclamation Reform Act of 1982 (RRA) (Public Law 97-295-96; Stat. 213), Central Valley Project Improvement Act of 1992 (Public Law 102-575, 106 Stat. 4713) and Water Conservation Bill of 2009 (SBx7-7) (California Water Code Section 10820). Additional requirement under the above laws is that the Plan document be updated every five years with updates of data submitted annually. This Plan is an update of the 2007 Plan document approved by USBR and includes the additional requirements under SBx7-7. This Plan includes data up to the end of Water Year 2011-12.

Westlands Water District continues an extensive water conservation program and works with its farmers and various agencies to manage the District's drainage problems. Past, present, and future activities are discussed in the Plan. The District is committed to the planning process because planning is essential to sound business management. The District serves as an extension of farm businesses which support it. Therefore, it makes good business sense to implement programs which prove to be both economically feasible and fit within the District's environmental and legal framework.

A commitment to planning has been fundamental since Westlands' formation in 1952. The farmers who organized the District realized that they possessed some of the most fertile and productive farmland in the world and that water would be the limiting factor on their livelihood. From the beginning, they planned for a pipeline distribution system with metered deliveries. Although this system was costly at the time, the farmers recognized that the water supply was not adequate to satisfy all future needs and that this limited resource must be managed as efficiently as possible to maximize its benefits.

Westlands' farmers have always felt that they must be good stewards of their land and water resources. In 1972 the District's Board of Directors authorized a water conservation program to supply Westlands' farmers with timely and valuable information on water and drainage management. This program has been expanded over the years and is recognized worldwide.

The District continues to face many challenges. Water supplies have been reduced over the years. Interim water which was plentiful in the early 1980's has not been available since 1989 and its future availability is uncertain. Drainage services provided for in the San Luis Act and the District's 1963 Water Service Contract were partially provided from 1980 through 1985. These services were terminated in 1986, and no viable alternatives have yet to be identified.

The continued reduced water supplies had greatly impacted farm and District revenues and their available capital. This has severely constrained the District's ability to fund existing programs and implement new ones, and has threatened the survival of many farms on the west side of the San Joaquin Valley. These factors have greatly influenced the District's planning process. However, Westlands continues its commitment to water conservation and recognizes that long-term survival of District farmers depends on the effective management of precious water.

Summary

The mission of Westlands Water District is to provide timely, reliable and affordable water supply to its landowners and water users, and to provide drainage service to those lands that need it. To this end, Westlands is committed to the preservation of its federal contract, which includes water and drainage service, and to the acquisition of additional water necessary to meet the needs of its landowners and water users. The following objectives were adopted to support this mission:

- Preserve and restore the federal contract water supply.
- Obtain supplemental water supplies through short- and long-term purchases and transfers; support individual transfers.
- Develop a process to examine the various options available for the purposes of supply enhancement and drainage mitigation.
- Support timely construction of cost-effective facilities to enhance the quality and reliability of water supplies.
- Conduct the maintenance, operational and administrative functions of the District in an efficient and effective manner.

Water conservation was an integral part of the design of Westlands' distribution system in the early 1960's. A closed pipeline distribution system and metered deliveries, prerequisites for optimum water management, enabled the District to equitably and efficiently deliver the District's water supply with virtually no losses to seepage, evaporation, and spills.

In 1972, the District began to look at on-farm water management as the area where immediate conservation gains could be made. The goal then, as it is today, was to provide farmers with accurate and up-to-date information and technical assistance to help them with water management planning and decisions.

Water Conservation Program

Westlands' current *Water Conservation Program* has evolved out of necessity and adversity into the Program that it is today, under the direction of the Water Conservation Coordinator, a licensed engineer. The Program's staff collects data, provides practical information to the farmers, renders technical assistance as necessary, and keeps abreast of statewide water conservation-related developments.

Westlands' *Water Conservation Program* has surpassed the goals to meet the changing needs of its farmers under increasingly difficult water supply and drainage conditions. The Program has responded to these needs and other critical issues with farmer information and assistance programs toward the following objectives:

- Increase seasonal application efficiency.
- Increase distribution uniformity.
- Increase crop yields.
- Decrease deep percolation.
- Decrease the effects of soil salinity.

The tangible results have been a relative stabilization of shallow groundwater depths, a substantial increase in the number of pressurized (sprinklers and drip) irrigation systems, and intensified irrigation management through the use of irrigation specialists and science-based technology, and a historic average District-wide seasonal application efficiency of 83 percent. The current *Water Conservation Program* consists of the following elements:

- The *Irrigation Guide* provides farmers with water requirements for various crops based on actual weather and computer modeling. The *Guide's* crop-water use values are verified with neutron probe sites strategically located throughout the District. A separate *Guide* for each of the District's three climatic regions are mailed, emailed or faxed to farmers weekly. The *Guide* for the three climatic regions is placed on the District's web page.
- *The Water Conservation and Management Handbook* (Irrigation Management Handbook) contains specific water management information for Westlands' farming conditions. The District plans to have the missing pages placed back up on the web page by the end of summer.
- Workshops and meetings with small groups of farmers facilitate a two-way flow of timely water management information. Key District staff and water management experts from the private sector, academia, and government are invited to present the latest tips on water supply and management, irrigation equipment, and available resources.
- Technical assistance and Water Conservation computer programs provide farmers with one-on-one interaction on irrigation management issues. The Water Conservation Coordinator is available to address farmers' technical questions and problems and assist them with the District's computer programs.
- The District maintains an aggressive program for the installation, upgrading, and repair of District water meters. Water meters are required at each District delivery and on private wells participating in any of the District's conjunctive use programs. They provide farmers and the District with an important water management tool.
- Groundwater monitoring provides farmers with information on the quality and depth of deep groundwater. This enables them to assess their groundwater development and use options at much lower cost than if they had to obtain the information on their own.
- Shallow groundwater monitoring provides farmers with information on the quality and depth of shallow groundwater on a District-wide basis. This gives irrigation managers another low-cost tool with which to develop their water management strategy.
- Efficiency testing is conducted on District pumps, which serve as part of the water

distribution system. This can help prevent potentially catastrophic system downtime and reduce electrical consumption and costs.

- Conjunctive use of surface and groundwater improves overall water supply reliability by making more efficient use of water that is available. In wet periods, use of surface water is encouraged to preserve groundwater supplies. In droughts, greater flexibility in the use of groundwater is facilitated to extract the maximum benefit from this resource.
- Irrigation System Improvement Program lease program offers water users an opportunity to lease/own equipment such as drip, micro-spray, sprinkler, and aluminum pipe. The goal of the program is to encourage conversion to more efficient means of irrigation.
- Satellite imagery purchased approximately once every two weeks, from USGS, processed by staff and placed on the District's web page. The imagery gives the Districts' farmers visual Distribution Uniformity on each of their fields. *Satellite imagery is provided to the District Farmer's on the private side of the District's website and is tailored to each individual Farm showing only their parcels.*

Section 1

Historical Background

Historical Background

Westlands Water District consists of nearly 1,000 square miles of prime farmland between the Diablo Range of the California Coast Range Mountains and the trough, or lowest point, of the San Joaquin Valley in western Fresno and Kings Counties. Westlands averages 22 miles in width at it widest point and stretches about 67 miles from Nees Avenue[1] in the north to Kettleman City in the south. Figure 1 shows the general location of Westlands in the western portion of the San Joaquin Valley.

Westlands includes two Distribution Districts which manage separate water contracts. In 2000 Westlands Water District Distribution District Number 1 (DD1) was formed[2] and in 2002, Westlands Water District Distribution District Number 2 (DD2) was formed.[3] Broadview Water District was annexed to Westlands Water District in 2004.[4] The locations of District Distribution District's 1 and 2 are depicted in Figure 2.

Westlands Water District is located in western parts of both Fresno and Kings Counties. The only communities within the District are Huron in Fresno County and Lemoore Naval Air Station in Kings County.[5] Huron's 2010 population was 6,754 with a population-projected increase of 25 percent by 2030. The population growth for Fresno and Kings Counties were 28 percent and 34 percent, respectively, during the period 1990 to 2010. Tables 1 summarize the population projections for selected communities through 2030.

Table 1: Community Population Projections

	Year			
Community	*2000*	*2010*	*2020*	*2030*
Firebaugh	5,743	7,549	9,700	11,700
Huron[6]	6,306	6,754	7,500	9,000
Mendota	7,890	11,014	14,000	17,000

The loss of agricultural acreage and ultimate loss of employment has led to population losses in specific areas of the county. With an uncertain water supply, it is difficult to determine the population trends over the short- and long-term. Neighboring communities are also greatly impacted by agriculture in Westlands for jobs and economic stability. These include the cities of Mendota, Kerman, Coalinga, and Lemoore.

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1 Nees Avenue is northern boundary of Broadview Water District annexation.
2 Resolution No. 101-00, Board of Directors, Westlands Water District, adopted on 14 February 2000.
3 Resolution No. 117-02, Board of Directors, Westlands Water District, adopted on 19 August 2002.
4 Resolution No. 111-04, Board of Directors, Westlands Water District, adopted on 22 November 2004.
5 Additionally, the Federal Correctional Institution (FCI), Mendota, California completed construction in 2012 and the population of Prison in June 2012 was 624 inmates. FCI Mendota is location near Mendota within the District boundary and is a medium security facility housing male offenders.
6 Huron is surrounded by Westlands, but is not in the District.

The population of Fresno and Kings Counties[7] in census years 1980, 1990, 2000 and 2010 are summarizes in Tables 2-4. The tables gives the percent of change and percent of population in unincorporated areas for the periods 1980-1990, 1990-2000 and 2000-2010.[8]

Table 2: Growth of Fresno and Kings Counties, 1980-1990

1980-1990

County/City	***Population*** 1980	1990	***Percent of Population Unincorporated areas*** 1980	1990	***Percent Change*** 1980-1990
Fresno County	514,621	667,490	37.1	23.9	29.7
Coalinga	6,593	8,212			24.6
Firebaugh	3,740	4,429			63.0
Fresno	217,346	354,202			18.4
Huron	2,768	4,766			72.2
Mendota	5,038	6,821			35.4
Others	88,047	129,424			46.5
Unincorporated	191,089	159,636			-16.5
Kings County	73,738	101,469	45.2	33.3	37.6
Avenal	4,137	9,770			136.2
Hanford	20,958	30,897			47.4
Lemoore	8,832	13,622			54.2
Others	6,454	13,364			107.1
Unincorporated	33,357	33,816			1.4

[7] U. S. Department of Commerce, United States Census Bureau.
[8] In the 2000-2010 section, two communities were added, the City of Kerman for Fresno County and Lemoore Naval Air Station for Kings County.

Table 3: Growth of Fresno and Kings Counties, 1990-2000

1990-2000

	Population		*Percent of Population Unincorporated areas*		*Percent Change*
County/City	***1990***	***2000***	***1990***	***2000***	***1990-2000***
Fresno County	667,490	799,407	23.9	21.5	19.8
Coalinga	8,212	11,688			42.1
Firebaugh	4,429	5,743			29.7
Fresno	354,202	427,652			20.7
Huron	4,766	6,306			32.3
Mendota	6,821	7,890			15.7
Others	129,424	159,644			23.3
Unincorporated	159,636	171,953			7.7
Kings County	101,469	129,461	33.3	25.6	27.6
Avenal	9,770	14,674			50.2
Hanford	30,897	41,686			34.9
Lemoore	13,622	19,712			44.7
Others	13,364	14,458			8.2
Unincorporated	33,816	33,182			-1.9

Table 4: Growth of Fresno and Kings Counties, 2000-2010

2000-2010

	Population		*Percent of Population Unincorporated areas*		*Percent Change*
County/City	***2000***	***2010***	***2000***	***2010***	***2000-2010***
Fresno County	799,407	930,450	21.5	18.9	16.4
Coalinga	11,688	13,380			14.7
Firebaugh	5,743	7,549			31.4
Fresno	427,652	494,665			15.7
Huron	6,306	6,754			7.1
Kerman	8,551	13,544			58.4
Mendota	7,890	11,014			39.6
Others	159,644	207,838			30.2
Unincorporated	171,953	175,706			2.2
Kings County	129,461	152,982	25.6	16.2	18.2
Avenal	14,674	15,505			5.7
Hanford	41,686	53,967			29.5
Lemoore	19,712	24,531			24.4
Lemoore Station	5,749	7,438			29.4
Others	14,458	24,813			71.6
Unincorporated	33,182	26,728			-19.5

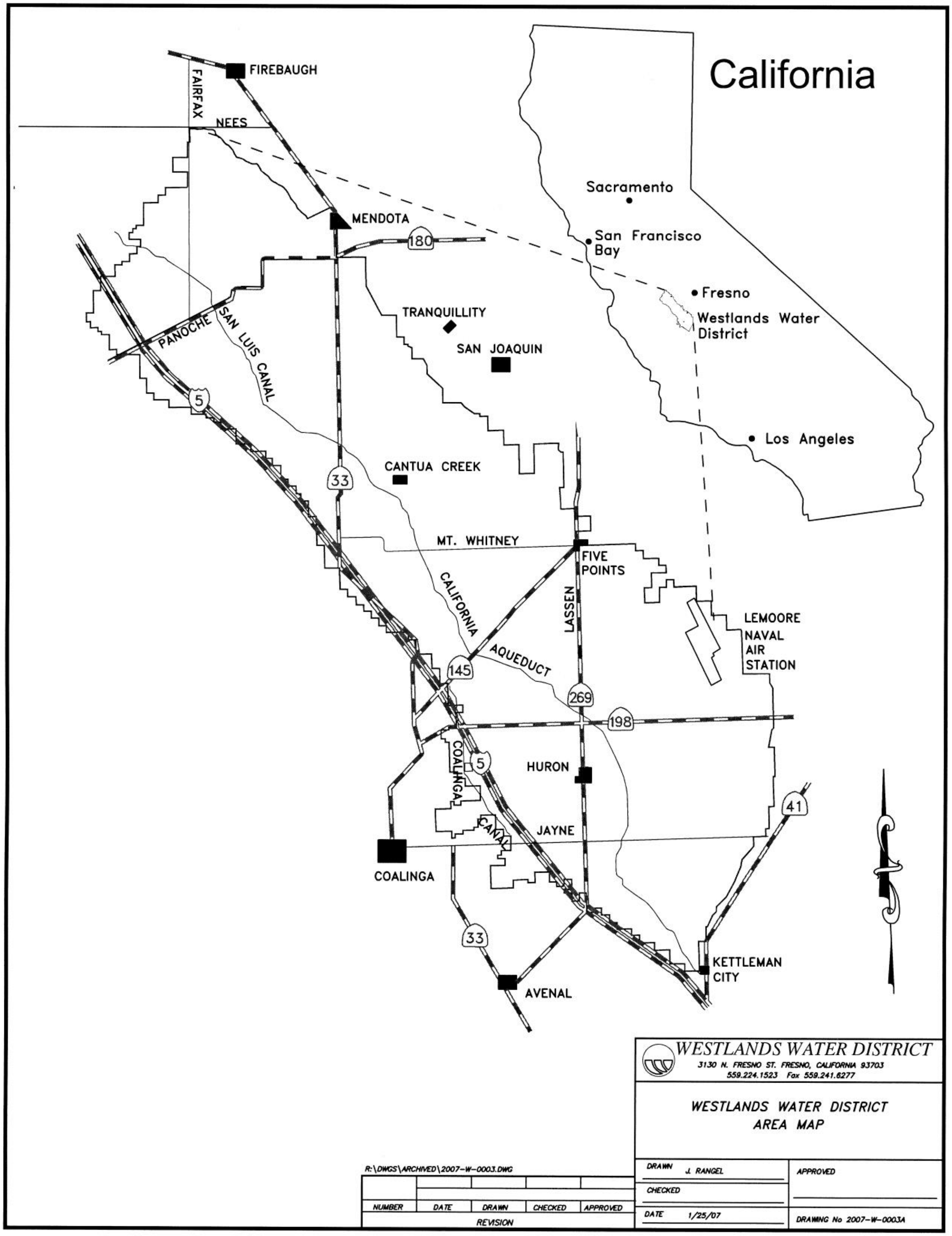

Figure 1: Westlands Water District and its location in California.

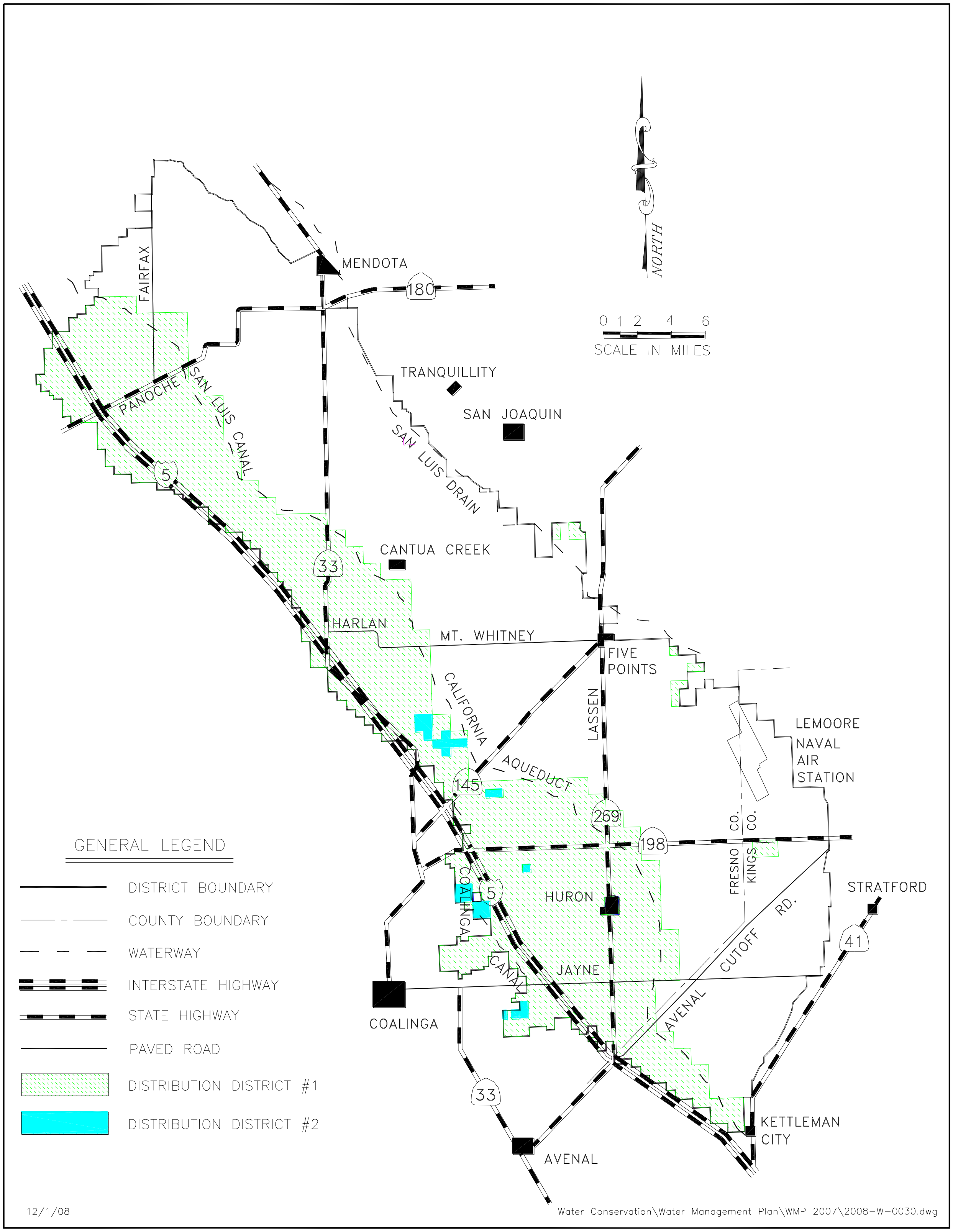

Figure 2: Distribution District's #1 and #2.

District Formation

Westlands formed under California Water District Law in 1952 upon petition of landowners located within the District's proposed boundaries. Nearly all land within the current Westlands' boundaries was at one time farmed using groundwater.

Negotiations between Westlands and the U.S. Bureau of Reclamation began on a contract to provide a dependable, supplemental supply of surface water through the Bureau's Central Valley Project (CVP) shortly after the District's formation. At that time, the federal government was considering the development and construction of the CVP's San Luis Unit (SLU). This involved cooperation between the federal and state governments with regard to shared water storage facilities and conveyance systems.

When the original Westlands was organized, it included approximately 376,000 acres. In 1965, it merged with its western neighbor, Westplains Water Storage District, adding 210,000 acres. Additionally, lands comprising about 18,000 acres were annexed to the District after the merger to form the current 604,000-acre District with an irrigable acreage of 568,000 acres. The original Westlands was referred to as Priority Area I and Westplains were referred to as Priority Area II, each under a separate water service contract with the Bureau.

	Date	***Acres in Contract***	***Classes***	***Acre-Feet***
First USBR contract[9]	1963[10]	604,000		900,000[11]
				250,000[12]

	Total Acres	***Irrigable Acres***
Original size	376,000	337,000
Current size	604,000	570,000

Westlands Water District does not have an M&I contract for Project water, but the District does convey water to other entities that do have contracts for Project water. Westlands does deliver water for incidental agricultural uses and its contract allows for non-agricultural uses that have been termed M&I.

[9] Forty-year Contract scheduled for renewal in the year 2007.
[10] Contract signed in 1963 but became effective in 1968 with first delivery of water.
[11] Per 1963 Water Service Contract.
[12] Per 1986 Barcellos Judgment.

2011 Non-Agricultural Uses

1. Fresno County Public Works, Helm Community Water Service District, Lemoore Naval Air Station, City of Huron, City of Coalinga
2. Cotton gins, fruit and vegetable packing sheds, tomato-processing plants, nut processing plants
3. Farm equipment repair facilities
4. Poultry production facilities
5. Dust Control

Soils and Hydrology

The San Joaquin Valley is a wide bedrock basin filled with thousands of feet of alluvial sediment deposited by streams and rivers flowing out of the adjacent mountains on both the east and the west (Figure 3). Westlands is located near the centerline of this basin, bordered on the east by the Fresno Slough and on the west by the Diablo Range of the California Coast Ranges.

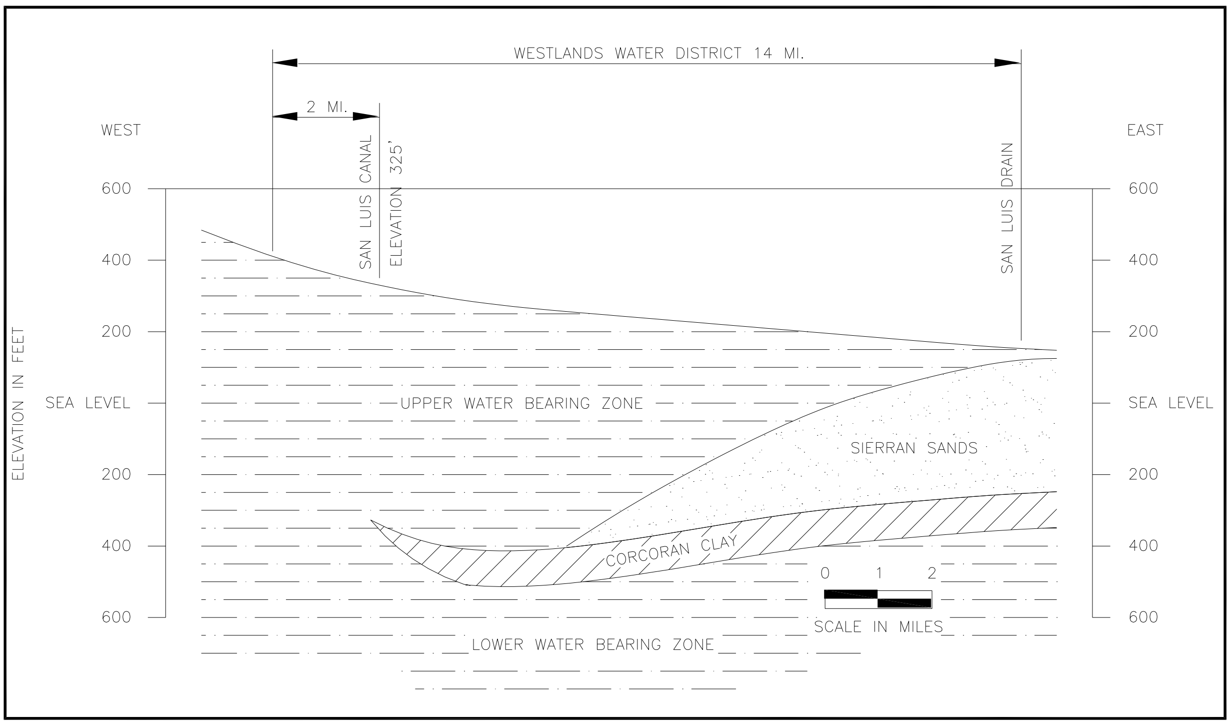

Figure 3: Generalized Hydrogeological cross section of Westlands.

The Sierra Nevada on the east side of the Valley is predominately comprised of uplifted granite rock overlaid in areas by sedimentary and metamorphic rock. Sierran alluvial deposits in the District consist primarily of well-sorted sands, with minor amounts of clay. The Sierran alluvium decreases in thickness and increases in depth below the surface toward the west. These coarse-textured sediments are characterized by high permeability and a low concentration of water-soluble solids.

One of the principal subsurface geological features of the San Joaquin Valley is the Corcoran Clay formation. Formed as a lakebed about 600,000 years ago, this clay layer ranges in thickness from 20 to 200 feet and underlies most of the District. Varying in depths from 200 to 500 feet in the Valley and to 850 feet along the Diablo Range, the Corcoran Clay divides the groundwater system into two major aquifers – a confined aquifer below and a semi-confined system above.

The Diablo Range consists of complex, folded, and uplifted mountains that are composed predominantly of sandstones and shale's of marine origin. These sandstones and shale's contain salts, as well as trace elements such as selenium. Eroded by creeks flowing from the Diablo Range, sediments form gentle sloping alluvial fans. The texture of the Diablo Range deposits depends on the relative position on the alluvial fan and ranges from coarse sand and gravel to fine silt and clay. Generally, those portions of Westlands lying high on the alluvial fans have permeable, medium-textured soils. With decreasing elevation from the west to east, soil textures become finer. These fine textured soils are characterized by low permeability and increased concentrations of water-soluble solids, primarily salts and trace elements.

The preliminary information in Appendix C "General Soil Map, Westlands Water District" provided by the Hanford Soil Survey Office of the Soil Conservation Service.[13]

Soil Association	***Estimated Acres***	***Effect on Water Operation and Management***
Tachi-Armona Gepford	1,000	Appendix C
Westhaven-Panoche-Excelsior	47,000	Appendix C
Ciervo-Cerini-Lillis	72,000	Appendix C
Lethent-Panoche-Westhaven-Cerini	40,000	Appendix C
Ciervo-Cerini-Panoche, Saline-Sodic	57,000	Appendix C
Ciervo-Cerini-Panoche	342,000	Appendix C
Panoche-Cerini, Subsided	45,000	Appendix C
Total	604,000	

Agricultural Drainage[14]

Salinization, or salt build-up in the soil, is one of the oldest problems faced by irrigated agriculture. Complicating Westlands' salinity problems is its soil structure in some areas where dense

[13] Westlands Water District spans parts of Fresno County (2006 soils data) and Kings County (1986 soils data) and the current District Soils Appendix incorporates 1993 soils data for both counties. The District would like to revise the soils appendix when USDA/NRCS completes an updated Kings County survey using the same detail as the 2006 Fresno County survey.

[14] District Water Users are responsible in controlling the movement of tail water from their fields and failure to do so will be consider a waste of water. Any Water User who is found to have wasted water will have their water service discontinued. (Appendix A: Regulations or Terms and Conditions for Agricultural Water Service, Article 2, Section 2.6, paragraphs G, H & I).

clay layers of varying depth and thickness restrict natural drainage. This causes an accumulation of unused irrigation water above the clay layers, resulting in a near-surface saline water table. The District agricultural lands that are severely affected by a saline water table are in need of artificial drainage facilities or in some cases conversion to non-irrigated use.

The original authorization for Westlands Water District included provisions for drainage service, but these facilities were never completed. Prior to construction of San Luis Unit facilities, it was believed that approximately half of Westlands would eventually need drainage service to remain productive. The problem can be managed, short term, though not fully eliminated, with intensive irrigation management. Salts must ultimately be exported from the area to achieve salt balance and maintain land productivity.

The effects of the accumulation of agricultural drainage-borne selenium in waterfowl led to the closure of Kesterson Reservoir in June 1986, which was the temporary terminus for the San Luis Drain. This made it more essential than ever to manage irrigation as efficiently as possible in the drainage-collector system service area and elsewhere in the District. Westlands currently has no outlet for subsurface drainage water, but a litigation judgment has ruled that the United States continues to have an obligation to provide drainage service.

Shallow groundwater can restrict crop root development resulting in a reduced yield. Most crops can use shallow groundwater as long as the salt concentration is not too high for the particular plant and the roots do not become waterlogged. Depth to shallow groundwater has been monitored in the District for more than 30 years. Shallow groundwater levels are typically highest in April after pre-irrigation and lowest following the cropping season in October after crops have extracted a portion of the shallow groundwater.

This problem was addressed in the San Joaquin Valley Drainage Report published in 1990. Achieving the recommendations for this problem were referenced to be given substantial deference in the 1992 CVPIA legislation as part of this water management plan.

The recommendations from this report for the Westlands sub-area included:

1. Deep percolation on 159,300 acres of drainage-affected lands can be reduced to 0.4 acre-feet per acre by improved irrigation management.
2. Reusing drainage water to irrigate about 12,100 acres of salt-tolerant trees and halophytes.
3. Operating 400 acres of evaporation ponds and about 1,500 acres of solar ponds.
4. Pump the semi-confined aquifer under about 19,000 acres of land.
5. Retiring 33,000 areas of irrigated agricultural lands.

While the need for a drainage outlet for the District is still a necessity, Westlands is in substantial compliance with the first recommendation. The average deep percolation for irrigated lands in the District during the period 1978 to 2011 as presented in table 23 of this report was 0.47 AF/Acre. Additionally, District data from analysis of the Irrigation Improvement Program during the years 1986-1991 showed that deep percolation on lands with a water table within the 6 feet of the soil surface averaged 0.23 AF/Acre on 168 fields within the District. These data would indicate that lands with a drainage problem are in compliance, and additionally, that the average deep percolation on all irrigated lands within the District complies with this goal. If all 604,000 acres of land within the District are considered, the average deep percolation is 0.42 AF/Acre.

Pumping of the semi-confined aquifer has not been an attractive recommendation due to lack of options for the use of the water. Westlands limited water supply could be enhanced if this water were of good quality, and would probably have been readily adopted. Red Rock Ranch Research Project has plans to drill a well by 2013 and begin pumping the semi-confined aquifer because the perched water table has dropped below the projects tile system. Red Rock Ranch has little or no saline water for the research project.

In 1997, the USBR initiated a voluntary land retirement program, funded by the CVPIA Restoration Fund. This program expected to purchase about 15,000 acres of drainage affected lands in the CVP service area to remove them from irrigated agriculture in 1998 and 1999. These actions were delayed pending preparation of satisfactory Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) studies. The draft EA and FONSI documents propose that approximately 7,000 acres will be retired in the District. The water allocation on the retired lands will remain with Westlands due to the signed agreement between the U.S. and Westlands.

In 1998 the District began purchasing drainage impaired land through various land acquisition programs removing the purchased lands water allocation and moving the allocation to none impaired lands. Under these programs the District has retired 88,066 acres of land with 44,000 acres of these lands that cannot be irrigated and 44,066 acres that can be irrigated but are mostly used for dry land farming (see Table 5).

The U.S. Court of Appeals for the Ninth Circuit (February 2000) concluded that the Department of Interior must provide drainage service to the District and the Bureau of Reclamation developed a Plan of Action (April 2001) outlining the proposed efforts in providing drainage service and considering a variety of options. The first phase resulted in the Preliminary Alternatives Report, published in December 2001. The second phase of the Plan of Action was the preparation of a Plan Formulation Report, published in December 2002. The third phase produced the Final EIS and the San Luis Drainage Feature Re-evaluation, Record of Decision (ROD).[15]

In a collaborative effort between the San Luis Unit water districts and the San Joaquin River Exchange Contractors Authority, the Westside Regional Drainage Plan developed in May 2003. The plan included adaptive management, land retirement of up to 200,000 acres, groundwater management, source control, regional reuse, treatment, and salt disposal. The plan calls for identification of sound and effective projects to manage drainage.

Westlands Water District formed a Coalition in 2004 which includes Westlands and Pleasant Valley farmers and meets the requirement by the State of California to have a waste discharge permit. The Collation monitors storm water runoff into the three creeks that drain into the District and reports quarterly to the Regional Water Quality Control Board. In the future (2014/2015) the Coalition will be

[15] http://www.usbr.gov/mp/sccao/sld/docs/sld_feature_reeval_rod.pdf.

required to monitor groundwater. When USDA/NRCS updates Kings County soils data, a revised map and appendix will be updated. The USDA/NRCS timeframe not known for Kings County soils update.

In March 2007, the USBR released the ROD and the In-Valley/Water Needs Land Retirement Alternative was selected. The alternative selected is the plan closest to the Westside Regional Drainage Plan. This alternative includes drainage reduction measures, drain-water reuse facilities, treatment systems, evaporation ponds and includes retiring 194,000 acres of land from irrigated farming. Implementation would require appropriation of funds by Congress and the apportionment of such funds by the Office of Management and Budget.

The District has budgeted money for the purchase of 5,000 acres of additional lands for purposes of acquiring water supply. This purchase has no deadlines and land will be purchased when willing sellers become available.

District farmers have sold lands to P.G. & E. for nine Solar Projects (~1,250 acres), six are completed and remaining three projects are under construction. In addition the District has Option agreements for solar projects on 18,000 District owned non-irrigated lands.

At the end of 2011, PG&E has completed three Solar Projects[16] on 328 acres of drainage impaired lands. PG&E has three additional Solar Projects[17] scheduled for 2012 covering about 450 acres. Additionally there are fourteen planned Solar Projects on private owned lands amounting to about 3,500 acres and seventeen planned Solar Projects on District owned land amounting to about 15,000 acres.

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[16] Stroud Solar Station, west of Helm, California; Five Points Solar Station and Westside Solar Station located south of Five Points, California.
[17] Cantua, Giffen and Huron Solar Stations.

Table 5: Westlands Water District Retired Lands

Land Purchase Program	***Assessable Acres***	***Irrigable Acres***	***Water Year***
1999 Land/Water Acquisition Program	643.49	634.00	1998/99
1999 Land/Water Acquisition Program	12,259.57	12,006.00	1999/00
1999 Land/Water Acquisition Program	1,706.84	1,674.00	2000/01
Sagouspe (Techite Funds)	4,289.58	4,075.00	2002/03
Sagouspe	15,447.61	14,042.45	2002/03
Britz Settlement	2,944.68 *	2,856.00	2002/03
Lands Sold Back/Reconveyed	(1,624.94) #	(1,546.00)	2002/03
WWD (Peck)	10,082.42 *	9,877.00	2003/04
Sagouspe	6,268.18	6,073.00	2003/04
Lands Sold Back/Reconveyed	(505.41) #	(486.00)	2003/04
Sub-Total	51,512.02	49,205.45	
WWD (Peck)	21,967.73 *	21,684.00	2004/05
Sagouspe	4,995.25	4,912.25	2004/05
Donated	13.26[18]	-	2004/05
Lands Sold Back/Reconveyed	(748.75)[19] #	(725.00)	2004/05
Sub-Total	77,739.51	75,076.70	
Broadview Water District	9,101.92 *	8,862.00	2005/06
Sagouspe	1,002.93	997.00	2005/06
Lands Sold Back/Reconveyed	(315.93) #	(317.00)	2005/06
Sub-Total	87,528.43	84,618.70	
Exchanged	1,592.46	1,565.00	2006/07
Exchange	(1,258.78)	(1,234.00)	2006/07
Sagouspe	4,437.94	4,411.00	2006/07
Lands Sold Back/Reconveyed	(1,883.67) #	(1,852.00)	2006/07
Sub-Total	90,416.38	87,508.70	
Lands Sold Back/Reconveyed	(2,602.28) #	(1,863.00)	2007/08
Lands Sold Back/Reconveyed	(10.00)[20]	(9.00)	2008/09
Lands Sold Back/Reconveyed	(53.50) #	(48.00)	2011/12
Land/Water Acquisition Program	316.38	311.00	2011/12
Total Land Retired	**88,066.98**	**85,899.70**	
Retained Allocation	**95,811.46**		

* Irrigation not allowed on these lands.

Water allocation retained by Westlands Water District.

[18] Reinhardt, Donald & Mariel.

[19] Includes lands sold to U.S. Department of Justice – Federal Bureau of Prisons for construction of Federal Correctional Institution (FCI), Mendota, California.

[20] Land sold to the City of Mendota and water allocation retained by Westlands Water District.

Climate

Annual precipitation in Westlands averages more than seven inches, the majority of which falls during the months of December through March. Summer maximum temperatures frequently exceed 100˚ F and winter temperatures occasionally fall below freezing. With a mean annual temperature of 62˚ F, the area has an average frost-free growing season over 280 days. The District is unaware of any impacts from micro climates on crop production.

Northern Zone[21]

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precept	1.43	1.31	1.38	0.81	0.43	0.23	0.05	0.12	0.27	0.54	0.90	1.14	8.61
Temp.	46	51	55	60	68	74	79	77	74	65	54	46	62
Max. Temp.	55	62	68	77	84	91	95	94	90	80	66	56	76
Min. Temp.	38	40	43	46	52	57	62	61	57	50	41	36	49

The average wind velocity and direction are **4.3 mph NW** and **338** average annual frost-free days.

Central Zone[22]

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precept	1.62	1.42	1.33	0.75	0.37	0.38	0.08	0.09	0.25	0.68	0.78	1.06	8.81
Temp.	45	51	55	60	67	72	78	78	73	64	53	46	62
Max. Temp.	55	62	68	74	83	88	94	93	89	79	66	55	76
Min. Temp.	36	40	43	46	52	57	61	60	57	49	41	36	48

The average wind velocity and direction are **5.4 mph NW** and **335** average annual frost-free days.

Southern Zone[23]

Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precept	1.47	1.35	1.18	0.51	0.25	0.06	0.02	0.03	0.17	0.37	0.67	0.92	7.01
Temp.	46	51	56	60	68	74	79	78	73	65	53	45	62
Max. Temp.	55	62	68	75	84	90	95	94	89	80	66	56	76
Min. Temp.	37	40	43	46	52	58	63	61	58	50	41	35	49

The average wind velocity and direction are **4.6 mph NW** and **337** average annual frost-free days.

[21] CIMIS Weather Station, Murrieta Farms/Adams & Highway 33, Tranquillity, California; 1976-2011, Rainfall, Mendota Dam/ CIMIS Weather Station, 1960-1998; Rainfall, CIMIS Weather Station, Murrieta Farms/Adams & Highway 33, 1999-2011. Temperatures are in degrees Fahrenheit and precipitation in Inches.

[22] CIMIS Weather Station, University of California, Westside Field Station, Five Points, California; 1982-2011, Rainfall, 1962-2011. Temperatures are in degrees Fahrenheit and precipitation in Inches.

[23] Westlands Automated Weather Station, two miles southwest of Huron, California, 1982-2011 and Rainfall, Westhaven, California/WWD, 1960-2011. Temperatures are in degrees Fahrenheit and precipitation in Inches.

Climate Change

The California Department of Resources describes Climate Change as "…general projected changes in the Earth's climate, including those resulting from global warming."[24]

Potential Climate Change Effects

"DWR expects within the next 20 years the following potential climate change effects will occur:

- **Water Demand** – Shorter winter, more hot days and nights, and a longer irrigation season will increase water demand.
- **Water Supply and Quality** – Reduced snowpack, shifting spring runoff to earlier in the year, has the potential to impact water supply.
- **Sea Level Rise** – The Delta will be at greater risk to increased salinity due to sea level rise.
- **Disaster** – more frequent as climate change brings increased climate variability".[25]

District Planning

Part of the District's mission statement states "…to provide a timely, reliable and affordable water supply to its landowners…" The District will continue to work through Federal and State Governments to secure a reliable and affordable water supply. Items that need to be completed in the near term are:

- Building a new environmentally friendly water conveyance system through or around the Delta.
- Building new water storage facilities, to accommodate earlier runoff.
- Increase the capacity of existing water storage facilities.

The District water supply is conveyed through the Delta with restriction in pumping due to environmental concerns. Building a new water conveyance system is a solution to the restriction in pumping due to these concerns. The State needs additional water storage facilities to meet the increasing demands for water. By increasing the capacity in existing water storage facilities and building additional water storage facilities, will go a long way in meeting the demands on California's and the District's water supply system.

[24] "Climate Change Handbook for Regional Water Planning", Prepared for: US Environmental Protection Agency Region 9 and California Department of Water Resources, http://www.water.ca.gov/climatechange/CCHandbook.cfm (2011), p. 2-1.
[25] "Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan (Draft)", California Department of Water Resources (2012), p.33.

Environment

The San Luis Drainage Feature Re-evaluation Record of Decision (ROD) lists three endangered or threatened species that are in need mitigation measures.

Giant Garter Snake (*Thamnophis gigas*)
San Joaquin Kit Fox (*Vulpes macrotis mutica*)
California Least Tern (*Sterna antillarum browni*)

The ROD In-Valley/Drainage-Impaired Land Retirement Alternative was identified as the Environmentally Preferred Plan because it requires the least amount of evaporation ponds and associated treatment systems. Mitigation Measures adopted by the USBR as part of ROD will have an adaptive management approach in cooperation with the Mitigation Work Group and permitting agencies. "Use of an adaptive management approach in conjunction with targeted monitoring will … minimize adverse effects."[26]

Environmental Resources

Within the District[27]

Name	*Estimated Acres*	*Improvement or management by District or others*
Mendota Wildlife Area	155 [28]	Owned and managed by CA Dept. of Fish & Game (F&G).
Pilibos Wildlife Area	127	Wildlife habitat operated under joint agreement between F&G, Department of Water Resources (DWR) and USBR.

Recreational Resources

Within the District

Name	*Estimated Acres*	*Improvement or management by District or others*
Fishing on the San Luis and Coalinga Canals	0	None

[26] San Luis Drainage Feature Re-evaluation Record of Decision, p. 21
[27] The locations are plotted on the Map in Figure 5.
[28] Mendota Wildlife Area consists of 12,425 acres with only 155 acres within the District.

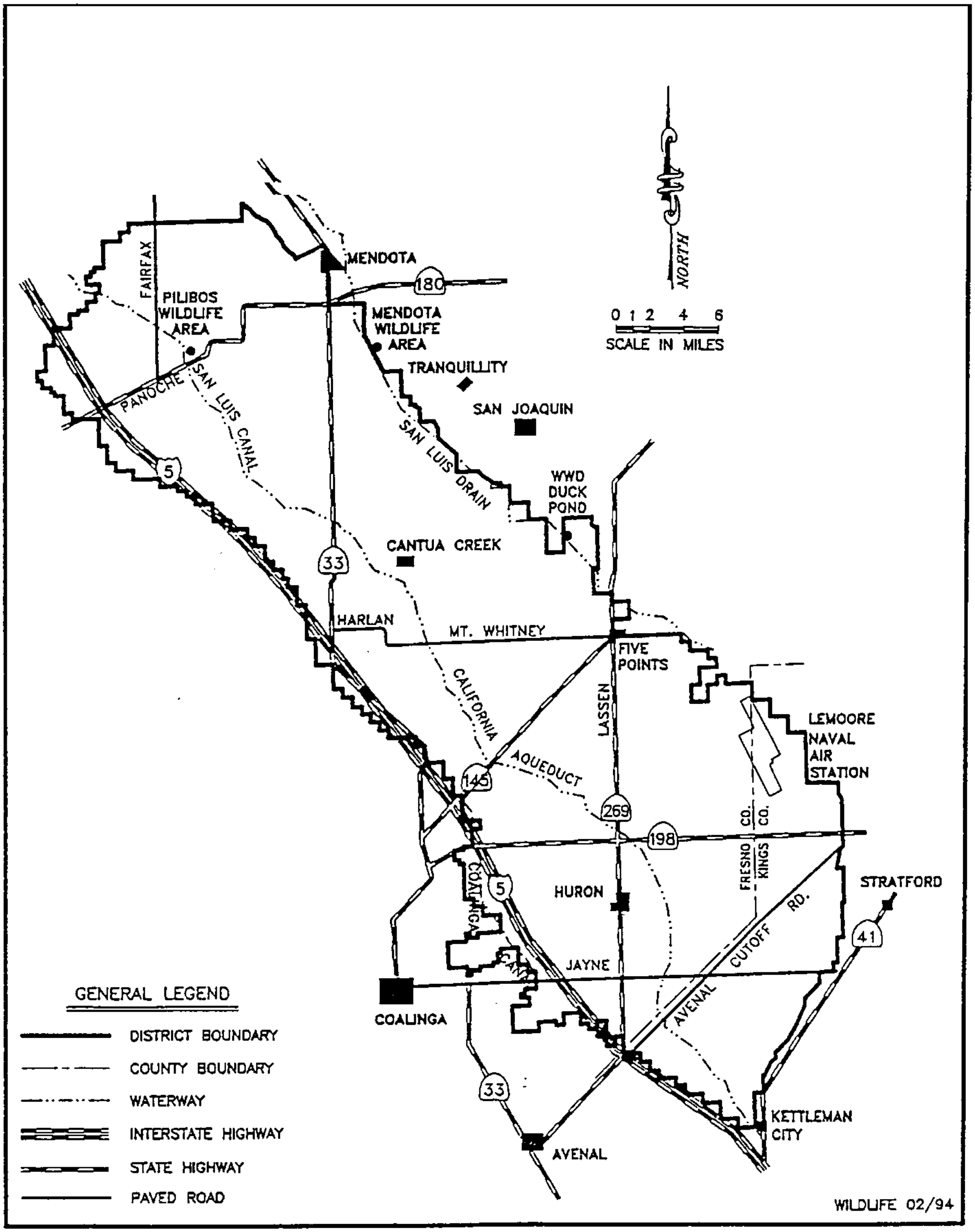

Figure 4: Location of Environmental and Recreation Resources.

Water Distribution System

Westlands is in the San Luis Unit of the CVP. The main water supply features of the Unit are completed and operational, including the Delta-Mendota Canal, the San Luis Dam and Reservoir, the San Luis Canal (SLC), and the Coalinga Canal (CC). However, lift pump stations on 12 percent of Westlands' laterals proposed for completion are yet to be constructed. These laterals and lift stations will be a major part of any future Westlands' Distribution System Completion Project. In addition, Westlands operates and maintains the 12-mile concrete-lined CC and the Pleasant Valley Pumping Plant, which have a capacity of 1,100 cubic-feet per second.

District Facilities

Westlands' permanent distribution system consists of a closed, buried pipeline network designed to convey irrigation water to 160- or 320-acre land units from the SLC, the CC, and a 7.4-mile un-lined canal[29] from the Mendota Pool. The distribution system was built between 1965 and 1979 and the area served by the completed system serves approximately 88 percent of the irrigable land in the District, including all land lying east of the SLC. The areas in Westlands where the distribution system is completed are shown in Figure 5.

Water is distributed through 1,034 miles of buried pipe, varying in diameter from 10 to 96 inches. Gravity and pumps feed 38 lateral pipelines from the east bank of the SLC, while water is pumped into 27 laterals on the west bank. Six partially completed laterals are served from the CC. The basic design flow rate of each on-farm delivery system is one cubic-foot per second per 80 acres. The water is delivered with a minimum head pressure of five feet above the high point of the parcel. Farmers control individual deliveries at each of the more than 3,400 metered outlet valves.

Most of the land in the original Westlands is east of the SLC and slopes gently from an elevation of about 320 feet to about 160 to 200 feet at the eastern boundary. Most of this land has gravity service from the SLC. Small re-circulating pumping plants at the headwork's of each of the gravity laterals pressurize the laterals serving lands adjacent to the SLC that are too high in elevation to be served through the gravity laterals. The lands lying west of the SLC are at higher elevations. These lands are served by pumping from the SLC and by gravity from the CC.

Most of the remaining District lands are served by farmer-constructed temporary-diversions. The farmers maintain these facilities for Westlands. Some of the pumping costs are offset by the availability of less expensive CVP power. Approximately one-third of the land between the SLC and the CC is served by pumping from the SLC. The other two-thirds are served by laterals from the CC.

Facilities Maintenance and Replacement

Westlands conducts an extensive ongoing preventive maintenance program for all its equipment

[29] See Appendix H, for reason this canal has not been lined.

and facilities. There have been no past system failures that have resulted in a significant loss of water. Distribution-system maintenance budgets vary depending on water availability. Maintenance expenditures were $5.73 million for the water year 2011-12. In years of reduced supply, the District utilizes O&M reserve funds to maintain the system.

In addition, the District has an ongoing policy for the installation of new delivery facilities when requested. The total District investment in the distribution and drainage system as of February 29, 2012, was $195.3 million. The present value of the completed distribution system is in excess of $500 million and is comprised of the following components.

Diversion Point	Description
63 Laterals from the San Luis Canal	Buried pipe-lines with metered turnouts
6 Laterals from the Coalinga Canal	Buried pipe-lines with metered turnouts
28 Temporary Laterals from San Luis Canal and 19 from Coalinga Canal	Pipe-lines with metered turnouts
3 Pumping Plants (PP) from Mendota Pool	PP 6-1, PP 7-1 & PP 7-2 metered (water from unlined canals)

Leak Detection

The District's Delivery System is monitored for leaks at least once a month along the whole system and District water users report leaks on their lands when they occur. Reported or found leaks very in size from about 1-2 gallons/minute (gpm) to up to blows of 2-5 cubic-feet/seconds (cfs). All leaks are repaired in timely manner ether under the District's Work Order System or on critical system through an emergency repair basis. Each one of the District's Laterals is inspected on a tri-annual schedule. The scheduled lateral will be dewatered and maintenance personnel will go into the lateral main-line to visually check for problem areas.

When a control valve on one of the District's 3,400 plus agricultural deliveries develops a leak, the valve is isolated and a request for repair is placed in the District's Work Order System. Repairs are scheduled and each repair is performed in a timely manner.

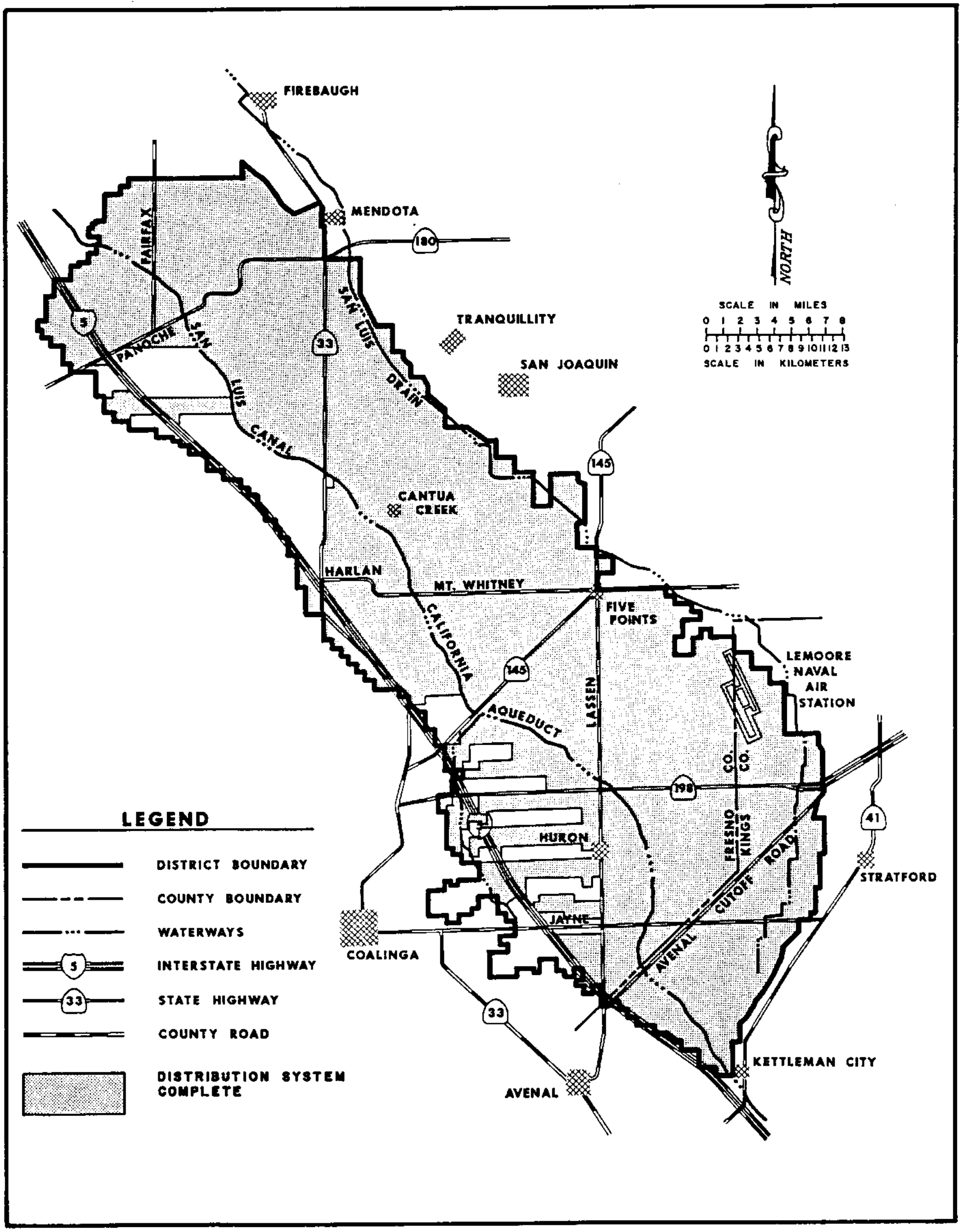

Figure 5: Areas where distribution system is complete.

Water Measurement

All water delivered, for both agricultural and non-agricultural purposes, is currently accounted for through any one of approximately 3,400 meters. The use of meters to measure water delivery is a cornerstone of any water conservation program. Meters enable water managers to accurately allocate limited supplies and recoup true delivery costs. They also enable the farmer to precisely measure the amount of water delivered and calculate irrigation efficiency. Without a reliable meter-based delivery system, farmers are more likely to apply a safety factor for each irrigation to avoid crop yield reduction under irrigation.

Recognizing these benefits, District founders elected to install flow meters as each lateral was originally constructed. Each of the original agricultural deliveries cost $1,400, in 1991 dollars, for a total of $4.3 million. District-wide meter accuracy is within plus or minus two percent as determined from calibration tests. Westlands' Meter Shop, located at the District's Five Points Shop and Field Office (FPSFO), is among the states most modern meter testing facilities. Meters are calibrated in the Meter Shop on a fixed schedule (every five years) and repaired as needed. See Table 6 for Ag Water Meter Data.

All customer water needs, including those covered by this urban plan, are satisfied from the agricultural contract. Non-agricultural accounts are classified as M&I and Incidental Ag accounts, as defined by the water delivery contract with the USBR. M&I accounts are those that fall into the Commercial, Industrial and Institutional (CII) classification. Out of the 222 non-agricultural accounts, 53 are "true" M&I accounts for the 2011/12 water year, March 1 through February 28.

Incidental Ag accounts would be those accounts providing for water needs incidental to agricultural production activities, such as shops, houses, and wash racks. Seventy-Eight percent of the "M&I" water accounts reported to the USBR could be classified as "Incidental Ag" water.

All water delivered by the District is metered. All meters are read on a monthly basis. Smaller meters, 2 inches or less, are generally of a turbine type and larger meters are a propeller type. All meters are serviced on an as needed basis and on a periodic basis, depending on size. Calibration of District meters averages within plus or minus 2 percent.

Turbine meters are generally serviced in place on an annual basis and are replaced when repair parts are no longer available, become unserviceable or become obsolete. The factory calibration is utilized throughout the life of the meter. The larger propeller meters are removed, returned to the meter repair facility and re-calibrated on a four-year cycle. See Table 7 for M&I Water Meter Data.

Westlands' bills monthly for all water delivered in the District, but in special cases M&I accounts are billed on an annual basis. All water meters are read and recorded monthly. The Customer Accounting Department utilizes software developed in-house to track all water delivered in the District. M&I water is billed for either one or two acre-feet in advance, based on the prior year use levels and the advance applied to actual use at the end of the year.

Table 6: Ag Water Meter Data

Meter Size	***Number***	***Accuracy (percentage)***	***Reading Frequency (days)***	***Calibration Frequency (months)***	***Maintenance Frequency (months)***
6.0″	11	+/- 2%	30	60	60
8.0″	174	+/- 2%	30	60	60
10.0″	244	+/- 2%	30	60	60
12.0″	1449	+/- 2%	30	60	60
14.0″	921	+/- 2%	30	60	60
16.0″	25	+/- 2%	30	60	60
18.0″	7	+/- 2%	30	60	60
20.0″	12	+/- 2%	30	60	60
26.0″	3	+/- 2%	30	60	60
30.0″	7	+/- 2%	30	60	60
34.0″	1	+/- 2%	30	60	60
36.0″	1	+/- 2%	30	60	60

Table 7: M&I Water Meter Data

Meter Size	***Number***	***Accuracy (percentage)***	***Reading frequency (days)***	***Calibration Frequency (months)***	***Maintenance Frequency (months)***
1.0″	32	Factory	30	Factory	12
1.5″	40	Factory	30	Factory	12
2.0″	89	Factory	30	Factory	12
3.0″	36	+/- 2%	30	60	60
4.0″	46	+/- 2%	30	60	60
6.0″	5	+/- 2%	30	60	60
8.0″	3	+/- 2%	30	60	60
12.0″	7	+/- 2%	30	60	60
14.0″	1	+/- 2%	30	60	60
24.0″	1	+/- 2%	30	60	60

Description of Meters

Meters that fail or are inaccurate are repaired and recalibrated immediately. To ensure accuracy, meters are placed on a five-year preventive maintenance cycle ensuring that each is overhauled and recalibrated at least quadrennial. O&M Reserve funds are used for preventive maintenance during water-short years when funds are short.

In addition to testing approximately 600 plus meters annually, the District also tests and calibrates an additional 250 meters installed by farmers on well discharges in conjunction with Westlands' Pumped Groundwater Exchange and Groundwater Integration Programs. These conjunctive use Programs maximize the use of the farmers' groundwater wells during drought periods. Operation and maintenance of all wells is the farmers' responsibility.[30] Under the present program, accurate metering allows both the farmers and the District to carefully manage and account for all water delivered. Other programs such as the Irrigation Management Information System (IMIS) are built on the foundation of a solid water-metering program.

The District's conveyance system is all buried pipeline, but the District does operate the Coalinga Canal for the USBR. All laterals have headworks on the California Aqueduct or the Coalinga Canal.

Miles Unlined Canal	***Miles Lined Canal***	***Miles Piped***	***Other***
7.4	0	1,034	0

Westlands does not have large storage reservoirs, tailwater recovery systems, or groundwater recharge facilities. Westlands has 16 small regulating reservoirs designed to act as a controlling mechanism at the upper reach of each pumping plant.

District Operations

In general, District farmers apply for an allocation from the USBR contract that the District administers. District regulations and operating procedures are included in the Appendix B. A water user can take delivery of their allocation as needed, throughout the season, which extends from March thru September. The March water year beginning allows the water user to better manage and utilize their allocation by adjusting their management decisions for the rainy season, rather than having to make the same decisions at the end of December, as was necessary previously.

Westlands operates an arranged rate-demand water ordering system. Farmers must notify the District 24 hours prior to beginning the irrigation. Flows are usually ordered in multiples of 24-hour periods, but can be adjusted for shorter periods with District approval.

Reclamation Law

Because Westlands contracts with the Bureau for water, its farmers are subject to Reclamation law and regulations, a body of statutes and rules governing the distribution and payment of federal Project water. The law also governs the repayment obligations to the United States for construction of the numerous Project facilities throughout the 17 western states.

Federal Reclamation law provides for interest-free repayment of the construction costs of irrigation Project facilities. It also limits the amount of land on which a landowner can receive low-cost water up to 960 acres (960 acres for a married couple). Acreage limitation does not apply to leased land.

Major changes were made to the law by the Reclamation Reform Act of 1982 (RRA). RRA

[30] In 2012/13 the District will began taking over responsibility for maintaining and texting all groundwater well meters.

increased the ownership limitation for individuals in districts with new or amended contracts to 960 acres, and for individuals who so elected. An individual is defined as an immediate family member, i.e. a person, his or her spouse, and/or a dependent. It also imposed new pricing requirements, which, among other things, eliminated the interest-free repayment of Project capital costs for water used on land leased in excess of the 960-acre entitlement.

In Westlands, acreage limitation has resulted in the orderly breakup of large private landholdings. Table 7 shows the number of farms has increased and the average farm size have decreased to 806 acres. Table 8 shows almost 75 percent of the farms are 960 acres or less. This percentage would be greater if equivalency acreage is considered.

Table 8: Irrigable Acreage Trends

Year	***Number of Water Users***	***Total Acreage***[31]	***Average Farm Acreage***[32]
1970	84	176,261	2,098
1975	210	461,498	2,198
1980	243	489,789	2,016
1985	289	503,917	1,744
1990	613	530,441	865
1995	600	542,763	905
2000	628	564,191	898
2005	699	560,547	802
2010	721	567,773	787
2011	704	567,605	806

Table 9: Water User Farm Size

	Number of Farms	
Farm Size (Acres)	***1995***	***2011***
320 or less	150	264
321 to 960	354	270
961 to 1,280	125	89
1,281 to 5,000	61	75
5,000 or more	10	6[33]

Water Costs

Westlands purchases water from the Bureau at a variety of costs depending upon the RRA status of the landowner, farmer, or irrigated land. The following are the District water rates for 2011-12 water-year.

[31] Irrigable acreage eligible to receive Project water, not adjusted for equivalency.
[32] Farms that is eligible to receive Project water.
[33] Number includes three Westlands Water District accounts.

Table 10: 2011-12 Water Rates[34]

	Cost of Service	New Law Full Cost	Old Law Full Cost
AGRICULTURAL WATER RATES			
United States Bureau of Reclamation [1]			
Water Rates	$ 39.68	$ 59.28	$ 74.91
Trinity PUD Assessment	0.05	0.05	0.05
Restoration Fund	9.29	9.29	9.29
San Luis Delta Mendota Water Authority [2]			
Authority O&M	$ 23.48	$ 23.48	$ 23.48
Westlands Water District [3]			
District O&M	$ 15.21	$ 15.21	$ 15.21
Prior Years Restoration Fund	-	-	-
Water Delivered Benefit	1.04	1.04	1.04
Water Exchange Obligation [4]	-	-	-
SWRCB Water Rights Fee	0.47	0.47	0.47
Actual USBR O&M	-	-	-
Actual USBR O&M Credit	-	-	-
SLDMWA True-up	(2.93)	(2.93)	(2.93)
Total Ag Water Rate	$ 86.29	$ 105.89	$ 121.52

MUNICIPAL AND INDUSTRIAL WATER RATES	
Acquired Supply	$ 231.32
Acquired Supply – NASL	**$** 447.69

Notes:

[1] U S Bureau of Reclamation rates are calculated on the basis of approximately 54% CVP water supply.
[2] San Luis Delta Mendota Water Authority rates are calculated on a water use estimate of 80%.
[3] Westlands Water District rates are calculated on the basis of 80% CVP Supply plus Other Water resulting in 1,071,918 AF Total Supply.
[4] Water Exchange Obligation rate is not paid by Pre-Merged or Annexed lands.

34 Westlands Water District, 2011-12 Water Rates & Charges, June 21, 2011.

Table 11: 2011-12 Charges[35]

Land Based Charges		Amount	Unit
Long-Term Water Supply D.S. – Area 1 and Area 2	$	8.4450	AC
District Water Supply D.S. – Area 1	$	9.6288	AC
District Water Supply D.S. – Area 2	$	22.4351	AC
Extraordinary Repairs of Pipe – Area 1 and Area 2	$	0.4361	AC
Operations & Maintenance Costs - All Lands	$	5.0160	AC
Operations & Maintenance Costs - Lands with Allocation	$	5.3058	AC
Operations & Maintenance Costs - Lands with System	$	2.9360	AC
Operations & Maintenance Costs - Lands with both Allocation and System	$	15.3172	AC
Drainage Service Area	$	3.8235	AC
Allocation Charges			
Water Allocation Benefit [1]	$	0.78	AF
Usage Charges			
Overuse of Water Supply	$	170.00	AF
Administrative Fee [2]	$	77.82	Mile
Distribution System Usage - Without Facilities [3]	$	0.8201	AC
Distribution System Usage - With Facilities [4]	$	4.5559	AC
Groundwater Management Program and Temporary Facilities			
Groundwater Management Program Power		Varies by Facility	AF
Temporary Facilities Power Surcharge		Varies by Facility	AF
Temporary Facility Credit [6]	$	(2.31)	AF
Account Monitoring Charges			
Overuse Monitoring	$	11,911.00	EA
Delinquent Payment Monitoring	$	81.00	EA
Advance Payment Monitoring	$	1,451.00	EA
Municipal and Industrial			
M&I Inspections [6]	$	37.34	EA
Acquired Supply Advance [7]	$	231.32	EA

Notes:

[1] Water Allocation Benefit charges are billed annually based on Interim Contract water allocated as of July 1.

[2] Charged per mile of lateral drained for each delivery point.

[3] Collected if water delivered to non-assessable land with User-installed facilities for which the repayment obligation has not been prepaid.

[4] Collected if water delivered to non-assessable lands with District-installed facilities for which the repayment obligation has not been prepaid.

[5] Temporary Facility Credits are billed on a per acre-foot basis for water delivered through temporary facilities.

[6] M&I Backflow Inspection costs are billed annually to each non-agricultural connection.

[7] Advance requirement doubles if prior year annual use is greater than one acre-foot. Based on adopted Acquired Supply rate.

[35] Westlands Water District, 2011-12 Water Rates & Charges, June 21, 2011.

District Revenue Sources

The District's fiscal year begins on March 1 and ends on the last day of February. The budget adopted in February may be changed during the year as necessary. Westlands raises annual operating revenue from water sales that are billed monthly. In a normal year, its water sales revenue is used for all operating expenses. In addition, assessments are collected for non-operating costs such as repayment for the District's distribution and drainage collector systems.

The District's O&M component of the water rate covers all costs associated with supplying and distributing water to customers, in addition to acquisition of capital assets and preventive maintenance programs. Rates may subsequently be adjusted if water supplies change. District O&M is added to the cost of CVP water.

Agricultural deliveries from the farmer's temporary facilities incur a power surcharge based on pumping lift, which is added to the water rates to recover pumping costs beyond that estimated for a permanent distribution system. The power surcharge applies to most lands west of the San Luis Canal and Coalinga Canal. Agricultural water rates for service through temporary facilities that are operated and maintained by the farmers are reduced for avoided Westlands' maintenance costs.

Untreated municipal and industrial (M&I) water is delivered to government facilities including Naval Air Station, Lemoore; area businesses; labor facilities; cotton gins; crop-grading stations; processing plants; and private homes. M&I water is billed for a minimum allocation of two AF, payable in advance. M&I water use accounts for less than 6,500 AF, or less than 1 percent of annual water sales.

Agricultural Water Payments

Westlands' farmers apply for an allocation of agricultural water in December for the forthcoming water year and enter into a contract with the District to accept and pay for it. The Bureau estimates the amount of water available to contractors as early as mid-February with supplies usually finalized by May. The available water supply is allocated to eligible farmers under the District's Regulations for the Allocation of Agricultural Water.

Payment for water and power used is due by the 25th day of the following month. In the event payment is not made for water allocated or used, future deliveries are suspended and the amount owed is added to the annual assessment of the land on which the water was allocated or used.

Landowner Assessments

Since 1984, the District has used the Benefit Assessment Valuation Schedule method of collecting funds to repay the United States for construction of the District's distribution and drainage collector systems.

Under the benefit valuation method, assessments are based on the relative benefits bestowed to the land by the District. For example, lands served by the District's distribution system are assessed at a higher rate than the 12 percent of lands not yet served.

The annual repayment obligation to the United States for costs incurred in building the District's distribution and drainage collector facilities currently stands at just over $3.99 million. Table 8 lists the per-acre assessments for various land classes. From 1984 to 1989, this obligation was collected entirely through direct landowner assessment. To make the assessment process more equitable, in 1990 the District began to collect 50 percent of the repayment obligation through landowner assessments and 50 percent as a component of the water rates. The repayment obligation will be paid off by 2018.

In 1988 after the closure of Kesterson Reservoir and the resulting drainage provisions of the Barcellos Judgment (described in the following section), the District began to levy an assessment of $5 million per year as up-front financing for future drainage projects. The trust fund, with accumulated interest, was intended to grow to $100 million. With the Bureau's failure to meet the Barcellos Judgment's deadline of December 31, 1991, to adopt a drainage plan for Westlands, the District canceled Drainage Trust Fund assessments and sought a court order for the release of the $17.6 million already accumulated.

On several occasions, the Board of Directors has levied one-time assessments for specific purposes such as refunds of landowners' overpayments and initial costs of the Distribution System Completion Project. In 1992 due to the 25 percent water supply, the Board levied a special administrative costs benefit assessment to fund certain parts of the District's operating budget that are of general benefit.

The Sagouspe agreement entered into on April 29, 2002 between Sagouspe, et al. (Area II lands) and the District. This agreement required the District to acquire sufficient lands to make an equal allocation of 2.6 to the Area II lands on the west side of the San Luis Canal. Area II landowners pay the first $2.5 million in annual Debt Service and thereafter the Debt Service is split dollar-for dollar on the remaining assessable acres with Area I and Area II. On March 1, 2008 the annual Debt Service was adjusted to reflect 70% for Area II and 30% for Area I lands on remaining assessable acres. The Debt Service will be paid off by March 1, 2029.

District Financial Resources Summary

The amount of revenue from water sales declined markedly in 1991 under a 25 percent water supply. District O&M charges were held at a level insufficient to offset the lower volume of CVP water to avoid added economic pressure on farmers from the continuing drought. This necessitated substantial cost cutting and drawing of funds from District reserves. Except for special assessments, as noted in the previous paragraph, income from assessments funds the District's long-term repayment obligations to the United States (distribution and drainage collector systems); and it is not used for normal operating expenses.

Believing it to be more equitable, in 1990, the District began to collect 50 percent of the obligation through landowner assessments and 50 percent as a component of the water rates.

Legal Background and Issues

The District is constrained in its water supply and allocation and drainage efforts by a landmark court decision known as the Barcellos Judgment. A lawsuit involving a number of water delivery and drainage issues was filed by District farmers and landowners against Westlands in 1979. In 1981, Westlands in turn sued the United States Government. The suits involved, among other issues, the District's contractual entitlement to Central Valley Project (CVP) water and drainage service, the District's service area, water costs, and allocation regulations. The suits were consolidated in Barcellos and Wolfsen, Inc., et al., vs. Westlands Water District, et al., and Westlands Water District, et al., vs. the United States, et al.

The litigation was resolved through a negotiated settlement between all parties which was subsequently approved by the District Court in the form of a judgment entered by the Court, commonly known as the Barcellos Judgment (December 1986).

Among other legal issues, the Judgment specifically:

- Upheld the validity of the 1963 Contract between Westlands and the Bureau for 900,000 AF of water to be delivered annually at the applicable 1963 Contract rate or the Reclamation Reform Act rate.
- Affirmed Priority Area I's right to timely apply for and purchase 900,000 AF of water annually. Unused Priority Area I water not timely applied for and purchased by Priority Area I is available for use in Priority Area II.
- Stated that the United States shall provide provisional water service of 250,000 AF at the "cost-of-service" rate-pending conclusion of the Contra Costa Water District vs. Hodel, et al. and Westlands Water District Delta Environmental Impact Statement lawsuit.
- Directed the Bureau to pursue a good faith effort to provide an additional 100,000 AF of firm water (supplemental water) on a long-term basis to Priority Area II.
- Established guidelines for the allocation of CVP water within Westlands.
- Established a trust fund for future drainage projects.
- Reaffirmed the District's water service area.

Westlands Board of Directors approved a settlement to the long-standing lawsuit Sagouspe, et al., vs. Westlands Water District, et al. in April 2002. The settlement requires Westlands to purchase drainage-impacted farmlands and redirect the water allocated to those lands to help equalized water allocations to Area I and Area II farmers.

Sumner Peck Ranch, a California corporation, et al., vs. Bureau of Reclamations, et al. lawsuit settlement was reached in December 2002. Under the settlement, Westlands will purchase approximately 33,000 acres of land over a three-year period and permanently remove the land from irrigated agriculture. The water currently allocated to those lands has been distributed to lands within the District to help equalize the amount of water allocated to Area I and Area II farmers.

Westland Water District's long-term Central Valley Project Contract expired on December 31, 2007 and a long-term contract renewal has not been finalized. Westlands will be required to operate under interim contract renewals for the foreseeable future.[36] The first CVP Interim Contract was effective beginning on January 1, 2008 and expired on February 28, 2010. CVP Interim Contract Two became effective on March 1, 2010 and expired on February 29, 2012. The third CVP Interim Contract became effective on March 1, 2012 and will expire on February 28, 2014.

Water Shortage Contingency Plan

Westlands delivers small quantities of untreated, non-potable CVP water which is ultimately used for municipal and industrial (M&I) purposes by Lemoore Naval Air Station and by various rural commercial and residential customers located within the District boundaries. Westlands also conveys raw water to the Cities of Huron and Coalinga, which have separate water supply contracts with the USBR. No water is treated prior to delivery. Westlands has no treatment facilities to provide potable water supplies to these incidental non-agricultural customers.

Westlands suffers under a water short situation even when 100% of the contract amount is available. Allocation and shortage procedures for agricultural water are presented in the Ag Water Management Plan for details on this topic. Even though M&I water supplies have been allocated under the agricultural contract and are currently last to be curtailed in a severe water shortage situation, discussions have occurred recently that propose the possibility of an M&I shortage provision.

The highest level of annual non-agricultural water deliveries has been approximately 6,500 AF. Given the reductions in Westlands' CVP water supplies due to federal regulatory restrictions, it is likely that future non-agricultural water deliveries will be reduced even with modest population increases in the area. This is because reduced agricultural water supplies from the federal government will lead to a reduction in processing-related uses and in the farm labor population living in Westlands.

Estimates of water demand for the next 12, 24, and 36 months should be similar to the non-agricultural water use in an average water year, about 5,000 AF. The "worst case" water supply estimates for the next 12, 24, and 36 months are zero. Currently all non-agricultural water is part of the CVP contract supply. Since the extent of the additional regulatory restrictions is unknown at this time, this possibility cannot be ruled out. However, it has been the policy of the USBR to deliver a minimum of 75 percent of historical M&I use, even when agricultural allocations are considerably less than that. Other supplies from internal groundwater transfers are possible but because of uncertainty that groundwater can meet Title 22 standards and the lack of proximity to District distribution facilities, these supplies cannot

[36] Environmental documentation necessary for execution of any long-term contract may be delayed in the foreseeable future.

be guaranteed.

The CVP allocation to Westlands is shared between agricultural, incidental agricultural and incidental non-agricultural water users. The District's Regulations for the "Allocation of Agricultural Water Within the Westlands Water District" (Appendix A) state "The District's General Manager is authorized to set aside from the total entitlement whether they be from the District's basic contract supply or some other general source of water, for each area of the District the amount of water needed for M&I purposes…." Historically, when the overall water supply has been reduced, the non-agricultural water allocation may not be reduced a similar percentage. In certain cases of severe reduction, it is likely that the District would receive CVP hardship water for health and safety purposes based on the statement of need.

Westlands believes that although there have been no mandatory reductions imposed on the District's non-agricultural customers, water conservation has occurred during periods of reduced supply. This is apparent when comparing non-agricultural water use in full and reduced water supply years (in 2008 and 2011 water use was less than above average in each year). In the unlikely event, that the CVP allocates no water to Delta export water-service contractors and the allocation for M&I use is less than 75 percent of historical use, the District will purchase water from other sources including an Emergency Drought Water Bank. Mandatory rationing will be imposed to the extent that sufficient water cannot be purchased.

The District's General Manager is authorized by the Board of Directors to prohibit the wasteful use of water in Westlands. Westlands' Allocation Regulations state, "The unauthorized using, taking, or wasting of water may subject the water user to civil or criminal prosecution. The General Manager is authorized, after oral or written notice to the water user, if in his judgment, it is advisable and in the best interest of the District, to lock the delivery facilities of, or discontinue water service to, any water user." Additionally, the Westlands' board may adopt a resolution on the use of non-agricultural water.

Each non-agricultural customer is metered according to AWWA standards, according to customer type. The price of non-agricultural water is set at the beginning of each year, based on the anticipated supply, but changes can occur later. District revenues from the sale of incidental non-agricultural water vary annually between one and two percent of the District's overall revenues and have little influence on the District's overall financial resources.

Plan of Action

The General Manager has the authority to discontinue water service if, in his judgment, water is being wasted. Additionally, the Board adopted a resolution prohibiting the waste of M&I water. The District is encouraging other water suppliers (Cities of Huron and Coalinga, and Lemoore Naval Air Station) which receive water through Westlands' distribution system to develop water conservation plans and water shortage contingency plans. Westlands will continue to read all meters in the District on a monthly basis.

Section 2

Water Resources Inventory

Water Supply

Unlike water agencies with more abundant supplies, Westlands must allocate (ration) water to its farmers, even in the wettest years. Its annual Contract entitlement from the Bureau's Central Valley Project (CVP) is 1,150,000 AF. The annual safe yield of the confined underground aquifer adds about another 200,000 AF. The total water available is about 13 percent (150,000 AF) short of the 1.3 million AF required to water the entire irrigable area in the District.

The surface water supply is allocated to more than 534,000 acres eligible to receive Project water. (An additional 34,000 acres farmed in the District ineligible to receive Project water must rely solely on pumped groundwater.)

The original Westlands entered into a 40-year water supply Contract with the Bureau in 1963, providing for the delivery of 900,000 AF annually. In 1965, the Bureau committed an additional 250,000 AF annually to the District, although the Bureau and Westlands recognized that amount was insufficient for the additional irrigable acreage.

The Merger Agreement between the original Westlands and Westplains Water Storage District was codified by California Water Law in 1965. It specifies that the original Westlands area have a priority right to the 1963 Contract water. The 900,000 AF delivered under the 1963 Contract, therefore, is allocated first to about 337,000 eligible acres in Priority Area I (the original Westlands area), providing about 2.6 AF/Ac.

The 250,000 AF allocation for Priority Area II (former Westplains area) provides only about 1.3 AF for each of the 187,000 acres eligible to receive Project water. An additional 18,000 eligible acres annexed to the District after the merger (Priority Area III) does not receive any allocation until and unless Priority Areas I and II have been allocated about 2.6 AF/Ac.

The 1963 Contract allowed Westlands to purchase additional (interim) water from the Bureau when it is available, which was usually allocated to Priority Area II. Between 1975 and 1988, the District purchased a total of more than 1 million acre-feet of additional water to boost average annual deliveries from 1.15 to 1.23 million AF. Since 1988, interim water has not been available. In addition to the Project water supply, since 1989 the District has been actively engaged in water marketing and conjunctive use with other agencies and purchases from the State Water Bank. While providing neither firm, abundant, nor economical water, these sources have provided insurance against well failures and higher than anticipated crop water needs.

The District's 1963 Water Contract ended on December 31, 2007 and Interim Water Contract One began the next day. Under the terms of the Interim Contracts Area's I & II will be treated the same but Area III will be treated the same as in 1963 Contract. The Interim Water Contracts duration is for two years and will be renewed until the signing of a new Long-term Water Contract.

DD1 was formed in 2000 for executing CVP Contract Assignments from Mercy Springs Water District (partial – 6,260 AF), Centinella Water District (2,500 AF), Widren Water District (2,990 AF), and Broadview Water District (27,000 AF) comprised Priority Area II and Priority Area III lands. However, under the District's rules for allocating water, that portion of DD1 comprised of Priority Area III lands do not receive an allocation of water from these assignments. DD2 formed in 2002 for purpose of executing an additional partial assignment (4,198 AF) of Mercy Springs Water District CVP Contract. The District's water supply totals include DD1 and DD2. When the WWD CVP contract is renewed the Distribution Districts Contract Assignments will be incorporated with the District contract. Table 12 lists surface water and groundwater usage by month for 2011.

Table 12: WWD Water Supplies by Month (2011)

Month	*Surface Water*	*Groundwater*[37]
January	29,863	3,980
February	75,995	3,735
March	65,567	2,323
April	78,004	3,970
May	121,973	5,570
June	162,627	6,720
July	186,931	5,993
August	145,083	5,845
September	70,014	2,513
October	37,090	1,803
November	28,859	535
December	39,560	1,788
Total	1,041,566	44,773

Groundwater Supply

Farming in the Westlands area originally used groundwater for irrigation. The District's first deep groundwater well was drilled in 1909 by G. T. Willis in Section 4, T.19S., R.18E., which is just west of present-day Lemoore Naval Air Station. Standing water was at about 50 feet, but Mr. Willis went down 700-800 feet to get more water.

The groundwater basin underlying Westlands is comprised generally of two water-bearing zones: (1) an upper zone above a nearly impervious Corcoran Clay layer containing the Coastal and Sierran aquifers and (2) a lower zone below the Corcoran Clay containing the Sub-Corcoran aquifer. The location of these water-bearing zones is depicted on a generalized cross section of the District shown on Figure 3. These water-bearing zones are recharged by subsurface inflow from the east and northeast, the compaction of water-bearing sediments, percolation of pumped groundwater, and percolation from imported and natural surface water. Land subsidence due to groundwater overdraft ranged from one to 24 feet between 1926 and 1972 (U.S. Geological Survey (USGS), 1988).

[37] Groundwater usage is estimated based on water pumped under the District's Groundwater Management Program (GWMP) and the number of operational groundwater wells not in the GWMP (number varies but for 2011 estimated at 40%).

Surface water deliveries from the San Luis Unit (SLU) began in 1968 and largely replaced groundwater for irrigation. However, extensive pumping occurred in 1977, a drought year when deliveries of CVP water amounted to only 25 percent of the District's entitlement. In response to the surface water shortfall, farmers reactivated old wells and constructed new wells, pumping groundwater to irrigate their crops. During 1977, groundwater pumping rose to nearly 500,000 AF and the piezometric surface declined about 90 feet, resulting in localized subsidence of about 4 inches according to USGS officials.

Groundwater pumping increased to about 300,000 AF in 1989-90 because of decreased CVP water supplies caused by the drought. Pumping during 1990-91 and 1991-92 estimated to be about 600,000 AF annually. This increase in pumping has resulted in a piezometric water surface decline of about 91 feet from 1988 through 1991, but had recovered by 1997.

Westlands does not supply groundwater to District farmers nor does the District regulate or control groundwater pumping; individuals pump their own groundwater. The District however, does survey the static water levels in the wells and the water quality and quantity of the pumped groundwater, as part of the Groundwater Management Plan completed under provisions of AB 3030 in 1996, see Appendix E. More recent District analyses of these data indicate that a better-estimated safe yield may be between 135,000 and 200,000 AF. In the 2012/13 water year, the District will begin reading all operational groundwater wells meters quarterly and will slowly began incorporating these groundwater meters into the District annual maintenance/testing schedule. The irrigable area, amount of Project water and groundwater used each crop year are shown in Table 13.

Table 13: District Water Supply (Crop Year)

Crop Year[38]	*Irrigable Area Ac*	*Project Water AF*	*Transfer AF*	*Ground Water*[39] *AF*	*Total AF*
1978	566,475	665,895	0	159,000	824,895
1979	565,917	1,084,386	0	140,000	1,224,386
1980	564,719	1,138,994	0	106,000	1,244,994
1981	563,301	1,244,446	0	99,000	1,343,446
1982	564,039	1,236,639	0	105,000	1,341,639
1983	567,184	1,090,888	0	31,000	1,121,888
1984	568,197	1,473,883	0	73,000	1,546,883
1985	568,554	1,315,548	0	228,000	1,543,548
1986	568,986	1,194,113	0	145,000	1,339,113
1987	566,844	1,309,252	0	159,000	1,468,252
1988	568,083	1,258,384	11,829	160,000	1,430,213
1989	567,817	1,136,714	21,194	175,000	1,332,908
1990	568,389	808,978	111,703	300,000	1,220,681
1991	568,470	282,957	93,776	600,000	976,733
1992	570,552	262,044	113,491	600,000	975,535
1993	567,390	444,237	221,664	225,000	890,901
1994	563,563	662,672	196,820	325,000	1,184,492
1995	563,781	729,238	189,405	150,000	1,068,643
1996	563,881	1,136,625	267,340	50,000	1,453,965
1997	563,900	1,005,434	326,939	30,000	1,462,373
1998	564,053	798,604	211,724	15,000	1,025,328
1999	564,271	1,076,148	171,035	23,000	1,270,183
2000	564,191	539,460	405,870	192,000	1,137,330
2001	564,274	691,127	171,465	234,000	1,096,592
2002	564,154	725,703	131,029	299,000	1,155,732
2003	563,633	844,950	142,625	221,000	1,208,575
2004	560,670	904,464	163,660	265,000	1,333,124
2005	560,547	788,926	179,390	118,000	1,086,316
2006	559,744	1,049,423	73,163	13,000	1,135,586
2007	556,547	891,224	130,273	243,000	1,264,497
2008	568,627	358,456	192,279	460,000	1,010,735
2009	568,652	225,763	117,519	480,000	823,282
2010	567,713	402,832	195,722	189,000	787,554
2011	568,803	795,601	144,513	69,000	1,009,114
Average	565,468	869,824	166,018	196,000	1,186,395

Other Water Supplies

On a year-by-year basis flood flows from the San Joaquin and Kings Rivers are available to Westlands. These water supplies flow into the Mendota Pool on a seasonal basis and are available to the District through the 7-1 Pumping Plant. Water was taken from this source in the Water Year 2011/12. The upper limit, due to pumping plant limitations, for water delivered from this source would be

[38] Crop year begins on October 1 and ends September 30 the following year.
[39] In the 1988 crop year the District began to estimate the amount of groundwater pumped, previously USGS provide the estimate.

approximately 20,000 AF.

Restrictions on the District's Water Sources

Westlands' long term outlook for project water deliveries shows an expectation of about 40-45 percent of contract delivery, while the most recent years have seen near full contract deliveries due to abundant precipitation conditions experienced in California.

Restriction	Restriction	Effect on District Operations
District is not receiving its full-contract supply because of implementation of the CVPIA.	Department of Interior, U.S. Bureau of Reclamation.	The CVPIA reallocated 800,000 of the CVP yield away from traditional uses for environmental purposes. It is not clear yet whether this amount of water can be "double-counted" and serve both restoration purposes as well as those required under the ESA, as it should. It also is not clear whether this water can be used more than once, i.e., used for temperature control upstream, but still be available for pumping to users south of the Delta, again, as it should.
District is not receiving its full contract supply because of implementation of the ESA.	Department of Interior, Fish and Wildlife Service; Department of Commerce, National Marine Fisheries Service.	Because of the listing of the winter-run Chinook salmon and the Delta smelt, as well as the potential listing of several other native species, Project operations have been drastically altered to meet requirements of the ESA. Consequently, to date, both Services have chosen to sharply restrict pumping at both the state and federal pumps in the southern Delta as their only course of implementation. This has resulted not only in a reduction of water supplies, but also has created an unfair and inequitable burden on those users south of the Delta.
District may not receive its full contract supply because of proposed water quality and salinity standards in the Delta.	U.S. Environmental Protection Agency (EPA).	With the EPA announcing proposed standards, it is unclear exactly what the impact will be. However, it is clear that there will be an impact, both in terms of water supply reductions and water costs. It will be some months before the precise effects can be quantified.
Court ordered reductions in pumping because of the operations of the CVP and SWP might cause the extinction of the Delta Smelt.	U.S. District Court for the Eastern District of. California	The reduction in pumping ordered by the Court will result in addition water supply shortages. As a result, it will be necessary to fallow more land, with associated impacts on farm workers, Westside communities, and other public agencies.

Source Water Quality Monitoring Practices

The District does not deliver any potable or treated water. Water is delivered directly from the California Aqueduct or the Mendota Pool on the San Joaquin River. Any requirements for drinking water uses of the water are the water user's responsibility; the water quality monitoring is accomplished by the individual water user. In general, biological monitoring and treatment are a necessity for any public water supplier. Several sources for raw water quality are available to District water users:

1. The Distribution Integration Program allows a water user to pump groundwater into the district distribution system that meets drinking water standards. Verification sampling is conducted when this program is in operation.
2. The District receives monthly Water Quality Reports from Checks 13, 18, and 21 on water delivered from the California Aqueduct. These reports document electrical conductivity (EC), Temperature and Turbidity on an hourly basis.
3. The annual groundwater-monitoring program conducted under the Groundwater Management Plan analyzes water from running wells in December for EC. The results are consolidated into a District groundwater quality map for the Groundwater Management Plan.

Crop Production

Westlands' farmers work some of the most fertile and productive land in the world, producing vital food and fiber products and economic wealth from renewable natural resources. More than 60 different crops are grown commercially in the District with the potential for scores of others. In addition, unlike many other key growing areas of California, urbanization is not a direct threat to productivity.

Westlands' farmers have combined generations of family tradition with state-of-the art advances in modern agricultural practices. They provide California and the United States an irreplaceable asset producing the three-way benefit of (1) superior crop yields, (2) high crop value, and (3) low water use.

The 2011 Crop Acreage Report, Table 14, lists the acreage devoted to each crop, the average yield, and the crop value produced. Crop Acreage Trends from 1978-2011 are shown in Tables 15-19. Prior to the delivery of Project water, Westlands' farmers primarily grew cotton and grain crops, such as wheat and barley, and some vegetables. However, between 1980 and 1996, the acreage devoted to vegetables increased to more than 220,000 acres, while grains declined by some 100,000 acres. Figure 6 shows the acreage of grains, safflower, and vegetable crops grown in the District during this period. Crops classified as grain and vegetable are indicated in Crop Production Reports. Part of the increase in vegetable production is attributed to the fact that traditional "salad bowl" growing areas, such as the Salinas-Monterey area and the Central Coastal counties of California, are becoming urbanized and water scarce. In addition, some coastal areas are faced with groundwater pumping limitations brought about by seawater intrusion.

As the District's farmers devote more resources to raising vegetable crops, (some of which are double-cropped) and to growing more than 131,000 acres of trees and vines, they are recognizing the need to produce growing high-quality marketable products that meet the consumer's increasingly high standards. Therefore, in addition to meeting crop water requirements for normal growth, significant amounts of water are used on plants for cultural practices such as weed control, climate control, holding tomatoes for harvest, and ensuring a tight head of lettuce or swelled garlic bulbs. Because of the continuing changes in water management due to cultural practices, Westlands' farmers now require more water on acreage where low water use crops, such as wheat and barley, were previously grown.

Table 14: 2011 Crop Acreage Report

Crop	***Acres***	***Crop***	***Acres***[40]
Alfalfa-Hay	6,933	Oats	1,206
Alfalfa-Seed	2,548	Onions-Dehy.	7,699
Almonds	70,805	Onions-Fresh	7,189
Apples	111	Oranges	1,396
Apricots	707	Parsley	432
Artichokes	5	Pasture	442
Asparagus	511	Peaches	1,119
Barley	3,858	Peas-Green	234
Beans-Dry	2	Peppers-Misc.	1,228
Beans-Garbanzo	4,471	Pistachios	20,255
Beans-Jojoba	11	Plums	549
Blueberries	222	Pomegranates	3,489
Broccoli	3,117	Pumpkins	26
Cabbage	101	Safflower	1,981
Cantaloupes	13,864	Seed Crop Misc.	898
Carrots Bulk	378	Grains-Sorghum	405
Cherries	652	Spinach	140
Corn-Field	647	Squash	64
Corn-Sweet	7,971	Stevia	56
Cotton-Lint-Acala	13,416	Sugar Beets	2
Cotton-Lint-Pima	85,097	Tangerines	1,377
Cucumbers	57	Tomatoes-Fresh	5,114
Garlic	14,039	Tomatoes-Proc.	71,976
Grains-Hay	37,424	Walnuts	447
Grapefruit	20	Watermelons	2,366
Grapes-Raisin	678	Wheat	70,266
Grapes-Table	744	NB Trees & Vines[41]	17,451
Grapes-Wine	11,994	Fallow	53,068
Honeydews	2,440	Non-harvested[42]	6,446
Lemons	406		
Lettuce-Fall	9,017	**Subtotal**	577,433
Lettuce-Spring	7,480	**Double Crop**	9,656
Nectarines	386	**Total**[43]	568,173

[40] USDA-CFSA net cropped acreages.
[41] Non-bearing (NB) trees and vines.
[42] Includes experimental and nursery crops.
[43] Total net cropped acreage in Westlands, excluding feedlots, commercial, residential and industrial areas.

Table 15: 1978-1985 Crop Acreage Trends

Crop	1978	1979	1980	1981	1982	1983	1984	1985
Alfalfa-Hay	13,771	13,450	10,182	11,438	6,256	10,887	11,136	10,768
Alfalfa-Seed	17,337	14,162	18,925	15,103	17,552	10,832	15,235	14,486
Almond	6,531	6,991	7,738	8,038	8,116	7,586	7,940	7,959
Apple	63	15	15	18	18	18	17	18
Apricot								122
Asparagus	54					483	412	382
Barley	126,862	78,840	76,547	54,206	45,818	21,004	22,674	24,901
Beans-Dry	1,873	1,090	2,149	2,755	4,033	101	3,872	7,545
Beans-Green	2,370	4,739	3,735	4,730	2,368	7,869		477
Broccoli	38	261	25			259	1,307	2,308
Cantaloupe	19,929	19,467	18,037	16,641	17,237	21,523	21,008	20,190
Carrot			585	120		706	946	1,176
Cauliflower	193	436	100	477			338	155
Corn-Field		598	1,896	152	1,175	980	7,803	7,153
Corn-Silage		595	400	5,133	5,665	171		
Corn-Sweet								871
Cotton-Acala	272,061	300,563	284,688	300,309	277,064	230,307	297,174	286,169
Cucumber				155	106		26	
Garlic	1,856	2,670	3,427	4,602	7,510	9,118	8,132	8,670
Grain-Sorghum/Milo	5,813	555	635	442	2,680	276	1,060	
Grape-Raisin			100	80	77	155		
Grape-Wine	4,566	4,924	4,782	5,603	6,247	5,262	6,767	6,633
Honeydew	100	150				399	348	225
Lettuce-Spring	7,358	8,876	6,123	3,529	3,100	5,870	6,420	8,813
Lettuce-Fall			1,367	3,801	3,391	5,640	1,551	5,879
Nectarine								72
Oats	677				174			255
Olive	423	423	412	423	423	423	423	423
Onion	2,433	4,320	3,803	6,393	8,772	9,070	8,921	9,954
Orange	157	157	157	157	157	157	182	163
Pasture	1,697	227	210	254	501	382	344	261
Peaches								54
Peas-Green	1,157	1,372	1,259	299	617	1,535	2,320	231
Pepper-Misc	532	877	972	1,321	1,110	1,498	1,039	1,392
Pistachio	565	584	572	886	2,243	1,968	2,102	2,252
Pomegranate	669	724	722	580	547	473	504	521
Rice	1,080	638	1,649	1,676	435	291	388	37
Safflower	9,393	14,550	9,982	7,219	10,507	9,573	8,161	3,846
Seed Crop-Misc	631	1,098	412	467	665	106	2,584	434
Sugar Beet	6,746	6,746	9,901	11,194	11,455	7,046	5,203	5,699
Tomatoes	30,224	37,504	27,857	29,656	45,000	56,949	59,817	54,211
Walnut	38	21	82	133	124	137	33	150
Watermelons								63
Wheat	1,591	16,051	55,637	60,507	52,528	49,045	50,314	49,989
N/B Trees/Vines		533	275	128	617	1,286	15	558
Fallow-Idle Land	36,335	25,743	16,527	18,203	26,128	93,773	16,340	30,579
Non-Harvested		609	347	707	3,278	1,464	773	3,245
Miscellaneous	129	405		167	242	931	871	352
Subtotal	**575,496**	**574,119**	**573,525**	**576,497**	**578,889**	**578,721**	**574,729**	**582,401**
Double Crop	(9,021)	(8,202)	(8,806)	(13,196)	(14,850)	(11,537)	(6,532)	(13,847)
Total	**566,475**	**565,917**	**564,719**	**563,301**	**564,039**	**567,184**	**568,197**	**568,554**

Table 16: 1986-1993 Crop Acreage Trends

Crop	1986	1987	1988	1989	1990	1991	1992	1993
Alfalfa-Hay	10,134	8,738	10,042	8,738	10,042	7,812	5,350	3,958
Alfalfa-Seed	19,130	17,839	14,321	13,453	13,049	8,942	6,297	3,896
Almond	8,301	7,972	7,363	8,381	7,159	8,016	11,817	11,843
Apple	14	70		411	360	554	1,095	1,348
Apricot	122	135	151	172	236	236	301	326
Asparagus	382	443	477	642	547	744		
Barley	22,996	12,866	10,678	15,953	8,587	3,094	10,297	8,226
Beans-Dry	6,074	3,740	8,691	10,052	4,382	2,958	6,836	3,112
Beans-Garbanzo								5,785
Beans-Green		2,282		2,070	3,004	408	231	1,810
Beans-Jojoba		10	10	11	11	11	11	11
Broccoli	4,130	6,413	5,137	2,175	1,003	2,180	2,733	3,209
Cantaloupe	25,345	23,152	18,603	21,310	20,402	17,489	15,997	19,775
Carrot	1,990	2,412	2,749	1,930	1,262	760	638	1,078
Cauliflower	229	435	1,136	170		473	71	150
Cherries								20
Corn-Field	6,926	791	94		665			
Corn-Silage			70					
Corn-Sweet	2,757	3,471	1,900	1,977	973	899	1,082	1,793
Cotton-Acala	231,142	266,483	290,062	241,995	235,290	177,102	195,658	213,057
Cotton-Pima					5,786	30,840	29,237	27,806
Cucumber		20			234		80	80
Eggplant								10
Eucalyptus				53	280	57	2	54
Garlic	9,011	11,583	11,345	12,338	14,500	14,466	14,647	16,239
Grain-Sorghum/Milo	323							
Grape-Raisin		40		61	131		109	255
Grape-Table	155	70	248	314	253	337	309	345
Grape-Wine	6,208	6,306	5,548	5,446	5,483	5,208	5,072	5,587
Honeydew	624	1,881	1,198	1,582	1,825	1,840	1,323	1,758
Lettuce-Spring	7,308	8,107	10,037	9,497	8,602	3,725	8,747	8,610
Lettuce-Fall	6,118	6,496	6,075	5,734	4,209	5,588	9,021	6,130
Nectarine	242	171	193	193	248	197	174	342
Oats	942		446	1,853				
Olive	422	413	413	413	583	471	549	421
Onion	11,357	12,230	12,704	12,839	11,442	8,835		
Onion-Dehy							6,749	8,453
Onion-Fresh							1,510	1,868
Orange	168	167	167	190	207	158	168	213
Pasture	355	540	631	1,697	474	711	485	927
Peaches	20		20	126	190	283	428	292
Peas-Green	301			2,009	1,109	1,039	55	
Pepper-Misc	2,320	2,202	2,253	547	993	917	1,640	1,433
Pistachio	2,534	3,215	2,403	3,365	3,120	4,715	3,892	4,153
Pomegranate	499	542	594	700	797	707	750	830
Plums								130
Prune							169	149
Rice	153	84						
Safflower	13,447	4,127	4,776	8,531	13,541	4,424	19,055	15,356
Seed Crop-Misc	543	745	1,196	1,448	1,234	1,395	670	554
Sugar Beet	11,880	9,730	8,337	7,806	7,393	3,182	5,045	6,445
Tomatoes	60,816	60,095	65,040	80,903	95,159	100,707		
Tomatoes-Fresh							2,959	3,335
Tomatoes-Proc.							75,811	74,964
Walnut	248	252	250	252	264	309		
Watermelons	390	109	25	65	120	278	310	304
Wheat	36,118	26,595	24,641	23,399	26,407	8,399	12,628	14,428
N/B Trees/Vines	821	236	2,497	1,647	6,361	5,423	1,593	2,773
Fallow-Idle Land	67,829	66,236	45,632	64,579	52,544	125,082	112,718	90,413
Non-Harvested	821	449	1,578	743	4,530	6,673	3,638	1,449
Miscellaneous	931	1,328	1,663	1,459	1,118	3,947		
Subtotal	**582,039**	**580,678**	**580,659**	**579,738**	**575,458**	**570,442**	**580,666**	**576,529**
Double Crop	(13,053)	(13,834)	(12,576)	(11,921)	(7,069)	(1,972)	(10,114)	(9,139)
Total	**568,986**	**566,844**	**568,083**	**567,817**	**568,389**	**568,470**	**570,552**	**567,390**

Table 17: 1994-2001 Crop Acreage Trends

Crop	1994	1995	1996	1997	1998	1999	2000	2001
Alfalfa-Hay	4,775	3,815	3,525	4,626	10,550	15,250	13,304	9,701
Alfalfa-Seed	4,600	6,825	6,531	6,326	12,393	14,110	8,915	2,214
Almond	12,202	13,877	14,561	22,039	24,401	28,103	29,178	31,683
Apples	972	1,118	1,445	1,628	1,568	1,102	1,127	707
Apricots	308	490	341	638	638	644	604	598
Artichoke						15	32	26
Asparagus	709	735	803	880	1,246	822	866	655
Barley	6,632	5,423	3,843	3,775	7,076	5,609	6,851	15,100
Beans-Dry	2,148	2,633	2,786	5,003	4,585	4,590	1,106	589
Beans-Garbanzo	9.091	10,539	15,245	6,588	3,524	7,277	8,082	8,320
Beans-Green		820	294	436	2,019	2,924	1,247	629
Beans-Jojoba	11	11	11	11	11	11	11	11
Broccoli	2,761	3,337	3.332	5,528	4,618	7,256	2,412	3,394
Cabbage	203	26	141	164	138	428	27	165
Cantaloupe	20,873	18,998	18,452	19,078	18,405	17,924	18,193	14,025
Carrot	332	606		256	371	1,168	328	283
Cauliflower				15	101	30	29	43
Cherries	20	40	40	101	80	82	123	143
Corn-Field		114	1,138	1,895	1,509	584	694	395
Corn Nuts							179	145
Corn-Sweet	1,875	1,461	2.018	3,786	4,595	5,289	4,240	3,621
Cotton-Acala	214,314	226,601	214,579	203,375	138,118	127,340	180,141	98,354
Cotton-Pima	25,315	42,105	57,782	59,889	74,729	75,860	28,024	90,215
Cucumber		127	104	162	40	78	214	204
Eucalyptus	46	21	24	46	76	42	59	53
Garlic	18,419	21,469	22,665	20,724	23,567	22,820	14,064	15,146
Grain-Sorghum/Milo			684	75	434	279	1,259	19,293
Grape-Juice			491					
Grape-Raisin	155		77		155			
Grape-Table	544	700	661	690	795	730	1,014	1,005
Grape-Wine	4,847	5,479	5,095	7,030	7,857	8,559	8,776	9,111
Honeydews	2,099	2,706	2,483	3,107	2,025	2,284	1,732	2,513
Lettuce-Spring	9,751	9,079	10,708	10,387	11,040	14,323	13,691	13,911
Lettuce-Fall	7,967	9,369	6,438	8,892	12,469	11,830	20,453	9,225
Melons-Mixed	492	1,340	976	845	806	746	642	658
Nectarine	149	148	108	118	30	30	32	30
Oats	153	505	96	655	1,313	493	284	371
Olive	312	487	504	312	312	312	312	312
Onion-Dehy	10,124	8,516	8,706	10,184	12,052	11,792	10,471	8,647
Onion-Fresh	2,458	2,183	1,883	2,094	2,285	12,956	2,410	3,232
Orange	156	156	156	216	216	325	216	216
Parsley			70	25		421	421	412
Pasture	298	604	2,009	748	2,425	1,396	1,554	1,739
Peaches	367	334	374	315	263	223	226	223
Peas-Green		1,237		120				
Pecan				14	72			
Pepper-Misc	1,169	1,597	2,229	1,168	1,310	2,193	1,747	1,790
Pistachio	3,861	4,399	5,747	7,202	7,170	5,040	5,238	9,333
Pomegranate	722	865	904	1,018	1,025	841	1,178	1,234
Potatoes-Sweet							29	
Plums	110							
Prune	75	149	164	149	149	149	149	229
Rice	110							
Pumpkins			20				62	
Radicchio			28	586	54		4	22
Safflower	7,306	8,982	4,925	3,325	3,698	2,567	2,209	4,409
Seed Crop-Misc	381	692	917	728	1,409	1,776	1,610	2,597
Spinach			6	19	51	53		75
Squash	32		3		81			
Sugar Beet	9,539	5,485	4,708	6,624	9,427	7,432	8,543	5,007
Tangerines		50	50	50	50	50	50	50
Tomatoes-Fresh	4,220	4,375	4,484	4,508	3,766	3,660	3,235	3,209
Tomatoes-Proc.	85,768	83,693	88,095	80,671	85,881	95,578	95,085	81,913
Walnut	340	260	506	443	466	435	459	356
Watermelons	349	350	758	1,064	1,279	1,528	1,399	1,454
Wheat	12,207	13,334	20,316	24,805	39,536	23,884	28,436	35,150
N/B Trees/Vines	3,201	2,576	3,327	3,210	4,041	4,420	6,577	4,359
Fallow-Idle Land	75,732	43,528	26,754	35,554	33,481	37,206	47,595	73,807
Non-Harvested	2,170	678	566	584	747	695	850	565
Subtotal	**572,723**	**575,160**	**576,458**	**581,672**	**578,790**	**583,053**	**577,446**	**577,590**
Double Crop	(9,160)	(11,379)	(12,577)	(17,772)	(14,737)	(18,782)	(13,255)	(12,783)
Total	**563,563**	**563,781**	**563,881**	**563,900**	**564,053**	**564,271**	**564,191**	**564,807**

Table 18: 2002-2009 Crop Acreage Trends

Crop	2002	2003	2004	2005	2006	2007	2008	2009
Alfalfa-Hay	13,150	12,307	10,684	9,205	13,304	11,473	13,144	12,428
Alfalfa-Seed	1,460	336	1,116	2,493	1,887	2,066	1,580	3,255
Almonds	33,134	37.554	40,102	48,325	55,180	66,210	70,252	67,863
Apples	467	387	291	185	332	285	297	263
Apricots	525	535	473	524	487	448	493	555
Artichoke	27				7	52		
Asparagus	671	620	462	587	726	761	752	546
Barley	7,634	7,199	5,587	12,033	5,647	5,102	10,581	3,697
Beans-Dry	1,093	949	822	565	512	380	669	2
Beans-Garbanzo	4,065	1,140	1,843	4,116	6,352	1,374	1,939	9,054
Beans-Green	386	250	1,447	717	158	235	2	
Beans-Jojoba	11	11	11	11	11	11		11
Blueberries				4	82	350	529	202
Broccoli	4,849	5,048	7,258	7,210	6,106	1,715	1,266	1,688
Cabbage	39				26	5		
Cantaloupe	14,260	16,713	17,712	19,482	15,580	16,568	16,460	12,379
Carrot	40	300	367	777	320	632	583	280
Cauliflower	15		79			1	142	
Cherries	212	252	237	388	432	325	295	521
Corn-Field	1,066	442	431	1,016	2,427	4,003	2,737	1,345
Corn Nuts	160							
Corn-Sweet	5,254	5,931	5,897	5,425	5,778	6,255	5,619	5,537
Cotton-Acala	101,310	121,853	102,242	74,718	44,167	25,311	6,103	1,637
Cotton-Pima	60,727	37,621	68,875	71,009	86,106	74,858	31,293	15,873
Cucumber	472	473	431	388	305	326	80	
Eucalyptus	51	51	24	97	24			
Garlic	17,039	18,465	16,166	9,463	10,486	12,584	10,285	8,857
Grain-Hay								1,149
Grains-Sorghum/Milo	960	99	1,499	4,272	19,293		11,540	1,846
Grapefruit	38	38	38	38	68	30	108	20
Grapes-Juice		180						
Grape-Raisin	145	185	801	916	461	225	839	443
Grape-Table	899	1,235	732	512	825	1,215	368	1,539
Grape-Wine	8,281	6,789	6,725	9,425	11,418	11,942	12,629	11,933
Honeydew	3,002	2,949	2,268	3,861	3,270	2,647	2,376	3,088
Lemons								97
Lettuce-Fall	10,473	10,367	9,513	12,717	11,221	6,244	11,183	11,933
Lettuce-Spring	15,059	13,482	14,563	14,599	15,818	15,665	4,946	7,936
Melons-Mixed	460	573	1,072	539	983	383		
Mustard	198	179	307	101		115	76	
Nectarines	190	90	224	358	425	382	382	319
Oats	3,400	1,665	23	3,431	4,182	629	1,306	588
Olive	312							
Onion-Dehy.	10,301	9,148	9,405	11,076	13,597	10,023	7,357	6,283
Onion-Fresh	2,869	3,824	3,753	4,638	4,671	5,139	4,126	4,941
Oranges	248	216	216	791	1,126	1,547	1,641	1,615
Parsley	317	710	456	158	918	1,061	568	609
Pasture	1,560	1681	559	2,357	1,027	1,187	1,109	287
Peaches	971	1,133	1,574	1,108	1,181	1,153	1,181	1,231
Peas-Green				6				150
Pepper-Misc.	1,214	1,578	2,297	1,989	2,126	2,077	1,196	740
Pistachios	7,429	11,158	9,868	11,880	15,130	16,834	21,113	17,396
Plums	144	144	264	342	368	276	268	313
Pluots					16	161	161	120
Pomegranate	1,372	1,481	1,653	1,739	1,814	2,516	2,994	3,400
Prunes	149	149	223	223	220	223	297	148
Pumpkins	7					4		20
Radicchio		63						
Safflower	3,956	2,236	200	1,321	2,564	7,761	38,782	1,313
Seed Crop-Misc.	1,747	1,172	2,066	917	1,644	888	1,063	311
Spinach	75	305	252	60	282	251	182	398
Squash			26	54		20		50
Stevia								54
Sugar Beet	5,083	4,984	4,719	4,766	4,228	5,577	3,031	
Sunflower						60		
Tangerines	50	50	183	183	183	183	50	88
Tomatoes-Fresh	2,815	4,528	3,255	4,695	5,832	5,655	3,495	3,020
Tomatoes-Proc.	90,390	88,048	92,395	80,842	87,418	95,520	86,011	78,205
Walnut	357	411	407	405	407	407	357	297
Watermelons	1,316	1,710	2,205	1,785	1,769	2,044	1,276	2,576
Wheat	34,179	57,844	43,384	48,591	35,037	35,407	64,707	53,748
Vetch		145						
N/B Trees/Vines	6,363	2,018	7,233	11,306	16,036	13,474	11,069	18,614
Fallow-Idle Land	94,572	76,654	70,367	66,804	54,944	96,409	131,717	156,239
Non-Harvested	553	1,722	1,461	1,435	3,130	1,103	41,156	41,156
Subtotal	**579,645**	**579,380**	**578,743**	**578,982**	**580,056**	**577,755**	**575,038**	**574,982**
Double Crop	(15,491)	(15,747)	(18,073)	(18,515)	(20,312)	(9,208)	(6,411)	(6,330)
Total	**564,154**	**563,633**	**560,670**	**560,547**	**559,744**	**568,547**	**568,627**	**568,652**

Table 19: 2010-2011 Crop Acreage Trends

Crop	2010	2011
Alfalfa-Hay	9,825	6,933
Alfalfa-Seed	3,203	2,548
Almond	68,255	70,805
Apples	111	111
Apricots	560	707
Artichoke		5
Asparagus	179	511
Barley	5,241	3,858
Beans-Dry	308	2
Beans-Garbanzo	5,618	4,471
Beans-Green	30	
Beans-Jojoba	11	11
Blueberries	227	222
Broccoli	1,582	3,117
Cabbage		101
Cantaloupe	15,132	13,864
Carrots-Bulk	361	378
Cherries	385	652
Corn-Field	424	647
Corn-Sweet	7,673	7,971
Cotton-Acala	4,200	13,416
Cotton-Pima	38,280	85,097
Cucumber	391	57
Garlic	9,881	14,039
Grain-Sorghum/Milo	805	405
Grapefruit	20	20
Grape-Raisin	450	678
Grape-Table	1,139	774
Grape-Wine	11,710	11,994
Honeydew	3,386	2,440
Lemons	97	406
Lettuce-Fall	7,381	9,017
Lettuce-Spring	9,217	7,480
Nectarine	373	386
Oats	1,517	1,206
Onions-Dehy	6,307	7,699
Onions-Fresh	5,380	7,189
Oranges	1,427	1,396
Parsley	876	432
Pasture	353	442
Peaches	1,117	1,119
Peas-Green	140	234
Pepper-Misc	812	1,228
Pistachios	19,301	20,255
Plums	404	549
Pomegranate	3,360	3,489
Prunes	148	
Pumpkins	10	26
Safflower	1,049	1,981
Seed Crop-Misc	704	898
Spinach	277	140
Squash	101	64
Stevia	5	56
Sugar Beet		2
Tangerines	609	1,377
Tomatoes-Fresh	3,477	5,114
Tomatoes-Proc.	75,460	71,976
Walnut	447	447
Watermelons	3,756	2,366
Wheat	76,730	70,266
N/B Trees/Vines	15,839	17,451
Fallow-Idle Land	122,598	53,068
Non-Harvested	8,741	6,446
Subtotal	**576,606**	**577,829**
Double Crop	(7,906)	(9,656)
Total	**568,700**	**568,173**

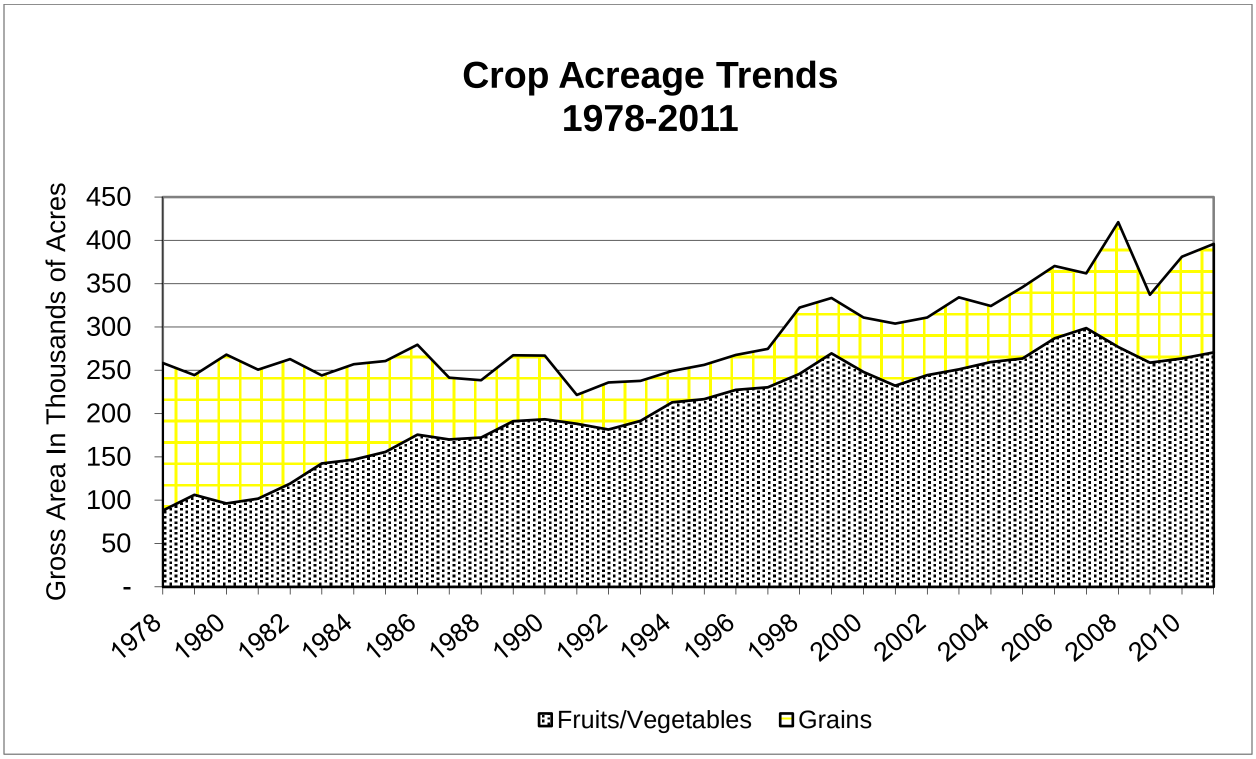

Figure 6: Grains and Fruits/Vegetables Acreage Trends.

Figure 7 shows the variable planting, growing, and harvest seasons and historical seasonal evapotranspiration (ET) of the major crops grown in Westlands during the year. This figure shows that the growing season is year round. Therefore, no single fixed annual crop-water use requirement can be established for the same crop that may be planted and harvested several different times during the year or used for different purposes. Examples are fresh market corn, grain, or silage; fresh market or processing tomatoes; onions and garlic for fresh market or dehydration; and various vegetables planted in either the spring or fall.

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Crop               ET(in)  Oct  Nov  Dec  Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec  Jan
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
ETP (In)           | 77.0 | 5.7| 3.1| 1.9| 1.8| 2.8| 4.4| 7.1|10.2|11.4|11.2|10.0| 7.4| 5.7| 3.1| 1.9| 1.8|
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Alfalfa Hay        | 46.9 |-C--|----|C---|----|----|---C|----C----C----C----C----C----|--C-|----|-C--|----|
Alfalfa Seed       | 36.5 |----|----|----|----|----|----|CC--|----|----|----|HHHH|----|----|----|----|----|
Almond             | 33.5 |HH--|----|    |    | B--|----|----|----|----|----|--HHHHHHHHHH--|----|    |    |
Asparagus          |  NA  |----|----|----|----|----|----|----|HHHHHHHHH|----|----|----|----|----|----|----|
Barley             | 14.7 |    |  PPPPPPPPPPPP|----|----|----|--HHHHH  |    |    |    |    |  PPPPPPPPPPPP|
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Beans, Dry         | 22.2 |    |    |    |    |    |    |PPPP|----|----|----|HHHHHHHHH|    |    |    |    |
Beans, Fresh       |  NA  |HHHH|    |    |    |    |    | PPPPPPPPPPPPPPPPPP|HHHHHHHHHHHHHH|    |PPPP|----|
Broccoli, Spring   |  NA  |    |    |PPPPPPPPP|----|---HHHHHH|    |    |    |    |    |    |    |    |    |
Broccoli, Fall     |  NA  |----|-HHHHHHHHHHH  |    |    |    |    |    |    | PPP|----|----|-HHHHHHHHHHH  |
Cantaloupes, Early | 11.5 |    |    |    |    |  PPPPPPP|----|----|HHHHHHHH |    |    |    |    |    |    |
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Cantaloupes, Late  | 12.0 |-HHH|    |    |    |    |    |    | PPPPPPPP|----|----|----|-HHH|    |    |    |
Cauliflower, Spring|  NA  |    |    |PPPPPPPP-|----|---HHHHHH|    |    |    |    |    |    |    |PPPPPPPP-|
Cauliflower, Fall  |  NA  |----|-HHHHHHH |    |    |    |    |    |    |    |PPPP|----|----|-HHHHHHH |    |
Carrot             |  NA  |    |    |    | PPPPPPPP|----|----|----|----|HHHHHH   |    |    |    |    | PPP|
Corn, Field        | 27.0 |    |    |    |    |    |  PPPPPPPPP---|----|----|---HHHHH |    |    |    |    |
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Corn, Silage       | 20.0 |HHHH|    |    |    |    |    |    |  PPPPPPP|----|----|-HHHHHHHH|    |    |    |
Cotton             | 26.2 |D---|HHHH|    |    |    | PPPPPPPPPP---|----|----|----|----|D---|HHHH|    |    |
Garlic             | 15.0 |PPPPPPPPP|----|----|----|----|----|----|----|HHHHHHHH |    |PPPPPPPPP|----|----|
Grapes             | 24.2 |----|----|    |    |    | B--|----|----|----|----|---HHHHHH|----|----|    |    |
Lettuce, Fall      |  4.9 |--HHHH   |    |    |    |    |    |    |    |    |   PPPP--|--HHHH   |    |    |
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Lettuce, Spring    |  4.0 |    |  PPPPPPPPPP--|----|---HHHHHH|    |    |    |    |    |    |    |  PPPPPPPPPP--|
Olives             | 36.5 |HHH-|----|----|----|----|----|----|----|----|----|----|----|HHH-|----|----|----|
Onions, Fresh      | 16.4 |    |PPPP|----|----|----|----|----|----|--HHHHHHHHHHHH|    |    |PPPP|----|----|
Onions, Dehydrator | 23.5 |  PPPPPPPPPPPPPPP--|----|----|----|----|----|--HHHHHHHHHH  |  PPPPPPPPPPPPPPP--|
Peppers            | 25.0 |HH  |    |    |    |    |  PPPPP--|----|----|----|----|HHHHHHH  |    |    |    |
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Pistachios         | 35.3 |----|----|    |    |    |    |B---|----|----|----|----|HHHH|----|----|    |    |
Pomegranate        | 30.7 |----|----|----|----|----|----|----|----|--HHHHH--|----|----|----|----|----|----|
Rice               | 41.0 |HHHH|    |    |    |    |    |    | PPPPP---|----|----|----|HHHH|    |    |    |
Safflower          | 26.9 |    |    |    |    |  PPPPPPPPPP--|----|----|---HHHHHH|    |    |    |    |    |
Sugar Beets, Fall  | 36.0 |PPPPPPPPPPPPP-|----|----|----|----|----|----|----|---HHHHHH|    |    |PPPPPPPP-|----|
                   |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Sugar Beets, Spring| 37.0 |HHHH|    |    |    |PPPPPPPPP|----|----|----|----|----|HHHHHHHHH|    |    |    |
Tomato, Frsh, Fall | 16.3 |HHHHHH   |    |    |    |    |    |    |    |    |PPPP|----|HHHHHH   |    |    |
Tomato,Frsh, Spring|  NA  |    |    |    |    |    |PPPPPPPPPPP---|-HHHHHHHH|    |    |    |    |    |    |
Tomato, Processor  | 18.9 |    |    |    |    | EEEEEEEEEEEEE|----|----|-HHHHHHHHHHHHH|    |    |    |    |
Wheat              | 19.3 |    |  PPPPPPPPPPPP|----|----|----|--HHHHH  |    |    |    |    |  PPPPPPPPPPPP|

Legend: P=Planting   E=Emergence   B=Bloom   C=Cutting   -=Growing   D=Defoliate   H=Harvest
```

Figure 7: Crop Planting, Growing and Harvest and Historical Seasonal ET.

On-Farm Irrigation Systems

District farmers are surveyed to determine the types of irrigation systems used during the crop year as part of the annual crop-production report survey. Several trends become apparent when this information is compared to a similar survey conducted in 1985, as shown in Table 20. In 1985, 63 percent of the District was irrigated exclusively by surface irrigation (furrow or border strip). In 1990, this figure decreased to 43 percent; in 1995, it decreased to 36 percent; in 2000, it decreased to 30 percent, in 2005 decreased to 23 percent and in 2010 surface irrigation decreased to 11 percent. The acreage irrigated only by sprinkler systems decreased from 21 (1985) to 11 (2010) percent. The acreage irrigated by a combination of sprinkler and furrow deceased from 15 (1985) to 11 (2010) percent. The drip/trickle acreage from 1985 to 1995, increased from 1 to 6 percent and the drip/trickle acreage from 1995 to 2010, increased from 6 to 65 percent.

Table 20: On-Farm Irrigation Systems

	Percentage of Land Irrigated						
Type of System	***1985***	***1990***	***1995***	***2000***	***2005***	***2010***	***2011***
Surface							
Furrow	60	38	34	28	20	8	10
Border Strip	3	5	2	2	3	3	3
Combination sprinkler/furrow	15	38	43	44	34	11	10
Pressurized							
Sprinkler	21	16	15	13	10	11	12
Drip/Trickle	1	3	6	13	33	67	65
Total	100	100	100	100	100	100	100

Various factors may account for these trends. The District has experienced a decrease in its water supply during the drought, which began in 1986. Project water supplies declined by over 100,000 AF annually for the five-year period ending in 1990 when compared to the previous five-year period. In 1990, the District received only 50 percent of its Contract allocation. To cope with these reductions and to continue farming their land, the farmers had to reduce field applications or pump additional groundwater. The pumped groundwater is more expensive than the surface water, and in most cases is of poorer quality.

Shallow-rooted vegetable crops are difficult to irrigate efficiently with surface systems and are best irrigated by sprinklers during the early portion of the growing season when small applications of water are desirable. Well-managed furrow irrigation will suffice during the remainder of the season, especially on those crops, which are susceptible to mildew caused by mid-to-late season sprinkler irrigations.

The irrigation systems used on the major crops grown in the District are shown in Table 21. High-value, shallow rooted crops such as tomato, garlic, and onion are most likely irrigated by a combination of sprinklers and furrow during the season. Lower-valued, deeper-rooted crops such as alfalfa and wheat are more likely to be surface irrigated. Moderate valued crops such as cotton have about one-half the fields irrigated by sprinklers for at least a portion of the season. Trees and vines such as almonds and grapes tend to be irrigated by pressurized systems and new plantings are almost exclusively drip/trickle irrigated.

Table 21: Crop Irrigation Systems[44]

Crop	*Border* (%)	*Furrow* (%)	*Sprinkler* (%)	*Spr/Fur*[45] (%)	*Drip* (%)
Almond		2	14	6	78
Cotton	1	51	16	32	
Garlic		8	12	80	
Melon	2	11	1	85	
Onion-Dehy			59	41	
Onion-Fresh			10	90	
Tomato-Fresh				10	90
Tomato-Process		6	3	90	
Wheat	7	45	28	20	

The District is pursuing funding for the 2013/14 water year to preform irrigation system evaluations for any District Water Users who wish this service. Beginning with the 2014/15 water year permanent funding will be budgeted to cover 25% of the cost for Irrigation System Evaluation for Water User requesting the service; up to 35 evaluations per year.

Seasonal Application Efficiency

The Seasonal Application Efficiency (SAE) is the ratio of the crop water requirements to applied water and is used to determine District-wide water use efficiency. The District-wide SAE averaged 83 percent during the period 1978 through 2011 and is shown in Table 22. The SAE's vary from a low of 72 percent to a high of 94 percent. The high SAE of 94 percent during the 1978 crop year was due to the high rainfall that occurred during December 1977 through April 1978. This eliminated the need for pre-irrigations and the applied water requirements for all winter crops. Differences in the SAE may be attributed to (1) alternative water management practices and irrigation systems used due to changes in cropping patterns, (2) weather variations, and (3) the increased use of water for the cultural practices required to produce high quality vegetable crops.

[44] 1997 farmer survey.
[45] Combination of sprinkler and furrow irrigation.

Table 22: District Seasonal Application Efficiency (Crop Year)

Crop Year	***Area***	***ET***	***EP***	***LRD***	***CP***	***CWR***	***AW***	***SAE***
	Ac	AF	AF	AF	AF	AF	AF	Percent
1978	566,475	1,038,432	313,759	40,260	10,000	774,933	824,895	94
1979	565,917	1,063,783	43,781	56,667	10,000	1,086,669	1,224,386	89
1980	564,719	1,110,665	80,939	57,207	10,000	1,096,933	1,244,994	88
1981	563,301	1,200,511	48,200	64,017	10,000	1,226,328	1,343,446	91
1982	564,039	1,092,494	44,669	58,213	10,000	1,116,038	1,341,639	83
1983	567,184	991,794	67,654	51,341	11,000	986,471	1,121,888	88
1984	568,197	1,219,669	36,124	65,753	11,000	1,260,298	1,546,883	81
1985	568,554	1,137,106	30,286	61,485	12,000	1,180,305	1,543,548	76
1986	568,986	1,063,689	95,168	53,807	12,000	1,034,328	1,339,113	77
1987	566,844	1,050,545	47,952	55,700	13,000	1,071,293	1,468,252	73
1988	568,083	1,095,899	55,181	56,702	13,000	1,110,420	1,430,213	78
1989	567,817	1,063,991	65,249	54,468	14,000	1,067,210	1,332,908	80
1990	568,389	1,062,302	74,386	49,100	14,000	1,051,016	1,220,681	86
1991	568,470	930,480	110,554	43,063	14,000	876,989	976,733	90
1992	570,552	942,959	151,541	39,011	14,000	844,429	975,535	87
1993	567,390	958,847	241,475	35,932	14,000	767,304	890,901	86
1994	563,563	970,136	47,225	37,839	15,351	976,101	1,184492	82
1995	563,781	993,328	179,851	28,766	15,823	858,066	1,068,642	80
1996	563,881	1,157,630	79,587	41,311	15,999	1,135,353	1,453,965	78
1997	563,900	1,102,236	115,158	33,119	16,372	1,036,659	1,362,373	76
1998	564,053	937,140	120,361	28,683	18,136	863,598	1,025,328	84
1999	564,271	1,005,086	5,479	39,286	19,894	1,058,787	1,312,870	81
2000	564,191	946,163	30,018	39,286	18,576	974,007	1,079,153	90
2001	564,274	923,675	87,443	40,492	16,622	893,345	1,081,942	83
2002	564,154	894,311	38,547	45,032	18,376	919,172	990,144	93
2003	563,633	913,403	65,014	35,250	18,032	901,671	1,143,907	79
2004	560,670	931,390	66,493	36,040	18,040	918,977	1,128,596	81
2005	560,547	917,765	77,917	35,823	16,339	892,010	1,066,561	83
2006	559,744	1,084,203	219,045	32,723	18,084	915,965	1,148,081	81
2007	568,547	962,362	19,881	47,449	18,438	1,008,368	1,264,815	80
2008	568,627	953,107	192,195	50,541	16,170	827,623	1,010,237	82
2009	568,652	796,001	137,321	50,174	14,545	723,399	823,282	88
2010	567,713	778,112	177,886	45,322	14,559	660,107	787,460	84
2011	568,171	950,660	140,514	29,949	14,832	854,927	1,082,380	79
Average	**565,803**	**1,007,374**	**97,323**	**45,334**	**14,610**	**969,994**	**1,171,985**	**83**

The difference between the amount of applied water and the amount of crop water requirement is the water loss due to all factors. This loss can be attributed to both on-farm distribution and irrigation system losses. Individual on-farm irrigation system losses will depend upon the type of irrigation system. These losses can generally be classified into two categories, evaporation and deep percolation. Deep percolation is water that infiltrates into the soil but becomes unavailable for crop use because it moved below the root zone. Deep percolation on all District irrigable land averaged about 0.47 feet during the period 1978 through 2011 as shown in Table 23. The depth of deep percolation shown in Table 23 is about 10 percent less than the depth that would occur when only the land actually irrigated is considered.

Data from Westlands' 1987-89 *Irrigation System Improvement Program (ISIP)* (described later) shows that deep percolation is about 0.1 foot in areas where the shallow groundwater is less than 6 feet below the soil surface. This is substantially less than the San Joaquin Valley Drainage Program's recommended goal.

Table 23: District Deep Percolation (Crop Year)

Crop Year	Irrigable Area	Applied Water	ML+CP	ET	EP	ETAW	Deep Percolation	
	Ac	*AF*	*AF*	*AF*	*AF*	*AF*	*AF*	*FT*
1978	566,475	824,895	19,797	1,038,432	313,759	724,673	80,425	0.15
1979	565,917	1,224,386	29,385	1,063,783	43,781	1,020,002	174,999	0.32
1980	564,719	1,244,944	29,880	1,110,655	80,939	1,029,726	185,388	0.34
1981	563,301	1,343,446	32,243	1,200,511	48,200	1,152,311	158,892	0.29
1982	564,039	1,341,639	32,199	1,092,494	44,669	1,047,825	261,615	0.49
1983	567,184	1,121,888	26,925	991,784	67,654	924,130	170,130	0.36
1984	568,197	1,546,883	37,125	1,219,669	36,124	1,183,545	326,213	0.59
1985	568,554	1,543,548	37,045	1,137,106	30,286	1,106,820	399,683	0.74
1986	568,986	1,339,113	32,139	1,063,689	95,168	968,521	338,453	0.68
1987	566,844	1,468,252	35,238	1,050,545	47,952	1,002,593	430,421	0.86
1988	568,083	1,430,213	34,325	1,095,899	55,181	1,040,718	355,170	0.68
1989	568,817	1,332,908	31,990	1,063,991	65,249	998,742	302,176	0.60
1990	568,389	1,220,681	29,296	1,062,302	74,386	987,916	203,469	0.39
1991	568,470	976,733	23,442	930,480	110,554	819,926	133,364	0.30
1992	570,552	975,535	23,413	942,959	151,541	791,418	160,704	0.35
1993	567,390	890,901	21,382	958,847	241,475	717,372	152,147	0.32
1994	563,563	1,184,492	28,428	970,136	47,225	922,911	233,153	0.48
1995	563,781	1,068,642	25,647	993,328	179,851	813,477	229,518	0.44
1996	563,881	1,453,965	34,895	1,157,630	79,587	1,078,043	341,027	0.63
1997	563,900	1,362,373	32,697	1,102,326	115,158	987,168	342,508	0.65
1998	564,053	1,025,328	24,608	937,140	120,361	816,779	183,941	0.35
1999	564,271	1,312,870	31,509	1,005,086	5,479	999,607	281,754	0.53
2000	564,191	1,079,153	25,900	946,163	30,018	916,145	137,108	0.27
2001	564,274	1,081,942	25,967	923,675	87,443	836,231	219,744	0.45
2002	564,154	990,144	23,763	894,311	38,547	855,764	110,617	0.24
2003	563,633	1,143,907	27,454	913,403	65,014	848,389	268,064	0.55
2004	560,670	1,128,596	27,086	931,390	66,493	864,897	236,897	0.48
2005	560,547	1,086,316	26,072	925,875	80,071	845,804	214,440	0.43
2006	559,744	1,135,586	27,254	1,086,858	219,035	867,823	240,509	0.48
2007	568,547	1,264,815	30,356	962,362	19,881	942,481	291,979	0.62
2008	568,627	1,010,237	24,246	953,107	192,195	760,912	225,079	0.48
2009	568,652	823,282	19,759	796,001	137,321	658,680	144,844	0.40
2010	567,713	787,460	18,899	778,112	177,886	600,226	168,335	0.45
2011	568,171	1,082,380	25,977	950,660	140,514	810,146	246,257	0.55
Average	**565,803**	**1,171,985**	**28,128**	**1,007,374**	**97,323**	**910,051**	**233,807**	**0.47**

Distribution Uniformity

The attainable Distribution Uniformity (DU) limits the irrigation efficiency of any irrigation system unless the crop is under irrigated. As its name implies, DU is the measure of how evenly the water is infiltrated into the soil profile. DU is a ratio of the average depth of water infiltrated into the soil in the quarter of the field infiltrating the least amount, to the average depth of total irrigation water infiltrated, in percent:

$$DU = \frac{Infiltration, Average\ Low\ Quarter\ Depth}{Infiltration, Average\ Field\ Depth} x100$$

This method of determining DU based on the low quarter infiltration depth was developed by the U.S. Department of Agriculture, Soil Conservation Service and has become the standard for comparing alternative conditions.[46] It should be emphasized that this equation does not account for the possibility that one-half of the low quarter, or 12.5 percent of the field, could be under irrigated. This results in inadequate leaching and a reduction in crop yield in this part of the field.

When an irrigation system operates at 80 percent DU, a farmer needs to apply an additional 25 percent of crop water requirement to adequately irrigate those parts of the field to which the system infiltrates the least amount of water. This over application results in losses to deep percolation below the crop root zone. A farmer can improve the system's DU through proper design and management, but no irrigation system's efficiency can exceed its attainable DU unless the field is intentionally under irrigated which reduces crop yields.

Average DU values for various irrigation systems measured by field evaluations, along with estimates of potential DU, are shown in Table 24. The table includes DU values for Westlands compiled from the 1987-1989 ISIP; 2003-2006 EISIP (Drip/Trickle only) and for drip/trickle irrigation systems evaluated throughout California by the Department of Water Resources' Mobile Laboratory Programs.[47]

Table 24: Distribution Uniformities

	Potential		*Measured*		
Irrigation System	***Tanji & Hanson***	***Merriam & Keller***	***Little***	***ISIP***[48]	***Attainable***
	(%)	(%)	(%)	(%)	(%)
Furrow	85	80	N.A.	79	80
Border	77	77	N.A.	N.A.	80
Basin	92	72	N.A.	N.A.	80
Sprinkler	75	75	N.A.	71	75 [49]
Drip/Trickle	85	82	74	84	80

The potential DU for each irrigation system is based on the mid-point of a range of values

[46] ASAE, 1980, Design and Operation of Farm Irrigation Systems, St. Joseph, Michigan.

[47] Little, D., 1989, "Analysis of Department of Water Resources' Mobile Lab Irrigation Evaluation Data for Irrigation Efficiency and Distribution Uniformity," Master's Thesis, Davis, California.

[48] Westlands Water District 1987-89 Irrigation System Improvement Program (ISIP) and 2003-2006 EISIP (Drip/Trickle only).

[49] A Distribution Uniformity of 80 percent is attainable when alternate sets are used.

provided by Merriam and Keller[50] and Tanji and Hanson.[51] Potential DU's for each irrigation system will vary from field to field depending on field specific conditions such as topography, soil texture, wind conditions, and water quality. The attainable DU's that can currently be achieved during the life of the system are based on the best commercial irrigation systems in the District and analysis of the measured DU's within Westlands. The absolute maximum attainable appears to be 85 percent, and that level would require a significant investment for technology and management to achieve and sustain this level, possibly with micro-irrigation and linear move systems.

After studying the differences in DU for the irrigation systems used in the District, it is evident that there is more variation in DU's within system categories than between categories. Therefore, it is concluded that proper system design for each field, along with good management, has a greater impact on DU and thus on irrigation efficiency than the type of system being used.

Irrigation efficiency values greater than the DU are the result of under irrigation; these high irrigation efficiency values occur at the cost of lower yields since parts of the field are under irrigated. The lower irrigation efficiencies noted for crops such as vegetables are due to difficulties in applying the precise amounts of water necessary to refill the shallow root zones.

Future Water Requirements

It is anticipated that cropping patterns in Westlands will change in the future. Current and projected cropping patterns based on trends during the past several years are shown in Table 25. Future cropping patterns will be influenced by (1) decreases in average farm size, (2) increases in water costs, (3) increases in acreage of high-value crops, (4) increases in double cropping, (5) lands taken out of production, (6) substantially reduced subsidies for crops and water, and (7) no fallow acreage. The projected acreages are determined by water need rather than availability.

Table 25: Present and Projected Cropping Patterns

Crop	***2011 Present***	***2030 Future***
	Ac	*Ac*
Alfalfa Hay	6,933	9,000
Cotton	98,513	50,000
Field Crops	85,472	75,000
Grain	82,189	6,000
Trees	100,834	155,000
Vegetables	137,374	140,000
Vines	13,446	15,000
Fallow	53,068	128,000
Subtotal	577,829	578,000
Double Crop	(9,656)	(20,000)
Total	515,105	430,000

[50] Merriam, J.L., and Keller, J., 1978, Farm Irrigation System Evaluation - A Guide for Management, Agricultural and Engineering Department, Utah State University, Logan, Utah.

[51] Tanji, K.K., and Hanson, B.R., 1990, "Drainage and Return Flows in Relation to Irrigation Management, Irrigation of Agricultural Crops," Agronomy Monograph No. 30, Madison, Wisconsin.

The information presented in Table 25 assumes a larger amount of land fallowed in 2030 due to the restriction in flows south of the delta. Some land will be used for alternative purposes and will be voluntarily removed from production. The water currently used on these lands will be used elsewhere within the District.

The projected water requirement for Westlands in the year 2030 is expected to be approximately 1.39 million acre-feet as shown in Table 26. This projection is based on the expectation that irrigation systems will be designed and operated to apply water more frequently, which should improve yields.

Crop ET will increase due to the more frequent irrigations, distribution uniformity will increase to 85 percent, and alternative water management practices will ultimately allow the seasonal application efficiency to improve to 80 percent without under irrigation. Some newly installed irrigation systems have distribution uniformities greater than 85 percent. However, regardless of the system, it is expected that production agriculture DU will, at best, average no greater than 85 percent over the course of the system's service life. Proper management is essential to achieve high efficiencies, even for systems, which have potentially high DU.

The District's firm water supply consists of 1.15 million AF of Project water and 200,000 AF of groundwater for a total of 1.3 million AF. This supply is less than the amount required by the farmers to keep ahead of the rising costs to produce the food and fiber needed by the state's ever increasing population.

Table 26: 2030 Projected water Requirement

Crop	*Area*	*Evapotranspiration*		*Effective Precipitation*		*Leaching* Requirement*		*Cultural Requirement*		*Crop Water Requirement*		*Seasonal Application Efficiency*	*Water Use*	
	Ac	AF/Ac	AF	AF/Ac	AF	AF/Ac	AF	AF/Ac	AF	AF/Ac	AF	Percent	AF/Ac	AF
Alfalfa hay	9,000	5.1	45,900	0.2	1,800	0.3	2,700	0.0	0	5.2	46,800	80	6.50	58,500
Cotton	50,000	2.4	120,000	0.1	5,000	0.1	5,000	0.0	0	2.4	120,000	80	3.00	150,000
Field crops	75,000	2.9	217,500	0.2	15,000	0.1	7,500	0.0	0	2.8	210,000	80	3.50	262,500
Grain	6,000	1.8	10,800	0.2	1,200	0.1	600	0.0	0	1.7	10,200	80	2.13	12,780
Trees	155,000	3.0	465,000	0.2	31,000	0.1	15,500	0.0	0	2.9	449,500	80	3.63	562,650
Vegetables	140,000	1.6	224,000	0.1	14,000	0.1	14,000	0.1	14,000	1.7	238,000	80	2.13	298,200
Vines	15,000	2.3	34,500	0.1	1,500	0.1	1,500	0.0	0	2.3	34,500	80	2.88	43,200
Fallow	128,000	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	80	0.00	0
Subtotal	578,000													
Double crop	(20,000)													
TOTAL	430,000		1,117,700		69,500		46,800		14,000		1,109,000	80		1,387,830

* Five percent of ET

Water and Salt Balance

Water and salt balances are simply defined as the amount of each that enters the root zone and its final destination. Water available for use in the root zone comes from four main sources: effective precipitation, groundwater wells, the San Luis Canal, and the Mendota Pool. Water leaves the root zone by crop evapotranspiration, surface evaporation, and deep percolation. Farmers are prohibited from moving Project water outside the farm or District boundaries without prior approval. Subsurface drainage water is not exported from or imported into Westlands. District and other studies show subsurface lateral inflow and outflow estimates to be nil and will not be considered in the water balance calculation. In addition, a small amount of shallow groundwater may be present in the root zone. This is not considered a renewable water source since once it is used; it can only be replaced by subsequent over-irrigation.

Since its inception, Westlands has been analyzing its irrigation water use. Water use, measured at each delivery, is compiled on an annual basis. Annual estimates of groundwater pumped have been provided by the U.S. Geological Survey, and more recently verified by the District's in-house groundwater monitoring program. District-wide crop evapotranspiration is calculated using computer models, which are field, verified with soil moisture data measured with a neutron probe. Effective precipitation is calculated from rainfall data collected at three weather stations. Leaching Requirement Depth (LRD) is the quantity of water required to leach salts below the crop root zone to maintain crop production.

The seasonal application efficiency is estimated for each crop year. After minor evaporative losses are considered, the quantity of water that percolates below the root zone is also estimated.

Water Balance

The water balance equation states that the sum of the water brought into the root zone, minus the sum of the water taken out of the root zone, must be equal to the change in storage of water. Since no Project water is taken out of the District, evapotranspiration, evaporation, and deep percolation are assumed the ultimate destination of all applied water.

Applied water is primarily surface water, supplemented by pumped groundwater. Pumped groundwater for 2011 was 45,000 AF and the Contract water supply for the most recent year was 80 percent. The ET, leaching component of deep percolation, and water for cultural practices are considered to be of beneficial use. The deep percolation, in excess of the LRD, considered lost and cannot be recovered for reuse because most of Westlands overlies saline shallow groundwater.

Table 27 shows the District’s average water balance in the root zone for the period 1978 through 2011, using data from tables 14, 22, and 23.

Table 27: Root Zone Water Balance[52]

	Inflow (AF)	Outflow (AF)
Project Water	978,640	
Effective Precipitation	97,323	
Pumped Groundwater	193,346	
Crop ET		1,007,374
Evaporation (ML + CP)		28,128
Deep Percolation (includes LRD)		233,807
	1,269,309	1,269,309

Shallow groundwater observations are made in April and October of each year for each side of the District. These indicate a stable situation and only minor changes in water storage. Fluctuations in shallow groundwater levels indicate that local over-irrigation in or immediately adjacent to a field, rather than lateral subsurface flow, is the main cause of changes during the irrigation season.

Salt Balance

A root zone salt balance is achieved when the amount of salts added to the root zone and the amount removed by leaching are equal. The inflow of salts to the root zone in Westlands from irrigation with Project water and groundwater is presented in Table 28.

Table 28: Root Zone Salt Balance

	Inflow		Outflow
Project Water[53]	475,000	Tons	
Groundwater[54]	336,000	Tons	
Fertilizers and Amendments	Unknown		
Deep Percolation			Unknown
Total	Unknown		Unknown

The generalized buildup of salts in Westlands' soil cannot be determined using standard procedures such as those described in Food and Agricultural Organization, Irrigation and Drainage Paper No. 29, Water Quality for Agriculture. These procedures assume the average salts in the applied water are equal to the average amount leached from the root zone. Such steady state conditions seldom exist. Furthermore, when this procedure is applied to a district or region, the average or steady state salt inflow/outflow can appear to be in balance, while leaching remains inadequate or excessive in specific localities. Inadequate leaching results in excessive root zone salinity and reduced crop production. Excessive leaching can result in increased deep percolation and rising shallow groundwater levels, which can also reduce crop production.

[52] Average of 1978 to 2011 Crop Years.
[53] Average Project Water EC=0.43 dS/m for 1978-2011.
[54] Average Groundwater EC=2.0 dS/m.

Westlands' actual root zone salt balance cannot be calculated because salts from mineral dissolution, soil amendments, and fertilizers are unknown as is the salt removed from the root zone by deep percolation and added from fluctuating shallow groundwater levels.

In addition, 1976 research by Drs. Kaddah and Rhoades[55] identified the difficulty with attempting to determine district-wide salt balance of an irrigation district. Their work in the Imperial Valley indicates that naturally occurring salts laid down during soil formation still have a significant effect on salinity and salt balance distribution. Specific field leaching values were also difficult to identify because typical leaching fraction analysis assumes a steady state condition of root zone salinity. In this condition, only those salts added to the field are concentrated and removed through deep percolation without considering other salt inputs or outflows.

Municipal and Industrial Uses

Municipal and Industrial (M&I) water uses are provided from the basic agricultural contract, under provisions that allow for M&I uses. True M&I uses should be differentiated from incidental agricultural uses. Incidental agricultural uses, provided for in the contract, are those on-farm support uses that are necessary to the conduct of agricultural activities, such as dust control on roads, wash racks, and water for on farm-water treatment plants. True M&I uses are those non-agricultural production uses within the District that support agricultural production, but are not on-farm operations, such as cotton gins, tomato processing plants, motels and restaurants. Westlands provides conveyance services to cities and governmental agencies, but does not provide any treated water.

Groundwater Recharge

Westlands does not have any groundwater recharge facilities within the District. Except for the western portion of the district, Westlands is generally considered to be sitting above a saline salt sink, the upper unconfined aquifer or shallow groundwater. Recharge for the lower confined aquifer comes generally from east of the District, below the Corcoran clay. Recharge of the confined aquifer might possibly occur in areas on the western edge of the District, near the coast range, where the boundary of the Corcoran clay is irregular.

The District does not have any groundwater banking activities outside of the District but some District Farmers have made investments in Semitropic Water Storage District groundwater bank and water transfers into/out are facilitated by the District. District growers may bank their District CVP allocation in SWSD; the District as contracting party under water service contracts with USBR seeks USBR approval. This is done on an as needed basis when CVP allocations are high enough to justify the banking activity.

[55] Kaddah, M.T., and Rhoades, J.O., 1976, "Salt and Water Balance in Imperial Valley, California," Soil Science Society of America Journal, Vol. 40, No. 1, Madison, Wisconsin.

Water Transfers

Water transfers have become an important component in Westlands water supply. Transfers from other districts are pursued each year to supplement reduced contract deliveries when the price is reasonable. Transfers within the District are used to supplement a water user's allocation from supplies currently available. Table 29 has a consolidated list of transfers into Westlands from other districts in Water Year 2011-12.

Table 29: Consolidated Transfer List, Water Year 2011-12[56]

	Transferred	
Agency	***In (AF)***	***Out (AF)***
Metropolitan Water District Exchange	53,795	
James ID	900	
Oro Loma	3,676	
Patterson ID	5,250	
Tranquillity ID	3,050	
Patterson ID	1,500	
West Stanislaus ID	2,500	
SJREC/SLDMWA	29,667	
Dudley and Indart	1,072	
Byron Bethany ID	2,500	
San Luis WD	1,500	
TLBWSD	2,500	
Panoche WD	600	
Panoche WD	450	
Empire Westside ID	400	
Del Puerto WD	400	
Byron Bethany ID	2,500	
Mercy Springs WD	25	
Panoche WD	450	
Panoche WD	450	
Panoche WD	150	
Panoche WD	250	
Panoche WD	100	
Del Puerto WD	400	
San Luis WD	30	
Del Puerto WD	1,000	
San Luis WD		-450
Del Puerto WD	500	
San Luis WD		-700
San Luis WD		-40
San Luis WD		-250
Transfer/Exchanges Total	**115,615**	**-1,440**

Water Accounting

[56] March 2011 to February 2012.

The intent of this section is to arrange quantified water supplies, uses and losses discussed earlier and arrange it in a water accounting form. These tables are intended to assist when analyzing best management practices, the water savings resulting from an individual practice can be estimated based on the water inventory. The water accounting is broken down into several tables, Surface Water Supply (Table 30), Ground Water Supply (Table 31), Water Supplies (Table 32), Conveyance System Losses (Table 33) and Crop Water Needs (Table 34). The data from the above tables are combined into the Overall Water Budget (Table 35) and Deep Percolation and Conveyance Seepage (Table 36). Table 37 lists the Annual Water Quantities Delivered Under Each Right or Contract from 1987 to present. Table 38 gives the amount of M&I Water Delivered in Westlands in 2011.

Table 30: Water Supply (2011 Crop Year)

Month	*USBR, Ag AF*	*State Project AF*	*Local Water Supply, AF*	*Upslope Drain Water, AF*	*Total AF*
October 2010	35,805				35,805
November	22,561				22,561
December	18,657				18,657
January 2011	29,863				29,863
February	75,995				75,995
March	65,567				65,567
April	78,004				78,004
May	121,973				121,973
June	162,627				162,627
July	186,931				186,931
August	145,083				145,083
September	70,014				70,014
Total	1,013,080				1,013,080

Table 31: Groundwater Supplies (2011 Crop Year)

	Pumped by District		*Pumped by District Water Users*		
Month	*Basin 1 AF*	*Basin 2 AF*	*Basin 1 AF*	*Basin 2 AF*	*Total AF*
October 2010	0	0	12,300	0	12,300
November	0	0	7,900	0	7,900
December	0	0	8,600	0	8,600
January 2011	0	0	4,000	0	4,000
February	0	0	3,700	0	3,700
March	0	0	2,300	0	2,300
April	0	0	4,000	0	4,000
May	0	0	5,600	0	5,600
June	0	0	6,700	0	6,700
July	0	0	6,000	0	6,000
August	0	0	5,800	0	5,800
September	0	0	2,500	0	2,500
Total	0	0	69,400	0	69,400

Table 32: Water Supplies (2011 Crop Year)

Month	*Surface Water AF*	*Ground Water AF*	*Effective Precipitation AF*	*Reclaimed Water AF*	*Total AF*
October 2010	35,805	12,300	0	0	47,805
November	22,561	7,900	107	0	30,668
December	18,657	8,600	6,146	0	33,803
January 2011	29,863	4,000	87,574	0	121,437
February	75,995	3,700	1,056	0	81,051
March	65,567	2,300	25,613	0	93,180
April	78,004	4,000	4,971	0	86,975
May	121,973	5,600	17,935	0	145,908
June	162,627	6,700	0	0	169,627
July	186,931	6,000	0	0	192,931
August	145,083	5,800	0	0	151,083
September	70,014	2,500	0	0	73,014
TOTAL	1,013,080	69,400	143,403	0	1,222,483

Table 33: Conveyance System Losses (2011 Crop Year)

Lateral or Res.	*Length Miles*	*Seepage AF*	*Evaporation AF*	*Operational Spills AF*	*Total Losses AF*
7-1 Inlet Canal	7.4	0	0	0	0
Regulating Reservoirs	____	196	31	0	227
TOTAL	7.4	196	31	0	227

Table 34: Crop Water Needs (2011 Crop Year)

Crop	*Area Acres*	*Planting Month*	*Harvest Month*	*Crop ET AF/Ac*	*Leaching Requirement AF/Ac*	*Cultural Practices AF/Ac*	*Water Needs AF*
Alfalfa Hay	6,933	Perennial	------	3.30	0.13	0.00	22,172
Alfalfa Seed	2,556	Perennial	Sep	2.48	0.08	0.00	6,087
Almonds	76,784	Perennial	Aug	3.00	0.16	0.00	226,200
Barley	2,617	Nov	May	1.14	0.01	0.00	2,814
Beans	4,520	May	Sep	0.84	0.02	0.00	3,614
Cantaloupe	13,866	Apr	Oct	0.97	0.03	0.00	12,954
Cotton	101,766	Apr	Oct	2.47	0.02	0.00	236,897
Garlic	14,520	Nov	Aug	1.28	0.03	0.10	19,003
Grapes	14,015	Apr	Sep	1.81	0.10	0.00	24,836
Lettuce-Spring	9,017	Dec	Apr	0.39	(0.01)	0.09	3,974
Lettuce-Fall	7,480	Sep	Oct	0.18	(0.01)	0.13	2,047
Onions	15,192	Nov	Aug	1.87	0.04	0.10	28,511
Pistachios	33,263	Perennial	Aug	2.65	0.15	0.00	86,724
Safflower	1,981	Mar	Aug	2.22	0.03	0.00	4,149
Tomatoes, Fresh	5,115	Apr	Jun	1.43	0.04	0.00	7,032
Tomatoes, Process	71,976	Mar	Jun	1.63	0.05	0.14	122,120
Wheat	44,917	Nov	Jun	1.57	0.01	0.00	66,369
Field-Misc.	2,927			2.00	0.06	0.00	5,622
Truck-Misc.	20,167			1.50	0.08	0.00	29,708
Tree & Vines-Misc.	11,272	Perennial	____	2.50	0.14	0.00	27,745
TOTAL	460,884						938,577

Table 35: Overall Water Budget (2011 Crop Year)

Step 2A-2011 Water Supply		from Table 32		1,225,483	AF
District Beneficial Uses					
2A2e	Environmental Consumptive Use		minus	28	AF
2C3	Ground Water Recharge	(planned)	minus	0	AF
2C4	Water Exchanges or Transfers		plus or minus		AF[57]
		Water Supply Available for Use		1,225,455	AF
District Non-Beneficial Uses					
2A2a	Conveyance System Seepage*	Table 33	minus	196	AF**
2A2a	Conveyance System/Reservoir Evaporation**	Table 33	minus	11,176	AF***
2A2a	Conveyance System Spills	Table 33	minus	0	AF
2A2d	Consumptive Use by Riparian Vegetation	(estimate)	minus	0	AF
		Available Water Supply		1,214,083	AF
		Quantity of Water Actually Delivered to Customers		1,214,083	AF
2C1	Crop Water Needs	Table 34	minus	938,577	AF
2D	On farm Drain/Spill Water Leaving the District	(estimate)	minus	0	AF
2D	Deep Percolation, in excess of Leaching Requirement		EQUALS	244,757	AF

* Wetlands mitigation on lateral 14.

** Mendota Pool inlet canal plus regulating reservoirs on pumped laterals.

*** Canal evaporation and misc. evaporation losses from on-farm surface irrigation systems

Table 36: Deep Percolation and Conveyance Seepage (2011 Crop Year)

Deep Percolation (Table 35)	AF	244,757
Conveyance Seepage (Table 33)	AF	196
Total of Deep Percolation plus Conveyance Seepage	AF	244,953
Irrigated acres	Ac	460,884
Irrigated acres over a perched water table, 5 feet or less	Ac	6,805
Irrigated acres over a salt sink, 20 feet or less	Ac	295,085
Portion of Deep Percolation/Conveyance Seepage flowing to a perched water table		1%
Portion of Deep Percolation/Conveyance Seepage flowing to a salt sink		64%
Total flowing to a perched water table or saline sink, AF		156,833

[57] Water transfers are included in monthly totals for USBR Ag in Table 30.

Table 37: Annual Water Quantities Delivered Under Each Right or Contract (Water Year)

Year	*USBR*	*USBR (CL II)*	*SWP Contract*	*Transfers*	*Totals*
1987	1,150,300			6,069	1,156,369
1988	1,215,000			15,959	1,230,959
1989	1,152,118			108,599	1,260,717
1990	694,491			18,502	712,993
1991	404,102			88,447	492,549
1992	488,083			124,143	612,226
1993	788,871			231,441	1,020,312
1994	606,392			146,368	752,760
1995	1,210,061			138,428	1,348,489
1996	1,173,028			264,142	1,437,170
1997	1,182,834			293,914	1,476,748
1998	961,912			179,765	1,141,677
1999	930,680			290,558	1,221,238
2000	831,094			359,129	1,190,223
2001	685,894			232,865	918,759
2002	882,694			158,373	1,041,067
2003	968,668			141,626	1,110,294
2004	918,362			144,939	1,063,301
2005	1,102,479			128,072	1,230,551
2006	1,044,824			78,257	1,123,081
2007	639,520			157,364	796,884
2008	336,153			198,825	534,978
2009	242,922			82,515	328,437
2010	523,983			189,192	713,175
2011	983,306			121,951	1,105,257
Total	21,117,771			3,902,443	26,125,471
Average	*844,711*			*156,098*	*1,000,809*

Table 38: M&I Water Delivered in Westlands in 2011[58]

Customer Type	*Number of Connections*	*2011 Use (AF)*
Single Family	0	0
Multi-family	0	0
Commercial	6	307
Industrial	40	1,126
Institutional	7	257
Landscape Irrigation	0	0
Wholesale	0	0
Reclaimed	0	0
Other, Incidental Ag	169	3,408
Unaccounted	0	0
Total	222	5,099

[58] There are no wastewater collection & treatment systems or recycling of M&I water in the District.

Section 3

Best Management Practices for Agricultural Contractors

Westlands Water District 2011 Agricultural Annual Update

Update submitted to USBR Area Office on March 30, 2012.

A1: Measurement

Summary of Actions 2011

Total number of customers:	700
Total number of customers with measured delivers:	700
Number of measurement devices installed this year:	0
Number of measurement devices upgraded:	0

Comments:

The District deliveries are metered with most water users having multiple deliveries. 692 meters were serviced with 570 tested and/or recalibrated with 3,214 hours and 1,811 hours expended respectively.

Calculated Actual Benefits Year 2011

Revenue increased after improved measurement:	No
Water savings from improve measurement:	No
Est. Ac. Ft. Saved:	0
2011 Expenditures:	$243,820
2011 Staff Hours:	5,012

Summary of Year 2012 Projected Actions

Number of measurement devices planned to install next year:	0
Number of measurement devices planned to be upgraded next year:	0

Comments:

The District will continue servicing and testing its meters.

Anticipated Year 2012 Budget

2012 Projected Expenditures:	$250,000
2012 Projected Staff Hours:	5,000

A2: Conservation Coordinator

Summary of Actions Year 2011

Name of Coordinator:	Russ Freeman
E-Mail:	rfreeman@westlandswater.org
Title:	Supervisor of Resources
Address:	3130 N. Fresno Street P.O. Box 6056 Fresno, CA 93703-6056
Phone:	559-241-6241
Fax:	559-241-6277
Cell Phone:	__
2011 Expenditures:	$83,000
2011 Staff Hours:	2,100

Summary of Year 2012 Projected Actions

2012 Expenditures: $83,000

2012 Staff Hours: 2,100

A3A: Water Management Service: On-Farm Evaluations

Summary of Actions Year 2011

Number of acres surveyed: 2,447

Comments:

The District contracted with the Irrigation Training and Research Center (ITRC) at California Polytechnic State University San Luis Obispo for monitoring of Performance of Funded Field Irrigation Systems installed under the District Enhanced Irrigation System Improvement program (EISIP) and USBR Grant. 30 systems were evaluated and found to have an average low quarter DU of 85%.

Actual Benefits Year 2011

Identified efficiency losses: No

Reduced tailwater: No

Number of acre-feet reduced by: 0

Other:

The number of acre-feet reduced is not known but because of reduced surface supply any water saving on one field will be applied to another field thus stretching the water supply. The District has Seasonal Application Efficiency is calculated at 83% and Drip Irrigation systems are used on 65% of the District irrigated lands.

2011 Expenditures: $72,700

2011 Staff Hours: 20

Summary of Year 2012 Projected Actions

Number of acre to be surveyed: 0

Other:

—

Actual Benefits Year 2011

Identified efficiency improvements: No

Reduced tailwater: No

Number of acre-feet reduced by: 0

2012 Expenditures: 0

2012 Staff Hours: 0

A3B: Water Management Service: Real-Time ET Evaluations

Summary of Actions Year 2011

Number of customers provided information: 700

Method of data distribution:

Newspaper: No

Bills: No

Newsletter: Yes

Internet: Yes

Other:

The “Irrigation Guide” is delivered to all water users on a weekly basis by fax, email, and/or mail per their request. In addition, the “Irrigation Guide” is made available to the public though the District’s webpage. Satellite images (1-2 images per month) of the District, are made available to all District water users. The water user logs onto the Districts webpage though secure access to view their individual field images.

2011 Expenditures: $1,282

2011 Staff Hours: 29

Summary of Year 2012 Projected Actions

List any projected changes:

No changes

2012 Expenditures: $1,300

2012 Staff Hours: 30

A3C: Water Management Service: Water Quality Data

Summary of Actions Year 2011

Water quality issue: No

Ground water analyzed: Yes

Surface water analyzed: No

Comments:

Surface Water Quality analysis is preformed by California Department of Water Resources (DWR) and Public water systems within the District perform their own Water Quality analysis as required by California Department of Health Services. Monthly water quality analysis is required under the District’s Distribution System Integration Program (DIP) on groundwater wells pumping into the distribution system. On the District annual groundwater survey (November/December) electrical conductivity (EC) measurements are taken on any groundwater well found pumping.

Actual Benefits Year 2011

List any decisions based on analysis of water:

None

2011 Expenditures: $350

2011 Staff Hours: 10

Summary of Year 2012 Projected Actions

List any changes planned concerning water analysis:

Increased monitoring of Groundwater wells in the DIP Program.

2012 Expenditures: $3,000
2012 Staff Hours: 125

A3D: Water Management Service: Educational Programs

Summary of Actions Year 2011

List educational programs the district supported or participated in:

Notices are produced for water users and land owners as needed, which consist of District supply information, legislative updates, District sponsored programs and community items. In addition, the District continuously updates its webpage with current topical information, resources and educational material relevant to the District.

2011 Expenditures: $14,105
2011 Staff Hours: 79

Summary of Year 2012 Projected Actions

List educational programs the district plans to support or participate in:

The publications will continue in the same form as prior years.

2012 Expenditures: $14,000
2012 Staff Hours: 80

A4: Pricing Structure

Summary of Actions Year 2011

One of the two selections below is required:

District currently prices water at least partly by volume.

Comments:

All deliveries are billed by volume; supplemental water priced at Spot Market rate.

2011 Expenditures: $0
2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

If not already billing in part by volume, enter the year the district plans to convert to billing by volume: 0

Comments:

__

2012 Expenditures: $0
2012 Staff Hours: 0

A5: Policy Evaluation

Summary of Actions Year 2011

List any policy changes or suggestions concerning water conservation/management (internal or external) recommended during the year:

—

Actual Benefits Year 2011

List any benefits received as a result of policy changes. Quantify the benefits if possible in terms of volume of water saved or affected, or dollars: None

2011 Expenditures: $0

2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

List any policies identified for review:

None

2012 Expenditures: $0

2012 Staff Hours: 0

A6: Contractor Pump Efficiency

Summary of Actions Year 2011

Number of contractor pumps tested for efficiency during the year: 350

Quantify the benefits, if possible, in terms of volume of water saved or affected, or dollars in energy savings:

District pumps range in size from 15 to 700 HP and are on triennial testing program. Overhauls are scheduled when pumps test-out at less than 60% efficiency.

Comments:

The District overhauled 65 pumps in 2011/12, which had tested below • 60% efficiency.

2011 Expenditures: $428,307

2011 Staff Hours: 2,552

Summary of Year 2012 Projected Actions

List any policies identified for review: 200

2012 Expenditures: $400,000

2012 Staff Hours: 2,000

B1: Facilitate Alternative Land Use

Summary of Actions Year 2011

One of the two selections below is required:

The district has land suitable for alternative use.

The district in cooperation with the land owners have converted the following number of acres this year: 263

The district in cooperation with landowners have converted the following number of acres total this year and all past years: 87,970

Comments:

In 2011/12 the District spent $3,061,000 to service debt issued for the purchase of these lands. The District has budgeted money for the purchase of additional lands. The District spends $140,000 to manage lands.

2011 Expenditures: $200,000

2011 Staff Hours: 1,000

Summary of Year 2012 Projected Actions

Areas expected to be converted: 4,737

2012 Expenditures: $200,000

2012 Staff Hours: 1,000

B2: Use of Recycled Water

Summary of Actions Year 2011

One of the four selections below is required:

District is investigating recycled water opportunities.

Number of acre-feet of recycled water received (put 0 if not applicable): 0

Number of years until projected project start: 0

Comments:

The District is exploring the purchase of treated water along with design/construction of conveyance. Westlands is negotiating with local municipalities for the purchase, at a reasonable cost and conveyance, of treated waste water. In the future the USBR implementation of the San Luis Drain Feature Re-Evaluation will collect shallow groundwater for treatment and reuse.

Actual Benefits Year 2011

Quantify the benefits, if possible, in terms of volume of water saved or affected, or dollars: __

2011 Expenditures: $0

2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

One of the two selections below is required:

District will investigate recycled water opportunities.

Estimated acre feet of water that may be available for recycling in the future: 40,000

2012 Expenditures: $500,000

2012 Staff Hours: 500

B3: Capital Improvements of On-Farm Irrigation

Summary of Actions Year 2011

One of the two selections below is required:

District has a loan or funding program.

Listing of programs offered:

Enhanced Irrigation System Improvement Lease Program (EISIP), Agricultural

Water Enhancement Program (AWEP)[five-year partnership with RCS/USDA], Enhanced Irrigation System Improvement Lease Program/Bureau Grant (EISIP/USBR) and Enhanced Irrigation System Improvement Lease Program/P3 (EISIP/P3).

Actual Benefits Year 2011

Estimate the dollar value of on farm improvements facilitated by the district: $7,042,427

2011 Expenditures: $19,250

2011 Staff Hours: 550

Summary of Year 2012 Projected Actions

District is expecting to facilitate a funding program:

Accepted

Listing of programs offered:

Enhanced Irrigation System Improvement Lease Program (EISIP), Agricultural Water Enhancement Program (AWEP)[five-year partnership with NRCS/USDA], Enhanced Irrigation System Improvement Lease Program/Bureau Grant (EISIP/USBR) [until April 2012] and Enhanced Irrigation System Improvement Lease Program/P3 (EISIP/P3).

2012 Expenditures: $5,000,000

2012 Staff Hours: 500

B4: Incentive Pricing

Summary of Actions Year 2011

District has an incentive price program: No

District is developing an incentive priced program: No

Water savings from incentive priced program: No

Comments:

"Water rates are a powerful tool to encourage improved water management. Incentive pricing can be used to encourage efficient use in a flexible and equitable manner." Incentive Pricing Handbook for Agricultural Water Districts, USBR (1997). The District has a de facto incentive pricing structure due to the fact that supplemental water must be purchased to meet minimum crop water requirements in all water years/and allocation scenarios.

Actual Benefits Year 2011

Describe the objectives/benefits of the incentive pricing program. Quantify where possible the effect of the incentive pricing program in terms of water dollars:

The District allows all water users to transfer water to others in the District and/or to transfer water from other water districts into the District. Additionally, the District sponsors a supplemental purchase program. The costs of most transfers are driven by market forces and thus often results in costs exceeding $200 per acre-foot.

2011 Expenditures: $2,800

2011 Staff Hours: 80

Summary of Year 2012 Projected Actions

List any changes expected in the incentive pricing program:

__

Number of years until district will have an incentive pricing program, if none exists currently (put "unknown" if applicable): unknown

2012 Expenditures: $3,000

2012 Staff Hours: 100

B5A: Line or Pipe Ditches and Canals

Summary of Actions Year 2011

District has all ditches lined or piped: No

District is investigating in lining or piping canals: No

Miles of pipeline installed this year: 0

Miles of canal lined this year: 0

Comments:

Westlands Water District delivery system consists of 1,034 miles of underground pipeline with over 3,400 metered turnouts, which radiates from the San Luis Aqueduct. In addition the District has one unlined canal (Inlet Canal) 7.4 miles which is used only when flood waters are available.

Calculated Actual Benefits Year 2011:

Acre-feet, estimated water saved from lining or piping canal: 0

2011 Expenditures: $0

2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

Proposed miles of canal to be piped or lined: 0

Comments:

__

Anticipated Year 2012 Benefits:

Acre-feet of water savings from proposed projects: 0

2011 Expenditures: $0

2011 Staff Hours: 0

B5B: Regulatory Reservoirs

Summary of Actions Year 2011

District has regulatory reservoirs: Yes

District is investigating regulatory reservoirs: No

District plans to add regulatory reservoirs: No

District regulatory reservoirs constructed: No

Comments:

The District delivery system was designed with regulatory reservoirs/tanks to maintain a consistent pressure within each lateral.

Calculated Actual Benefits Year 2011:

Current total capacity of regulatory reservoirs (acre-feet): 0

Estimated water savings from spills or operational improvements related to regulatory reservoirs (acre-feet): 0

Improved water management with regulatory reservoirs: No

Comments: __

2011 Expenditures: $0

2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

District will install or investigate development of regulatory reservoirs: No

Comments: __

Anticipated Year 2012 Benefits:

Estimate additional capacity to be added in 2012 (acre-feet): 0

Estimate additional capacity needed for optimum operation (acre-feet): 0

2012 Expenditures: $0

2012 Staff Hours: 0

B6: Flexible Water Ordering

Summary of Actions Year 2011

District has an on-demand delivery system: Yes

District has reached the maximum flexibility currently feasible without major physical improvements to the delivery system: Yes

District is investigating improving delivery flexibility: No

Describe any improvements in delivery flexibility completed or under investigation:

__

Actual Benefits Year 2011

Estimate the number of acres benefited by increased flexibility (acres): 0

2011 Expenditures: $0

2011 Staff Hours: 0

Summary of Year 2012 Projected Actions

One of the three selections below is required:

District will investigate improvements to delivery flexibility.

Comments:

District staff is looking into development of a mobile water ordering "app".

Anticipated Year 2012 Benefits:

Improved service to customers: No

2012 Expenditures: 0

2012 Staff Hours: 0

B7: Spill and Tailwater Recovery

Summary of Actions Year 2011

District has spills or tailwater leaving the district:	No
District is investigating development of a spill/tailwater recovery system:	No
District implemented a spill/tailwater recovery program:	No

Comments:

The District prohibits spilling of tailwater, per District Regulations; water user in violation may have service terminated.

Calculated Actual Benefits Year 2011:

Acre-feet, estimated water conserved by implementing a spill/tailwater recovery program:	0
2011 Expenditures:	$0
2011 Staff Hours:	0

Summary of Year 2012 Projected Actions

District will investigate implementation of a spill/tailwater recovery program:	No
District will implement or continue a spill/tailwater recovery system:	No

Comments: __

Anticipated Year 2012 Benefits:

Acre-feet, estimated water conserved from the proposed or continued project:	0
2012 Expenditures:	$0
2012 Staff Hours:	0

B8: Plan to measure outflow

Total # of outflow (surface) locations/points:	0
Total # of outflow (subsurface) locations/points:	0
Total # of outflow points:	0
Percentage of total outflow (volume) measured during report year:	0

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

Estimated cost in $1000's

Location & Priority	2011	2012	2013	2014	2015

The District does not allow the outflow of surface water from the District and all Water Users are responsible in controlling tail water on their farms. Any Water User found in violation of these regulations will have their water service discontinued. (Appendix A: Regulations or Terms and Conditions for Agricultural Water Service, Article 2, Section 2.6, paragraphs G, H & I)

B9: Conjunctive Use

Summary of Actions Year 2011

District has conjunctive use options:	No
District is investigating a conjunctive use program:	No
District implemented a conjunctive use program:	No

Comments:

The Districts individual water users use groundwater to supplement for the lack of surface water supply.

Calculated Actual Benefits Year 2011:

Acre-feet, water charged to ground water or otherwise stored:	0
Acre-feet of water pumped from wells or otherwise retrieved:	45,000
2011 Expenditures:	$19,250
2011 Staff Hours:	550

Summary of Year 2012 Projected Actions

District will investigate a conjunctive use program:	No
District will implement a conjunctive use program:	No

Comments:

—

Anticipated Year 2012 Benefits:

Acre-feet, water expected to be charged to ground water or otherwise stored:	0
Acre-feet of water expected to be pumped from wells or otherwise retrieved:	0
2012 Expenditures:	$21,000
2012 Staff Hours:	600

B10: Automate Canal Structures

Summary of Actions Year 2011

District's distribution system is completely automated:	Yes
District is investigating system automation:	Yes
District implemented an automation project:	Yes

Comments:

The District is testing Magnetic (Mag) meters on a small lateral and researching automatic meter reading systems.

Calculated Actual Benefits Year 2011:

Implementation of project reduced spills or increased flexibility:	No
Acre-feet, estimated amount of water that would have spilled without the project:	0
Implementation of project improved service to customers:	No
Acres, estimated acres provided with improved service:	0
2011 Expenditures:	$0
2011 Staff Hours:	0

Summary of Year 2012 Projected Actions

District will investigate automation for distribution system: Yes

District will implement an automation project: No

Comments: __

Anticipated Year 2012 Benefits:

Acre-feet, estimate of water spill which could be eliminated by proposed automation project: 0

Acres, estimate of acres provided with improved service by proposed automation project: 0

2012 Expenditures: $0

2012 Staff Hours: 0

B11: Water User Pumping

Summary of Actions Year 2011

District promotes a local utility company's pump testing program: No

List method(s) of promotion: __

District promotes its own pump testing program for its customers: Yes

List method(s) of promotion:

Water users who are enrolled in the District Groundwater Management Program (GWMP) are required to maintain an efficiency of 60% or greater. Pump Efficiency Tests are required on a triennial basis (when the pumps are used) and the cost of these test are borne by the pump owners. The administration expenditures and staff hours reflects the number of tests received each year. The District will look into providing local utility district pump testing program information on its website.

Number of customer pumps tested: 7

2011 Expenditures: $35

2011 Staff Hours: 1

Summary of Year 2012 Projected Actions

District will promote pump testing program: Yes

Estimated number of customer pumps to be tested: 50

Comments:

Same as previous year.

2012 Expenditures: $280

2012 Staff Hours: 8

Facilitate or promote water customer pump testing and evaluation.

File Attachment:

No Answer

B12: GIS Mapping

Has the District implemented this BMP? Yes

Estimated cost in $1000's

Planning Stages	2011	2012	2013	2014

Mapping Processes	2011	2012	2013	2014

2012 Westlands Water District Annual Update Comments

Dated: June 13, 2012
Response: June 20, 2012

USBR comments/questions followed by District response:

Section A3A: Water Management Service: On-Farm Evaluations

Your previous submittal for 2010, provided the projected number of acres to be surveyed at 8,000 acres, whereas only 2,447 acres were surveyed. Although there isn't a clear definition of what your goal is for the next 5-yr plan update regarding the number acres to be surveyed and a portion of the lands are fallowed, it is still important to continue surveying the irrigated lands. Your anticipated goal to survey irrigated lands for 2012 is zero. Please explain why your district is not planning to implement on-farm evaluations.

On-Farm Evaluations within the District are preformed when funding is available. The 2011 evaluations were part of the District Enhanced Irrigation System Improvement Program (EISIP) and a USBR Grant. USBR declined to provide funding assistance in 2012.

Section A3B: Water Management Services: Real-Time ET Information

The Summary of Year 2012 Projected Actions specifies no changes but the projected expenditures increased and the projected staff hours decreased. Can you please explain the reasoning for this?

Looking at the District's 2011 numbers (expenditures: 1282; staff hours 29) and the 2012 numbers (expenditures: 1300; staff hours 30) there is no change.

Section A3C: Water Management Services: Water Quality Data

Your previous report states that your agency was planning to expend $4,400 and 130 staff hours. Your agency actually expended $350 and 10 staff hours. Why was there a considerable decrease in expenditures and hours?

Water quality is required for the Distribution System Integration Program (DIP) and the expense for these tests are incurred by the water user. Expenditures for the DIP program is only staff hours.

The DIP program allows the District water users to pump groundwater in the Distribution Laterals after receiving written approval from all water users on the Lateral in question and the well water meeting Water Quality requirements. Water quality tests (Title 22) are required on a triennial basis and follow up compliance monitoring is submitted every two months while groundwater is being pumped into the Distribution System.

When the surface supply is higher the number of water users in the DIP program is reduced because of the cost of pumping is higher than the cost of Supplemental Water. Last year the District's water users received 80 percent of their CVP allocation and Supplemental Water was less expensive, hence the reduction in number of hours.

Section A4: Pricing Structure

Just for clarification, when you state that "District currently prices water at least partly by volume," you are implying that you charge a fixed rate and a volumetric rate based upon water use and "supplemental water priced at Spot Market rate," refers to a different rate based upon the price of purchasing and delivering additional purchased water.

The District has two levels of water supply; a base allocation available under the District's Water Service Contracts with USBR and a supplemental allocation available on a subscription basis. That portion that is supplemental is charged at a higher "Market" based rate while the base allocation is charged at a cost base rate.

Section B1: Facilitate Alternative Land Use

Although only 263 acres have been converted in 2011 out of the 5,000 acres expected to be converted, we understand that it is time consuming to processing agreements, please provide the number of pending agreements to covert lands and the amount of acres pending for conversion. It may be more reasonable to state the areas expected to be converted each year as realistic projections even though your agency budgets more.

The District's purchase of 5,000 acres has no deadlines and land will be purchased when willing sellers become available.

Section B11: Water User Pumping

In 2010, 10 pumps were tested. In 2011, 7 pumps were tested. Your agency is projecting 50 pumps to be tested. Please provide a brief description of what your agency is doing to increase program participation.

The District's Groundwater Management Program (GWMP) requires a pump efficiency test once every three years. Pumps can only be tested when they are planned to operate. The increased number of tests for 2012 is projected because of 2012 extreme reduction in the surface water supply. Only those water users whose wells participate in the GWMP may be compelled to submit efficiency tests.

Section 4

Best Management Practices for Urban

Background

The mission of Westlands Water District (District) is to provide a timely, reliable and affordable water supply to its landowners and water users, and to provide drainage service to those lands where it is necessary. The District's farmers are very efficient in the management and utilization of available water supplies as identified in the District's Agricultural Water Management Plan submitted to the United States Bureau of Reclamation (USBR) in September 1999.

The District does not have a USBR Municipal and Industrial (M&I) water supply contract, but does exercise provisions in its Agricultural Water Service Contract for use of water for "incidental agricultural purposes". These purposes include M&I activities incidental to agricultural operations including but not limited to single-family dwellings, farm housing, commercial operations, and industrial operations.

This Urban Water Management Plan (Plan) is supplemental to the aforementioned Agricultural Water Management Plan and included in this Plan are appropriate sections from the agricultural plan. This Plan is submitted in accordance with CVPIA and the 1999 plan criteria developed by the USBR.

Westlands Water District delivery system consists of 1,034 miles of underground pipeline with over 3,400 Ag metered turnouts, which radiates from the San Luis Aqueduct. All customer water needs, including those covered by this urban plan, are satisfied from the District's agricultural contract. The water delivered to Commercial, Industrial and Institutional is conveyed through the District's agricultural delivery system and is non-potable water. Water delivered to Community Service Areas (CSA) in turn delivers treated water to their customers and thus is responsible for their leaks, toilets and landscape programs.

The water delivered for M&I purposes under this Plan is not treated, is not in a potable state, and the District does not warrant the quality of the water. A portion of the M&I supply is delivered to Public Water Systems within the District that are regulated by the State and County Department of Health Services. However, none of these suppliers is a retail supplier.

The water conveyed to the Lemoore Naval Air Station (LNAS) is not subject to the provisions of this Plan since LNAS is under Department of Defense water conservation regulations. M&I water is delivered through the District's distribution system to the cities of Huron, Avenal and Coalinga, however, they are responsible to develop their own individual urban water management plans, and as such, they are not considered under this Plan.

This Plan identifies all other water uses delivered into the District that are non-agricultural. Historically the USBR and the District have categorized these uses as M&I for administrative purposes, however, this Plan provides a further categorization of "true" M&I uses and "incidental agricultural" uses under the provisions of the District's contract.

This Plan will present the required water resources information and a plan for implementing the appropriate Best Management Practices (BMP's).

Westlands Water District 2011 Urban Annual Update

Update submitted on 6/29/2012, to the California Urban Water Conservation Council.

Base Year Data

Reporting Unit (Base Year): 2008

BMP 1.3 Metering

Number of unmetered accounts in Base Year: 0

BMP 3.1 & BMP 3.2 & BMP 3.3 Residential Programs

Number of Single Family Accounts in Base Year: 0

Number of Multi-Family Units in Base Year: 0

BMP 3.4 WaterSense Specification (WSS) Toilets

Number of Single Family Housing Units constructed prior to 1992: 0

Number of Multi-Family Units prior to 1992: 0

Average number of toilets per single family household: 0

Average number of toilets per multi-family household: 0

Five year average resale rate of single family households: 0

Five-year average resale rate of multi-family households: 0

Average number of persons per single family household: 0

Average number of persons per multi-family household: 0

BMP 4.0 & BMP 5.0 CII & Landscape

Total water use (in Acre Feet) by CII accounts: 0

Number of accounts with dedicated irrigation meters: 0

Number of CII accounts without meters or with Mixed Use Meters: 0

Number of CII accounts: 0

Comments:

All customer water needs, including those covered by this urban plan, are satisfied from the District's agricultural contract. The water delivered to Commercial, Industrial and Institutional is conveyed through the District's agricultural delivery system and is non-potable water. Water delivered to Community Service Areas (CSA) in turn delivers treated water to their customers and thus is responsible for their Toilets, Landscape programs.

BMP 1.1: Operations Practices

Conservation Coordinator

Conservation Coordinator: Yes

Contact Information

First Name: Russ

Last Name: Freeman

Title: Supervisor of Resources

Phone: (559) 241-6241

Email: rfreeman@westlandswater.org

Water Waste Prevention

Water Agency shall do one or more of the following:

a. Enact and enforce an ordinance or establish terms of service that prohibit water waste

To document this BMP, provide the following:

a. A description of, or electronic link to, any ordinances or terms of service.
b. A description of, or electronic link to, any ordinances or requirements adopted by local jurisdictions or regulatory agencies with the water agency's service area.
c. A description of any water agency efforts to cooperate with other entities in the adoption or enforcement of local requirement.
d. Description of agency support positions with respect to adoption of legislation or requirements.

You can show your documentation by providing files, links (web addresses), and/or entering a description:

File name(s): Email files to office@cuwcc.org: __

Web address(s): URL: comma-separated list:

http://www.westlandswater.org/wwd/randr/article.2.pdf?title=Regulations%20for%20Allocation%20and%2 [**text box to small (remainder of address) 0and%20Use%20of%20Agricultural%20Water]**

Enter a description:

All waste water is prohibited by District regulation, Article 2, Section 2.6, paragraph I.

I. The unauthorized using, taking, or wasting of water is prohibited and may subject the water user to civil or criminal prosecution.

BMP 1.2: Water Loss Control

AWWA Water Audit

Agency to Complete Training In The AWWA Water Audit Method: No

Email to office@cuwcc.org – Worksheets:

Agency to Complete Training In The AWWA Water Audit Method: No

Agency to Complete Training In The Component Analysis Process: No

Complete/Updated the Component Analysis (at least every 4 years)? No

Component Analysis Completed/Update Date: __ format:mm/dd/yyyy

Record Keeping Requirements: (Date/Time Leak Reported, Leak Location, Type of Leaking Pipe Segment or Fitting, Leak Running Time from Report to Repair, Leak Volume Estimate & Cost of Repair)

Agency Located and Repaired Unreported Leaks to the Extent Cost Effective: Yes

Does your agency maintain in-house records of audit results or the completed AWWA worksheet for the completed audit which could be forwarded to CUWCC: Yes

Does your agency keeps records of each component analysis performed, and incorporates results into future annual standard water balances? Yes

Annual Summary Information

Complete the following table with annual summary information (required for reporting years 2-5 only)

Total Leaks Repaired	*Economic Value of Real Loss*	*Economic Value of Apparent Loss*	*Miles of System Surveyed For Leaks*	*Pressure Reduction Undertaken for loss reduction*	*Cost of Interventions*	*Water Saved (AF/Year)*
105			1,034			0.00

Is your Agency implementing an "At Least As Effective As" variant of this BMP: Yes

If yes, please explain in detail why you consider it to be "At Least As Effective As":

See comments

Please Upload Document(s): __

Comments:

Agricultural Water is distributed through 1,034 miles of buried pipe, varying in diameter from 10 to 96 inches. Gravity and pumps feed 38 lateral pipelines from the east bank of the San Luis Canal, while water is pumped into 27 laterals on the west bank. The District's Delivery System is monitored for leaks at least once a month along the whole system and water users repo **[text box to small (remainder of comments) report leaks on their lands when they accrue. Report or found leaks very in size from about 1-2 gallons/minute to up to a blows of 2-5 cubic-feet/seconds (cfs). All leaks are repaired in a timely manner under the District's Work Order System. The Laterals are on a tri-annual inspection schedule, where the lateral is dewatered and where maintenance personal go into the lines visually check for problem areas.**

Non-agricultural water accounts are classified as Incidental Ag and the water is delivered from the Agricultural Delivery System listed above. All the non-agricultural water accounts are metered. The amount of water delivered to non-agricultural water accounts amounts to less than 0.1 percent of the total amount of delivered by the District.]

BMP 1.3: Metering with Commodity

Implementation

Does your agency have any unmetered service connections? No

If YES, has your agency completed a meter retrofit plan? Yes

Enter the number of previously unmetered accounts fitted with meters during reporting year: 0

Are all new service connections being metered? Yes

Are all new service connections being billed volumetrically? Yes

Has your agency completed and submitted electronically to the Council a written plan, policy or program to test, repair and replace meters? No

Please Fill Out the following Matrix

BMP 1.4: Retail Conservation Pricing

Implementation (Water Rate Structure)

Rate Structure	*Customer Class*	*Total Revenue Commodity Charges*	*Total Revenue Customer Meter/Service (Fixed Charges)*
Uniform	Commercial	101,869.05	222.12
Uniform	Industrial	373,043.72	1,480.80
Uniform	Institutional	85,239.39	259.14

Implementation Option (Conservation Pricing Option): Use Annual Revenue As Reported

Retail Waste Water (Sewer) Rate Structure by Customer Class

Agency Provide Sewer Service: No

Is your Agency implementing an "At Least As Effective As" variant of this BMP? Yes

If Yes, please explain in detail why you consider it to be "At Least As Effective As"

see comments

Comments:

The District's water rates vary from year to year depending on available supply. Water users are incentivized to conserve water through higher rates in dry years. Non-portable water delivered to CII customers.

BMP 2.1: Public Outreach – Retail Reporting

Does your Agency perform Public Outreach? Yes

Is your agency performing public outreach?

Number of Public Contacts	*Public Information Programs*
24	Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets
607	General water conservation information

Contact with Media

Are there one or more wholesale agencies performing public outreach which can be counted to help your agency comply with the BMP? No

Is a Wholesale Agency Performing Website Updates?

Did one or more CUWCC wholesale agencies agree to assume your agency's responsibility for meeting the requirements of and for CUWCC of this BMP? No

Is Your Agency Performing Website Updates?

Enter your agency's URL (website address): http://www.westlandswater.org

Describe a minimum of four water conservation related updates to your agency's website that took place during the year:

The District continuously updates its website (http://www.westlandswater.org) with the current topical information, resource material and educational materials relevant to Westlands.

Did a least one Website Update take place during each quarter of the reporting year? No

Public Outreach Annual Budget

Enter budget for public outreach programs. You may enter total budget in a single line or brake the budget into discrete categories by entering many rows. Please indicate if personnel costs are included in the entry.

Number of Category	Amount	Personnel Costs Include?	Comments
Bill Inserts	*$11,072.65*		
Mailing	*$267.08*		

Additional Public Information Program

Please report additional public information contacts. List these additional contacts in order of how your agency views their importance / effectiveness with respect to conserving water, with the most important/ effective listed first (where 1 = most important).

Were there additional Public Outreach efforts? No

Social Marketing Programs

Does your agency have a water conservation "brand," "theme" or mascot? No

Marketing Research

Have you sponsored or participated in market research to refine your message? No

Community Committees

Do you have a community conservation committee? No

Training

None

Social Marketing Expenditures

None

Partnering Programs - Partners

None

Partnering Programs - Newsletters

None

Is your Agency implementing an "At Least As Effective As" variant of this BMP? No

Comments:

None

BMP 2.2: School Education Programs, Retail Agencies

School Programs

Does your Agency implement the School Program? Yes

School Program Activities

Classroom presentations:

Number of presentations 0

Large group assemblies:

Number of presentations 0

Children's water festivals or other events:

Number of presentations 0

Cooperative efforts with existing science/water education programs (various workshops, science fair awards or judging) and follow-up:

Number of presentations <u>0</u>

Other methods of disseminating information (i.e. themed age-appropriate classroom loaner kits):

<u>None</u>

Staffing children's booths at events & festivals:

Number of booths <u>0</u>

Water conservation contests such as poster and photo:

<u>None</u>

Offer monetary awards/funding or scholarships to students:

Number offered <u>6</u>

Total Funding <u>$6,000.00</u>

Teacher training workshops:

Number of presentations <u>0</u>

Fund and/or staff student field trips to treatment facilities, recycling facilities, water conservation gardens, etc.:

Number of tours or field trips <u>0</u>

College internships in water conservation offered:

Number of internships <u>0</u>

Career fairs/workshops Number of presentations <u>0</u>

Is your Agency implementing an "At Least As Effective As" variant of this BMP? <u>No</u>

Comments:

<u>None</u>

BMP 3: Residential

1 – 2) Residential Assistance / Landscape Water Survey

	Single Family	*Multi Family*
Total Number of Accounts	0	0
Total Number of Participants Overall	0	0
Total Number of Leak Det Surveys	0	0
Total Number of Showerheads	0	0
Total Number of Faucet Aerators	0	0
Total Number of Landscape Water Survey	0	0

3) High Efficiency Clothes Washers (HECWs)

Number of installations for HECWs with an AVERAGE Water Factor of 5.0 <u>0</u>

WF less than 5.0 <u>0</u>

4) WaterSense Specification (WSS) Toilets

(Agency must complete information for at least one coverage option (For Traditional 1, 2, or 3; For Flex Track 1, 2, 3, or 4). You are encouraged to include information on other coverage options, as available. If seeking credit for additional water savings, you must select Flex Track option)

4.1 Retrofiton Resale Ordinance is in Plac <u>No</u>

4.2 A 75% Market Saturation Achieve <u>No</u>

4.3 WSS Toilets Installed

	Single Family	Multi Family
Number of WSS Toilets Installed	0	0

5) WSS for New Residential Development

	Single Family	Multi Family
Residential development Rebates	No	No
Recognition Programs	No	No
Reduced connection Fees	No	No
Ordinances	No	No

BMP 4: CII

A) High – Efficiency Toilets.	
Number	0
B) High – Efficiency Urinals (0.5 gpf)	
Number	0
C) Ultra Low Volume Urinals	
Number	0
D) Zero Consumption Urinals (0.0 gpf)	
Number	0
E) Commercial High – Efficiency Single Load Clothes Washers	
Number	0
F) Cooling Tower Conductivity Controllers	
Number	0
G) Cooling Tower pH Controllers	
Number	0
H) Connectionless Food Steamers	
Number	0
I) Medical Equipment Steam Sterilizers	
Number	0
J) Water – Efficient Ice Machines	
Number	0
K) Pressurized Water Brooms	
Number	0
L) Dry Vacuum Pumps	
Number	0

Water Uses Non-Portable:

Non-Potable Water Billed

Customer Type	*Meter Accounts*	*Metered Water Delivered*	*Un-metered Accounts*	*Un-metered Water Delivered*	*Description*
Commercial	*6*	*307.39*	*0*	*0.00*	
Industrial	*40*	*1,125.66*	*0*	*0.00*	
Institutional	*7*	*257.21*	*0*	*0.00*	

Non-Potable Water Un-Billed

None

Water Uses Portable:

Potable Water Billed

None

Potable Water Un-Billed

None

Section 5

Plan Implementation

Plan Implementation

The District will continue provide its customers with information related to efficient water management. The District water conservation web site will be expanded to include pages concerning non-agricultural water management and conservation. The current real-time agricultural crop water ET information is currently delivered via, the Irrigation Guide is mailed weekly, faxed weekly to all water users who have FAX machines available, and on the web site updated daily, will be expanded to include non-agricultural vegetation water use and irrigation. This web site will also be a portal to other non-agricultural water use resources on the Internet. The following information will also be provided:

- Costs and potential water savings of water management measures.
- Climate-appropriate landscaped designs and plants.
- Efficient landscape irrigation equipment.
- How to determine landscape irrigation timing and quantity based on real-time ET data.
- Efficient plumbing fixtures and cost-sharing programs.
- Commercial, industrial and institutional efficiency programs.

<u>School Education Program</u>

The District web site will be expanded to include educational and resource materials that will support education and awareness of water conservation concerns. These efforts will continue on an ongoing basis. Each year the District awards Scholarships to a senior from each of six different Westside High Schools. A committee of District employees through an Application process (which includes an essay) chooses the Scholarship winners and each winner gets $1,000 paid in their names to the college of their choice.

<u>CII Conservation Programs</u>

The District will provide informational materials that will facilitate audits for all CII water users. The District will seek assistance and work with Reclamation to determine the appropriate conservation measures, surveys and audits for the various types of CII water users in the District. Types of CII water users vary greatly, but are mostly associated with the agricultural nature of the District, crop processing, airstrip operations, roadside businesses, and schools. This variety combined with the small numbers implies that expertise required and assistance provided will be specific to the situation. Informational material and grants from Reclamation for assistance will be important components necessary to achieve results, if improvements are necessary.

Section 6

Regional Criteria

Agricultural Regional Criteria

Information required of Districts Located in the Drainage Problem area

The District is in the Westlands Sub-Area, as identified in A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990). This section presents recommendations from the report that have been incorporated into our water conservation program to improve conditions in the drainage problem areas. The recommendations for 2040 in the Westlands Sub-Area include:

1. Source Control
2. Reusing drainage water
3. Evaporation ponds
4. Pumping the semi-confined aquifer
5. Retiring irrigated agricultural lands

The following discussion is provided for information purposes only and is not a plan for future action. The drainage obligation question is in litigation. It is inappropriate for the District to make a commitment to future drainage actions prior to resolution of the litigation.

Background

Since 1985, the District has studied a number of available or emerging drainage technologies, at a cost of over $8 million, none of which proved to be both technically and economically feasible. This includes land application, evaporation and solar ponds, biological selenium removal, a deep injection well, cogeneration, agro forestry, and upper zone pumping.

Source control efforts have proven successful in reducing problems in the drainage-impacted areas of the District. Sound water management by affected farmers has reduced deep percolation below the crops' root zone and lessened the immediate impacts of the lack of artificial drainage. Westlands' Water Conservation Program has been actively involved in providing District farmers with information and assistance directed at achieving higher irrigation efficiencies and reducing deep percolation. This was the main emphasis in the District's 1987-91 Irrigation Improvement Program which almost $1 million was provided to District farmers to obtain the services of irrigation consultants. Under this program, consultants evaluated the farmers' irrigation systems and management and made recommendations that were directed at increasing irrigation effectiveness and reducing deep percolation.

Results from the Irrigation Improvement Program as analyzed by District staff show that the deep percolation goal of 0.4 AF/Acre (AF/Ac) in the shallow groundwater areas has already been achieved as recommended by the San Joaquin Valley Drainage Project (SJVDP). Irrigation data analyzed in shallow groundwater areas of 20 feet or less and 5 feet or less show the average deep percolation to be about 0.4 AF/Ac and 0.2 AF/Ac, respectively. The District-wide deep percolation averages 0.47 AF/Ac as shown on Table 23 of this document.

Current Efforts

Currently two agro forestry demonstration projects, managed by the Westside Resource Conservation District, are being conducted on lands within the District. These projects concentrate subsurface drainage water by using it on salt tolerant trees and halophytes and finally use solar evaporation to reduce the saline water to salt. The San Joaquin Valley Drainage Plan set a goal of reusing drainage water to irrigate about 12,100 acres of salt-tolerant trees and halophytes with subsurface drainage water by 2040. A reprint of a November/December 1998 Irrigator article describing the status of one of these demonstrations follows:

Results at Diener's Red Rock Ranch Drainage Project Are Encouraging
Diener recognized for his commitment to good irrigation management
"The Westlands Irrigator", November/December 1998

Much attention has been focused on John Diener's Red Rock Ranch drainage/agro forestry demonstration -- and with good reason. The results from the three-plus year demonstration project showed the concept is working, and helped Diener earn the recent honor as named the California Grower Magazine/Center for Irrigation Technology Irrigator of the Year award.

Diener admits there still are some unanswered questions, but the reclamation of a previously saline field now planted to broccoli indicates the concept's success. Three years ago before tile drain lines were installed under the now-planted, 30-acre broccoli field, Diener tried to farm wheat. His yield was a dismal two tons of wheat and the salinity level of the soil was 10 units of electrical conductivity (EC) in the upper one-foot of the soil. Today, three years later, the EC is 1 unit in the upper portion of the soil -- an acceptable level for most vegetable crops and EC levels are down by as much as 50 percent in the next two-to-three feet of soil, said Diener. Next year, Diener plans to plant processing tomatoes on the field.

The tile drain lines were placed six-feet deep, 400-feet apart throughout the full 150-acre field. The field irrigated using the District's surface water, with well water serving as a supplemental supply. Eucalyptus trees were planted along the western border of the field to help intercept regional subsurface drainage flows coming under his field. This helped reduce the subsurface drainage flows to a more manageable level.

Working with cost-share funds from a Bureau of Reclamation challenge grant, and with expertise from the Westside Resource Conservation District, U. S. Natural Resource Conservation Service (formerly the U.S. Soil Conservation Service), and the State Department of Water Resources, Diener embarked on the agro forestry concept that encompasses a whole section of land. The project was designed to tile one-quarter of land each year, beginning in 1995. The fields tiled in 1996 and 1997 are beginning to show similar progress as the first field, said Diener.

The other fields are on their way to raising salt-sensitive crops, but still are being reclaimed through alfalfa and safflower. This next year, Diener will be planting dehydrator onions on the field tiled in 1996.

All of the drainage water coming off these fields is collected at the low-end of the fields and is pumped to an adjacent 120-acre field. Commingled with the subsurface drainage flows are six-inches of the District's surface water and surface tail water return flows. This water is used to irrigate salt-tolerant sugar beets, alfalfa seed and crested wheat grass which is used for grass hay. Diener said this field showed “reasonably good yields,” with the sugar beets producing 28 tons per acre at 15.5 sugar. The grass hay netted about five-tons per acre.

The next step in the process collects the subsurface drainage water which is used to irrigate 13 one-acre blocks of feed crops. At this point, the drainage water is about 8,000 to 9,000 parts per million total dissolved solids. In comparison, seawater is about 40,000 ppm TDS. Salt grass, a coastal type of Bermuda grass used for grass hay, is one of the varieties planted in this third step.

In the fourth step, salt-tolerant halophytes, like atroflex, salicornia, cord grass and iodine bush, are planted in an experimental basis. “The ease of management is the primary focus of selecting halophytes,” said Diener. The idea is to enhance the salt concentration to about 25,000 ppm TDS of the drainage water entering the last stage in the solar evaporator.

The plastic-lined, two-acre solar evaporation field is the final stage of the process. The water is contained in the evaporation pond-type facility, equipped with sprinklers to disburse the water and accelerate evaporation, and to help keep any water from ponding. The idea is to keep any birds from visiting or nesting in the evaporator. The process has reduced the volume of water, so that all that is left is the salt. In addition, Diener has ideas on how to manage that.

The residual salt, a combination of sodium sulfate, has been tested in the making of high-quality glass. The salts also contain some boron and selenium, most of which has been reduced by as much as 60 to 80 percent through volitization by the crops.

Diener is hopeful the boron derived from the process can have a market on the west side. “Some of the areas in the District that are not irrigated with well water may actually have a boron deficiency. Many vegetable crops, like broccoli and cauliflower, need about three-to-four pounds per acre of boron,” said Diener. “We may have a place to go with this stuff,” he added.

Diener is hopeful that the research for uses of the salt and minerals will continue. “We’re reading the results as we get them, using the information to make the next move a right one," said Diener, who's motivated by a strong sense of stewardship for the productive west side soils and efficient use of water.

A study will be prepared next year on the results of the Red Rock Ranch project, with the hope that farmer's and others will be able to use to process to help reclaim drainage-impacted areas. Diener hopes that funding will become available to help support four-or-five more of these drainage/agro forestry demonstration projects in other drainage areas. The sustainability of this project makes it so appealing for farmers, like Diener who do not have an outlet for their drainage water, as well as for farmers in the San Joaquin River/Grasslands drainage areas who must reduce selenium loads and address River water quality issues.

Land Retirement

In 1998 the USBR, with participation of the District, has established and funded a voluntary land retirement program established with the goal of retiring 15,000 acres of drainage affected lands. This program will retire the lands from irrigated production but the water will remain within the District with the land being dry land farmed. The San Joaquin Valley Drainage Plan set a goal of retiring 33,000 acres of drainage problem lands by 2040. The USBR suspended this program due to insufficient environmental documentation. A draft EA/FONSI issued in 1999 calls for a 7,000-acre land retirement/project in Westlands Water District.

Urban Regional Criteria

There are no regional M&I criteria for this region.

Appendix A

Adopted: 7/20/87
Revised: 1/17/12

ARTICLE 2. REGULATIONS FOR THE ALLOCATION AND USE OF AGRICULTURAL WATER WITHIN WESTLANDS WATER DISTRICT

2.1 PURPOSE

Westlands Water District has long-term contractual and legal entitlements with the United States for a firm supply of 1,150,000 acre-feet (AF) of Central Valley Project (CVP) water during each water year. In some years, the District may acquire additional water pursuant to its entitlements, or other water. Pursuant to District Resolution No. 128-95, the Board of Directors has adopted the following Regulations establishing the rules and procedures for allocation and use of agricultural water.

2.2 GLOSSARY OF TERMS AND DEFINITIONS

A. agricultural water - water used for irrigation and other agricultural purposes.

B. Agricultural Water Allocation Application and Purchase Agreement (referred to as Allocation Application) - an agreement between the District and a water user which describes the land held by the water user, the amount of water requested by the water user, and which obligates the water user to accept and pay for all water supplied by the District.

C. allocation - amount of water ratably distributed from any source of supply to eligible District lands.

D. Area I - lands which formed a part of Westlands Water District on June 28, 1965 (the original Westlands area), as shown on Westlands Water District Dwg. No. 582, dated December 21, 1976, revised November 1, 1986, entitled “Areas of Water Service Priority.”

E. Area II - lands which formed a part of the original Westplains Water Storage District on June 28, 1965 (the original Westplains area), as shown on Westlands Water District Dwg. No. 582, dated December 21, 1976, revised November 12, 1986, entitled “Areas of Water Service Priority.”

F. Area III - lands which became a part of Westlands Water District after July 1, 1965 (the annexed area), as shown on Westlands Water District Dwg. No. 582, dated December 21, 1976, revised November 12, 1986, entitled “Areas of Service Priority.”

G. area entitlements - amount of contract water allocated for each District area.

H. contract water - any water obtained under the contractual and legal entitlements including additional and interim supplies.

I. cropland - irrigable acreage as determined by U.S. Consolidated Farm Service Agency (CFSA), formerly the ASCS, measurements.

J. water set aside for system losses and other uses.

K. entitlements - water provided pursuant to the contractual and legal obligations between Westlands Water District and the United States for water supply and distribution: 900,000 AF under the 1963 Contract and 250,000 AF of provisional water under the Barcellos Judgment.

L. furnish - to deliver or provide.

M. M&I use - the use of water for drinking, cooking, bathing, showering, dish washing, and maintaining oral hygiene or purposes of commerce, trade or industry.

N. other water - water other than contract water.

O. overuse - use in excess of available supply.

P. per acre entitlement - ratable share of contract water:

The Area I entitlement is 900,000 AF divided by the number of Area I cropland acres for which Allocation Applications are timely received; the Area II entitlement is 250,000 AF divided by the number of Area II cropland acres for which Allocation Applications are timely received.

Q. rescheduling - carryover of water for use in the next water year.

R. system gain - an increase in water available for allocation due to the difference in relative accuracy between state operated and maintained headworks meters and District operated and maintained water delivery meters.

S. system loss - either a direct loss or a reduction in water available for allocation because of the difference in relative accuracy between state operated and maintained headworks meters and District operated and maintained delivery meters.

T. transfer - assignment of water from one water user to another.

U. unused water - available supply at the end of the water year.

V. water user - landowner or lessee of land who has submitted and executed an Allocation Application.

W. water year - each 12-month period that begins on March 1 and ends on the last day of February following.

2.3 CONTRACTUAL ENTITLEMENTS

A The entitlement of agricultural water for Area I is 900,000 AF less water set aside there from for M&I use, system losses, and other uses.

B. 1. The entitlement of agricultural water for Area II is 250,000 AF less water set aside there from for M&I use, system losses, and other uses.

2. Area II's entitlement will be supplemented by any amount of the Area I entitlement not

timely applied for and purchased pursuant to these Regulations.

3. Any contract water in addition to the 1,150,000 AF in any water year shall be allocated to Area II until the average per acre allocation of contract water for all Area II eligible cropland is equal to the average per acre entitlement for all Area I eligible cropland.

C. No contract water shall be allocated to Area III until the allocation of contract water for eligible cropland in Areas I and II is equal to the per acre entitlement in Area I. Additional contract water then available to Area III will be allocated until the per acre allocation is equal to the per acre entitlement in Area I.

D. Any contract water in addition to the quantities described above will be allocated ratably on a per acre basis to satisfy timely applications first to eligible cropland in Areas I and II, then to eligible cropland in Area III, and finally on a first-come, first-served basis to all District cropland.

E. Prior to, and in conjunction with, the calculation of per acre entitlements in any water year, the General Manager shall set aside from the available water supply the amount of water for M&I use in accordance with Article __ of the District's Rules and Regulations, system losses, and other uses approved by the Board of Directors. The General Manager may later allocate this water according to these Regulations if it is no longer necessary for such purposes.

F. If the United States does not provide the District with a full supply of contract water, the shortage will be proportionately applied to the area entitlements.

G. If there is a reduction in the rate at which water can be delivered to the District because of operational or other limitations, each water user's share of the delivery rate will be equitably adjusted as determined by the General Manager.

2.4 OTHER ALLOCATION RULES AND PROCEDURES

A. Other water obtained by the District shall be made available to all cropland in the District without regard to area priority and shall be allocated on a per acre basis, unless otherwise directed by the Board of Directors.

B. Allocations of water shall be increased or decreased as more or less water becomes available for distribution within the District.

C. 1. System loss will be deducted first from the water set aside in each Area for such purposes, and second, from individual allocations in direct proportion to the water used by each water user.

2. System gain shall be apportioned to each Area according to total use and ratably allocated to individuals on a per acre basis.

D. Other water made available to the District specifically for direct transfer to a water user shall be allocated to the water user for whom it was intended. This water may be used or transferred within or outside of the District at the discretion of the water user, subject to applicable state and federal laws and District approval, or any conditions of use placed on the water when it was first transferred into the District.

E. Notwithstanding any other provisions of the Regulations, water made available for specified purposes shall be distributed and used in accordance with such specified purposes.

F. All per acre allocations of water will be made on the basis of cropland acres as determined prior to the time of the allocation. Any changes to cropland acres will be used for future allocations only, and will not be used to adjust prior allocations.

G. In order to receive an allocation, all cropland must be eligible under Reclamation law and any applicable District Regulations.

2.5 APPLICATION FOR WATER

A. To receive an allocation of contract water for agricultural purposes in any water year, a water user must timely apply therefore by filing an Allocation Application at a designated District office annually on or before January 15. Applications received after January 15 shall not receive an allocation unless accepted by the General Manager. Applications received after January 15 that are so accepted by the General Manager shall only be entitled to receive a proportionate share of contract water made available to the District after the date of such late application's acceptance.

B. The General Manager may require supplemental application(s) for additional contract water or other water made available to the District.

C. If more than one Allocation Application for the same parcel of land is received and there is a dispute between the applicants regarding who should receive the water, priority will be given to the landowner, if one of the applicants owns the land in question. If no applicant owns the land, priority will be given to the water user who can provide satisfactory evidence of the right to occupy the land and receive the water. A lease or written consent from the landowner is considered satisfactory evidence. If the dispute arises after the water has been allocated, remedy is limited to unused water.

D. No water will be allocated to any land for which water charges, assessments, land-based charges, or any other money owed to the District have been delinquent for 30 days or more at the time the water is allocated or to any land for which advance payment is required until such advance payment is received, or in lieu thereof security, in a form acceptable to the General Manager, for such payment has been provided.

2.6 USE AND TRANSFER OF WATER

A. No water may be transferred out of the District without District approval.

B. Contract or other water may be used on any eligible cropland within the District.

C. A water user may transfer his contract or other water to another water user in any area of the District. Such transfer shall be in writing on a form provided by the General Manager.

D. The District will not transfer water from a water user to another resulting from a change in ownership or lease of land. However, if land is transferred by a change in ownership or lease with the result that the water user no longer owns or leases any District land, the unused water shall be transferred to the water user to whom the ownership or leasehold of such land has passed unless a transfer of water is requested pursuant to these Regulations.

E. The General Manager may restrict or prohibit the use or transfer of water allocated to any cropland if a dispute exists among landowners regarding the allocation or use of such water.

F. Water service shall be discontinued when a water user has exhausted his available water supply.

G. Each water user shall take reasonable steps to reuse or control tail water. The failure to do so shall constitute a waste of water.

H. The General Manager is authorized, after oral or written notice to the water user, to lock the delivery facilities of, or discontinue water service to, any water user who violates these Regulations or Terms and Conditions for Agricultural Water Service.

I. The unauthorized using, taking, or wasting of water is prohibited and may subject the water user to civil or criminal prosecution.

2.7 PAYMENT FOR WATER

No water, regardless of source, shall be made available for delivery, transfer, or any other use by a water user who fails to make required payments to the District, regardless of the source of the water user's obligation for payment. Rules for payment are set forth in the Terms and Conditions for Agricultural Water Service and other agreements, if any, between the water user and the District.

2.8 YEAR-END PROCEDURES

A. After final water use and supply accounting is completed for the water year, the District will determine the amounts of unused water or overuse for each water user.

B. Unused water may be rescheduled if such a program is available.

C. A water user with unused water that cannot be rescheduled will not be relieved of the obligation to pay for the unused water. The rate paid for such unused water shall include the cost of the water and any applicable District costs.

D. A water user with overuse will have his allocation of contract water in the following year reduced by the amount of his overuse, first from the area in which the overuse occurred and then from any area in which the water user has an allocation of contract water. If this water user is not a water user in the following year, the amount of overuse will be attributed to the cropland that had been farmed by the water user. Further, any allocation of contract water to that cropland will be reduced by the amount of overuse attributable to such cropland.

2.9 MISCELLANEOUS

A. The General Manager is authorized and directed to do any and all things necessary to implement and effectuate these Regulations.

B. An appeal from any decision made pursuant to these Regulations shall be made to the Finance and Administration Committee of the Board of Directors. Such appeal shall be in writing and shall be filed with the District Secretary within 15 working days after notice of the decision. The decision of the Finance and Administration Committee may be appealed to the Board of Directors. Such appeal shall be in writing and shall be filed with the District Secretary within 15 working days after notice of the decision. The decision of the Board shall be final.

C. The General Manager shall provide notice of any changes or revision to these Regulations to all District landowners and water users.

Appendix B

WESTLANDS WATER DISTRICT

OFFICE--3130 N. FRESNO STREET/MAILING--P. O. BOX 6056, FRESNO, CA 93703
TELEPHONE: WATER ORDERS (559) 241-6250/OTHER (559) 224-1523/FAX (559) 241-6276

TERMS AND CONDITIONS FOR AGRICULTURAL WATER SERVICE

1. The allocation and furnishing of water shall be subject to all regulations of the Board of Directors of the District as the same may exist now or hereafter be amended or adopted. In the event of a conflict between these terms and conditions and the regulations, the latter shall be controlling.

2. All water shall be delivered pursuant to a request by the water user for the delivery of a specific flow rate to a specific parcel of land. The request shall be made within the time and in the manner prescribed by the General Manager.

3. Water will be furnished by the District subject to the terms and conditions under which it is made available to the District including, but not limited to, the requirements of federal Reclamation law. The District will use its best efforts, to the extent that it has water and capacity available and taking into account the requirements of other water users to receive water from District facilities, to provide such water in the manner and at the times requested. The District may temporarily discontinue water service or reduce the amount of water to be furnished for investigation, inspection, maintenance, repair, or replacement of any of the District's facilities. The District will give the water user notice in advance of such temporary discontinuance or reduction, except in case of emergency, in which event no notice need be given. In the event the District issues a notice to discontinue or curtail water use, and District facilities are required to be re-filled because the water user fails to discontinue or curtail such use within the prescribed time, the water user shall pay an administrative charge established by the Board of Directors for each point of delivery in violation. No liability shall accrue against the District or any of its officers, directors, or employees for damage, direct or indirect, because of the failure to provide water as a result of system malfunctions, interruptions in service necessary to properly operate and maintain the water distribution system, or other similar causes which are beyond the District's reasonable control.

4. By taking delivery of water from the District, the water user assumes responsibility for, and agrees to hold the District harmless from, all damage or claims for damage which may arise from his use of the water after it leaves the District's facilities. The water user further agrees that there are no intended third party beneficiaries established and nothing contained herein, expressed or implied, is intended to give to any person, partnership, corporation, joint venture, limited liability company or other form of organization or association any right, remedy or claim under or pursuant hereto, and any agreement or covenant required herein to be performed by or on behalf of the water user or the District shall be for the sole and exclusive benefit of the water user or the District.

5. The water furnished by the District is not in a potable state and the District does not

warrant the quality or potability of water so furnished. By taking delivery of water from the District, the water user assumes responsibility for, and agrees to hold the District harmless from, damage or claims for damage arising out of the non-potability of water furnished by the District.

6. All water will be measured by the District with meters installed, maintained, and calibrated by it and such measurements shall be final and conclusive.

7. Charges for agricultural water, hereinafter referred to as "water charges," shall be established by the Board of Directors. The water charges shall include District operation and maintenance costs and any other costs determined by the Board to be payable as part of the water charges. The water charges shall also include the applicable water rates required pursuant to the Reclamation Reform Act of 1982, the Central Valley Project Improvement Act of 1992, and the Judgment in Barcellos and Wolfsen, Inc., et al. v. Westlands Water District, et al., and Westlands Water District, et al. v. United States, et al., U.S. District Court, Eastern District of California, Nos. CV-79-106-EDP and CV-F-81-245-EDP, respectively. Water charges shall be adjusted retroactively to the extent required and authorized by federal or state law or regulations or District regulations. The General Manager may adjust the water charges as necessary and legally authorized to account for increases or decreases in the estimates used to establish the water charges.

8. Payments for water service shall be due on the 25th of each month or 15 calendar days after the date on which the monthly bill for such service is mailed, whichever is later. Payment for the "Water Allocation" component of the District's annual repayment obligation to the United States shall be due on July 25. Notwithstanding the foregoing, water users who farm on lands that are not subject to assessment by the District shall be subject to advance payment, and payment for water service for the entire water year shall be due on February 25, preceding the water year; provided, that in lieu of advance payment, the District, at its option, may accept in a form satisfactory to the General Manager a written guarantee from a recognized financial lending institution or an assignment of any and all charges to land in the District owned by the water user. When any deadline established herein falls on a Saturday, Sunday, or holiday, it shall be extended to the next working day. Payments postmarked on or before the due date shall be deemed to have been received by the due date. Charges not paid by the applicable due date shall be delinquent.

9. All payments shall be made at the District's Fresno Office.

10. Advance payment shall be required for the acquisition costs of water transferred into the District from other agencies, pump-in water, or any allocation resulting from the District being able to obtain other water, prior to the allocation of such water to water users. The advance payment will be due by a date to be established by the General Manager. Excluding those water users subject to advance payment, conveyance-related costs for such water will be billed to water users upon water use.

11. All claims for overcharges or errors must be made in writing and filed with the District at its Fresno Office within 10 working days after the date the bill is received by the water user or landowner. In the event the water user or landowner files a timely written protest, the District's

Finance & Administration Committee shall consider the protest at its next regular meeting and notify the water user or landowner in writing of its decision. The Committee's decision shall be final, unless a written appeal to the Board of Directors is filed with the Secretary of the District within 15 working days after notice of the decision. In the event of an appeal, the decision of the Board shall be final. The filing of a protest or an appeal does not nullify the payment requirement or the District's right to discontinue water service as provided in these terms and conditions. However, in the event the protest or appeal is sustained, the District will refund the amount of the overcharge and penalty, if any.

12. During any 12-month period, the penalty for a water user's first delinquent payment shall be 2 percent of the delinquent charges, except as described hereinafter. The second delinquency shall be 5 percent and the penalty for a water user's third and any subsequent delinquency shall be 10 percent, on current charges due, excluding any penalties or interest imposed on delinquent charges from a prior month. The 2 percent penalty shall not be levied with respect to a water user's first delinquency in any 12-month period if the delinquent payment is received by the District on or before the last working day of the month, but the delinquency shall continue to be the water user's first delinquency for purposes of this paragraph. Delinquent charges shall bear interest at a monthly rate of 1½ percent. Interest shall not, however, accrue after the delinquent charges together with applicable penalties and interest have been added to, and become a part of, the annual assessment levied on the land by the District. All payments and credits shall be applied to the earliest delinquent charges.

13. At the time of filing the District's assessment book with the District Tax Collector, delinquent charges, together with applicable penalties and interest, may be added to and become part of the assessment levied by the District on the land which received the water or for which other charges were incurred. If the water was not furnished, the applicable delinquent charges may be added to the land to which the water was allocated. The District shall notify the landowner of the anticipated amount(s) prior to adding the assessment. The added amount shall be a lien on the land and impart notice thereof to all persons. If the assessment becomes delinquent, penalties and interest will be added as provided by law.

14. To supplement the procedure described in Paragraph 13, the District may elect to file and record a Certificate of Unpaid Water Charges as provided in California Water Code Section 36729. This Certificate creates a lien in the amount of delinquent charges on any land owned by the delinquent water user, or acquired by the water user before the lien’s expiration, within the recording County.

15. Agricultural water service shall not be provided to, nor shall a transfer of water be permitted to or from, any water user or parcel of land for which there are delinquent charges or assessments, regardless of the source of the water user’s or parcel of land’s obligation to the District or the nature of the District’s service for which the charges were imposed, and notwithstanding the fact that the delinquent charges, including applicable penalties and interest, have been added to the assessment(s) on the parcel(s) for which they were incurred. Water service shall be discontinued on the 1st of the month following that in which charges or assessments become delinquent, or as soon

thereafter as reasonably possible; provided, that when the 1st of the month falls on a Saturday, Sunday, or holiday, such service shall be discontinued on the next working day.

16. The General Manager may require that all current charges be paid before the transfer of remaining water will be allowed.

17. If a water user's delinquent charges are delinquent for 30 days or more, or if a water user's delinquent charges are added to the annual assessments on any lands within the District, or the procedure in paragraph 14 is implemented, the General Manager shall require, as a condition of resumption of water service, that advance payment of all water charges be made for the 12-month period immediately following resumption of service, according to a schedule to be determined by the General Manager. In lieu of advance payment, the District, at its option, may accept in a form satisfactory to the General Manager a written guarantee from a recognized financial lending institution.

18. The General Manager, after consultation with and approval by the Finance & Administration Committee, may also require advance payment and/or payment by cashier's check or such other actions as he may deem necessary when a water user's account is determined, based on the payment history or other actions of the water user, to create a financial risk or hardship for the District. Circumstances which constitute the basis for such a determination include but are not limited to the following: (1) instances of a water user's checks being returned unpaid or (2) instances where a water user whose account is delinquent has, in violation of District regulations, taken water from a District delivery. In lieu of advance payment, the District, at its option, may accept in a form satisfactory to the General Manager a written guarantee from a recognized financial lending institution.

19. As used in these terms and conditions, the term “charges” includes water charges, land-based charges and payments due the District under any lease or other agreement between the District and the water user.

20. Agricultural water service shall not be provided to any water user who has failed to file, or to any lands for which there has not been filed, the certification or reporting forms required pursuant to Reclamation law, and particularly the Reclamation Reform Act of 1982. Any water delivered in violation of this provision may be subject to charges and administrative fees pursuant to federal law or regulation.

21. Agricultural water service shall not be provided to any water user who fails to provide the District with crop information at the time(s) and in the form required by the General Manager.

22. By applying for or taking delivery of agricultural water from the District, the water user agrees to these terms and conditions of service.

23. The District may modify or terminate these terms and conditions; provided, that such modifications or terminations are prospective only and notice thereof is given prior to the effective

date.

Appendix C

United States Department of Agriculture
Soil Conservation Service
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GENERAL SOIL MAP

Hanford Soil Survey Office-for West Fresno County SSA
By Kerry Arroues, Supervisory Soil Scientist, 11/23/1993

WESTLANDS WATER DISTRICT

This general soil map (Figure 8) shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretative purposes. Each of the broad groups and the map units in each group are described in the following pages. For further definitions of terminology used in these descriptions, use the table titled "TERMINOLOGY USED IN SOIL SURVEY DATA ENTRY OR MANUSCRIPT EDITING". As usual, on an ongoing soil survey, all information is tentative and subject to revision.

Soil Association #1: Tachi-Armona-Gepford (1,000 acres)

These soils are very deep, poorly drained, saline-sodic soils on flood plains and in flood basins. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of less than 6 feet.

- -Tachi and Gepford soils have clayey textures with a high shrink-swell potential.
- -Armona soils have loamy textures and are stratified. Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands water District.

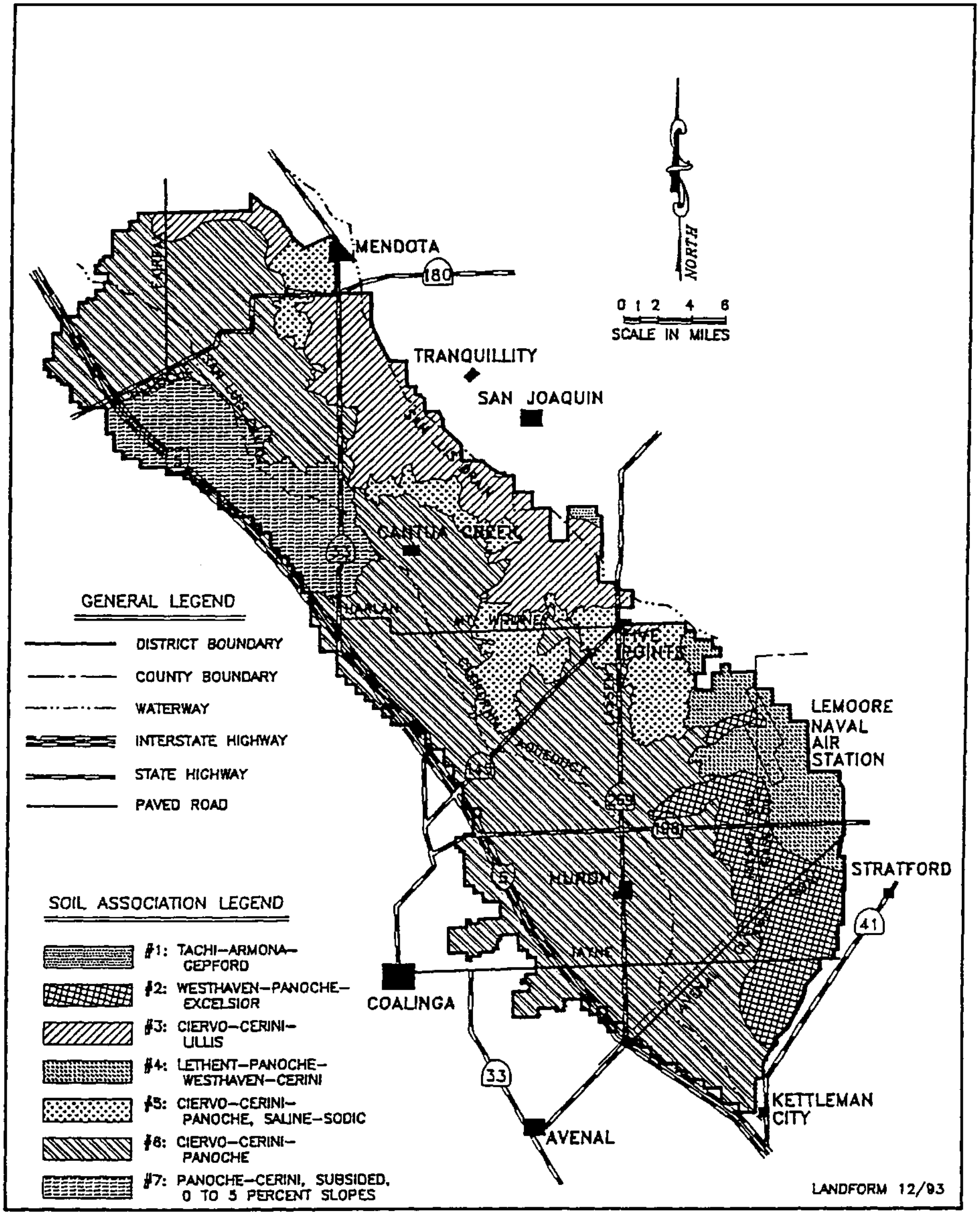

Figure 8: General Soil Map - Westlands Water District.

If this unit is used for irrigated crops, the main limitations are salinity and sodicity, a high perched water table, very slow permeability and flooding. The high shrink-swell potential on the Tachi and Gepford soils should be considered before installing cement structures. High shrink-swell clay can cause cement structures to buckle.

Intensive management is required to reduce the salinity and maintain soil productivity. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim this soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Content of salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.

- Tile drainage can be used to lower the water table if a suitable outlet is available.
- Because of the very slow permeability on the Tachi and Gepford soils and stratification on the Armona soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.
- The risk of flooding can be reduced by the use of levees, canals and diversions.

Soil Association #2: Westhaven-Panoche-Excelsior (47,000 acres)

These soils are very deep, well drained and moderately well drained soils on low lying alluvial fans and low fan terraces.

- Westhaven soils are stratified and have silty textures.
- Panoche soils have loamy textures.
- Excelsior soils are stratified and have coarse-loamy textures.

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands Water District.

If this unit is used for irrigated crops, the main limitations are stratification and moderately slow permeability.

- The Westhaven and Excelsior soils are limited by a stratified profile that restricts permeability. Because of the moderately slow permeability of these soils, the length of runs should be adjusted to permit adequate infiltration of water. Good irrigation water management on these stratified soils requires that irrigation amounts and timing be adjusted to account for the available water capacity which can vary depending on the size, depth and texture of the strata.
- The Panoche soils have no major limitations.

Soil Association #3: Ciervo-Cerini-Lillis (72,000 acres)

These soils are very deep, moderately well drained to poorly drained, saline-sodic soils with a high perched water table on distal alluvial fans and low stream terraces.

- Ciervo soils have clayey textures which usually become coarser with depth.
- Cerini soils are stratified and have fine-loamy textures.

- Lillis soils are clayey with a high shrink-swell potential.

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands water District:

- If this unit is used for irrigated crops, the main limitations are salinity and sodicity, a high perched water table and slow permeability. The high shrink-swell potential on the Lillis soil should be considered before installing cement structures. High shrink-swell clay can cause cement structures to buckle.
- Intensive management is required to reduce the salinity and maintain soil productivity Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim this soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Content of salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.
- The Ciervo and Lillis soils have very slow permeability. The Cerini soil is limited by a stratified profile that restricts permeability and creates a perched water table. Because of the very slow and slow permeability of these soils, the application of water should be regulated so that water does not stand on the surface and damage the crops.
- Tile drainage can be used to lower the water table if a suitable outlet is available.

Soil Association #4: Lethent-Panoche-Westhaven-Cerini (40,000 acres)

These soils are very deep, moderately well drained and well drained, saline-sodic soils on distal alluvial fans and flood plains. Much of this map unit has developed a high perched water table within six feet of the surface, especially near the northwest corner of Lemoore Naval Air Station.

- Lethent soils have clayey textures.
- Panoche soils have loamy textures.
- Westhaven soils are stratified and have silty textures.
- Cerini soils are stratified and have fine-loamy textures.

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands Water District:

If this unit is used for irrigated crops, the main limitations are salinity and sodicity, a high perched water table, slow permeability and stratification.

- Intensive management is required to reduce the salinity and maintain soil productivity. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim this soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Content of salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.
- Lethent soils have very slow permeability. Westhaven and Cerini soils have slow permeability. Panache soils have moderately slow permeability. Because of the

moderately slow to very slow permeability of these soils, and stratification on the Westhaven and Cerini soils, the application of water should be regulated so that water does not stand on the surface and damage the crops.
- Tile drainage can be used to lower the water table if a suitable outlet is available.

Soil Association #5: Ciervo-Cerini-Panoche (57,000 acres)
These soils are very deep, moderately well drained and well drained, saline-sodic soils on mid alluvial fans and flood plains. Some of this map unit has developed a high perched water table within 6 feet of the surface.

- Cierva soils have clayay textures which usually become coarser with depth.
- Cerini soils are stratified and have fine-loamy textures.
- Panoche soils have loamy textures.

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands Water District:

If this unit is used for irrigated crops, the main limitations are salinity and sodicity, moderately slow permeability to very slow permeability, and a high-perched water table in some areas.

- Intensive management is required to reduce the salinity and maintain soil productivity. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim this soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Content of salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.
- Ciervo soils have very slow permeability. Cerini soils have slow permeability. Panoche soils have moderately slow permeability. Because of the moderately slow permeability to very slow permeability of these soils, and stratification on the Cerini soils, the application of water should be regulated so that water does not stand on the surface and damage the crops.
- Where a perched water table within six feet of the surface is present, tile drainage can be used to lower the water table if a suitable outlet is available.

Soil Association #6: Ciervo-Cerini-Panoche (342,000 acres)
These soils are very deep, moderately well drained and well drained soils on alluvial fans and flood plains.

- Ciervo soils have clayey textures, which usually become coarser with depth.
- Cerini soils are stratified and have fine-loamy textures.
- Panoche soils have loamy textures.

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands Water District:

If this unit is used for irrigated crops, the main limitations are stratification on Cerini soils and slow permeability or moderately slow permeability.

- Ciervo soils have slow permeability. Cerini soils have moderately slow permeability. Because of the slow permeability on the Ciervo soils and moderately slow permeability and stratification on the Cerini soils, the application of water should be regulated so that water does not stand on the surface and damage the crops. Good irrigation water management on these soils requires that irrigation amounts and timing are adjusted to account for the available water capacity which can vary depending on the size, depth and texture of strata.

Soil Association #7: Panoche-Cerini, subsided, 0 to 5 percent slopes (45,000)

These soils are very deep, well-drained soils on alluvial fans and flood plains, which have subsided unevenly across the landscape due to near-surface subsidence.

- Panoche soils have loamy textures.
- Cerini soils are stratified and have fine-loamy textures

Effect on water operations and management and any limitations on agriculture resulting from soil problems within the Westlands Water District:

- If this unit is used for irrigated crops, the main limitations are near-surface subsidence, moderate hazard of water erosion, moderately slow permeability on the Cerini soil, and occasional flooding in low-lying areas. The near surface subsidence should be considered before installing cement structures. Subsidence can cause cement structures to buckle.
- Sprinkler or trickle irrigation is best suited where subsidence has occurred near the surface. Hollow areas caused by subsidence make furrow and border irrigation more difficult. Irrigation water needs to be applied at a rate that insures optimum production without increasing deep percolation, runoff and erosion.
- Because of the moderately slow permeability of the Cerini soil, the application of water should be regulated so that water does not stand on the surface and damage the crops. To avoid over-irrigating, applications of irrigation water should be adjusted to the available water capacity, the water intake rate and the crop needs.
- Use of pipe, ditch lining or drop structures in irrigation ditches facilitates irrigation and reduces ditch erosion.
- The risk of flooding can be reduced by the use of levees, canals and diversions.

Appendix D

Definitions of Irrigation Terms

Acre-Foot (AF): The volume of water required to cover one acre to a depth of one foot (43,560 cubic feet). An acre-foot equals 325,851 U.S. gallons.

Advance Ratio (AR): For furrow irrigation, the ratio of the total time irrigation water is applied to the furrow (set time) to the time needed for irrigation water to reach the lower end of a sloping furrow (advance time).

$$AR = \frac{SetTime}{AdvanceTime}$$

Annual Distribution Uniformity (ADU): *See "Distribution Uniformity."*

Annual Irrigation Efficiency (AIE): *See "Irrigation Efficiencies."*

Applied Water (AW): Water applied to a field by irrigation, excluding the tailwater which runs off the field and is collected for reuse in the irrigation of another field on that farm, expressed as a depth of water in inches or feet.

Available Soil Moisture: The difference in soil moisture content between Field Capacity and Permanent Wilting Point. This represents the moisture which can be stored in the root zone for use by crops, expressed as a depth of water in inches or feet (*Israelson & Hanson, 1979*).

Beneficially Used Water (BU): Irrigation water used to satisfy a portion or all of the following: evapotranspiration, leaching requirement, special cultural practices, and/or water stored in the soil for use by crops, expressed as a depth of water in inches or feet (*ASAE, 1988; Burt, et al., 1988*).

Conservation: ". . . planned management of a natural resource . . . ." (*Webster's New World Dictionary, 1989*).

Crop Root Zone: The soil depth from which a mature crop extracts most of the water needed for evapotranspiration. The crop root zone is equal to effective rooting depth and is expressed as a depth in inches or feet. This soil depth may be considered as the rooting depth of a subsequent crop, when accounting for soil moisture storage in efficiency calculations (*Burt, et al., 1988*).

Crop Water Requirement (CWR): The infiltrated water required to grow a crop, expressed as a depth of water in inches or feet (*Burman, et al., 1981*).

$$CWR = ET - EP + LRD + CP$$

Cultural Practices (CP): Irrigation water which is used for necessary farming practices such as soil reclamation, climate control, crop quality, and weed germination, expressed as a depth of water in inches or feet (*Burt, et al., 1988*).

Deep Percolation (DP): The amount of irrigation water that flows below the crop root zone and is unavailable for evapotranspiration, expressed as a depth of water in inches or feet (*Merriam & Keller, 1978*).

Depth of Water: The depth of a volume of water spread over a given area, expressed as a depth of water in inches or feet.

Distribution Uniformity (DU): The ratio of the average low-quarter depth of irrigation water infiltrated to the average depth of irrigation water infiltrated, expressed as a percent (*ASAE, 1988*).

Effective Precipitation (EP): That portion of rainfall that contributes to satisfying the evapotranspiration and/or leaching requirement of a crop, expressed as a depth of water in inches or feet (*Burman, et al., 1981*).

Electrical Conductivity (EC): The property of a substance to transfer an electrical charge and a measure of the salt content of water. EC_w is the term used as a measure of the salt content of irrigation water, ECe is the term used as a measure of the salt content of an extract from a soil when saturated with water, expressed as decisiemens per meter (dS/m) (*Doorenbos & Pruitt, 1984*).

Evapotranspiration (ET): The amount of water loss over a period of time through transpiration from vegetation and evaporation from the soil, expressed as a depth of water in inches or feet (*Doorenbos & Pruitt, 1984*).

Evapotranspiration of Applied Water (ETAW): The portion of the total crop evapotranspiration that is satisfied by applied water, expressed as a depth of water in inches or feet (*Central Valley Water Use Study Committee, 1987*).

Evapotranspiration Potential (ETP): Evapotranspiration potential is a value calculated with a modified Penman equation and is equal to daily alfalfa evapotranspiration when the crop occupies an extensive surface; is actively growing, standing erect, and at least eight inches tall; and is well watered so that soil water availability does not limit evapotranspiration, expressed as a depth of water in inches or feet (*Burman, et al., 1980*).

Field Capacity: Depth of water retained in the soil after ample irrigation or heavy rain when the rate of downward movement has substantially decreased, usually one to three days after irrigation or rain, expressed as a depth of water in inches or feet (*Doorenbos & Pruitt, 1984*).

Groundwater Table: The upper boundary of groundwater where water pressure is equal to atmospheric pressure, i.e., water level in a bore hole after equilibrium when groundwater can freely enter the hole from the sides and bottom (*Doorenbos & Pruitt, 1984*).

Infiltration Rate: The rate of water entry into the soil expressed as a depth of water per unit of time in inches per hour or feet per day. The infiltration rate changes with time during irrigation (*Burt, et al., 1988*).

Irrigation Efficiencies: Irrigation efficiencies are used to determine the efficiency of replacing moisture in the soil profile and may be calculated for single or multiple irrigations and are the ratio of the depth of water stored to the depth of applied water. The equations for single and multiple irrigations are as follows:

Pre-irrigation Efficiency (PIE): This definition is used to calculate the efficiency of an on-farm pre-irrigation and is the ratio of the sum of the depth of water used for soil moisture replacement and cultural practices to the depth of applied water, expressed as a percentage (*Burt, et al., 1988*). No leaching requirement is included.

$$PIE = \frac{SMR_1 + CP_1}{AW_1} x100$$

Regular Season Irrigation Efficiency (RIE): This definition is used to calculate the efficiency of one or more regular season on-farm irrigations and is the ratio of the sum of the depth of soil moisture replacement water and water used for cultural practices for each irrigation after the pre-irrigation to the sum of the depths of water applied during these irrigations, expressed as a percentage. No leaching requirement is included (*Burt, et al., 1988*).

$$RIE = \frac{SMR_2 + CP_2 + SMR_3 + CP_3 + \cdots + SMR_n + CP_n}{AW_2 + AW_3 + \cdots + AW_n} x100$$

Annual Irrigation Efficiency (AIE): This definition is used to calculate the efficiency of all on-farm irrigations and is the ratio of the sum of the depth of soil moisture replacement water and water used for cultural practices for all irrigations plus the water to satisfy the seasonal leaching requirement to the sum of the depths of water applied during all irrigations, including the pre-irrigation, expressed as a percentage (*Burt, et al., 1988*).

$$AIE = \frac{SMR_1 + CP_1 + SMR_2 + CP_2 + \cdots + SMR_n + CP_n}{AW_1 + AW_2 + \cdots + AW_n} x100$$

Where n = total number of irrigations, n = 1 is the pre-irrigation.

Leaching Fraction (LF): The ratio of deep percolation V_{dp} to infiltrated irrigation water V_{iw}. It is the fraction of water that enters the root zone by irrigation that is not used in ET and which passes below the root zone as deep percolation (*Rhoades, 1991*).

$$LF = V_{dp}/V_{iw}$$

Leaching Requirement (LR): The theoretical amount of infiltrated irrigation water that must pass (leach) beyond the root zone in order to keep soil salinity within acceptable levels for sustained crop growth. Different models may be used to estimate LR. For uniform and no rainfall conditions, a simple estimate is:

$$LR = \frac{EC_w}{5EC_e - EC_w}$$

Where EC_w is the electrical conductivity of the infiltrated irrigation water and EC_e is the maximum EC of the saturated extract of the soil tolerable (not causing significant yield loss) by the crop in question. Actual leaching needed for salinity control may be more or less than this estimate dependent upon uniformity of irrigation/infiltration and amount and distribution of rainfall, respectively.

Leaching Requirement Depth (LRD): The depth of water corresponding to the leaching requirement including extra water for non-uniformity in distribution.

$$LRD = \frac{ETAW}{(DU \div 100)} x \frac{LR}{(1 - LR)}$$

Low Quarter Depth: The average depth of water infiltrated into the quarter of the field infiltrating the least amount, expressed in inches or feet.

Minor Losses (ML): Water losses due to evaporation during irrigation, uncollected surface runoff from the field, and on-farm conveyance and storage systems expressed as a depth of water in inches or feet.

Permanent Wilting Point (PWP): The moisture remaining in a soil at a uniform soil moisture tension of about -15 bars of atmospheric pressure, which is the approximate tension at which plants irreversibly wilt due to moisture stress, expressed as a depth of water in inches or feet.

Pre-irrigation: An irrigation that occurs prior to the planting of a crop.

Pre-irrigation Efficiency (PIE): See "Irrigation Efficiencies."

Regular Season Irrigation Efficiency (RIE): See "Irrigation Efficiencies."

Salt Balance: The condition when the amount of salts added to a soil profile through irrigation and the amount removed by leaching are equal (i.e., no net gain nor loss of salt in the crop root zone). This balance will be established if adequate leaching occurs each year; the average root zone salinity at equilibrium will depend upon the amount of leaching and the quality of the applied water (*Hoffman, et al., 1980*).

Seasonal Application Efficiency (SAE): This term measures the efficiency of applied irrigation water based on crop water requirements, where evapotranspiration is estimated using a modified Penman equation and crop coefficients and is expressed as a percentage.

$$SAE = \frac{BU}{AW} x100 = \frac{CWR}{AW} x100$$

$$CWR = ET - EP + LRD + CP$$

Soil Moisture Deficit (SMD): The amount of water needed to refill the crop root zone to field capacity at the time of irrigation, expressed as a depth of water in inches or feet (*Westlands Water District, 1985*).

Soil Moisture Replacement (SMR): The amount of water that is used to replace a portion or the entire soil moisture deficit, expressed as a depth of water in inches or feet.

Tailwater: Applied irrigation water that runs off the lower end of a field. Tailwater is the average depth of runoff water, expressed in inches or feet.

Under-irrigation (UI): The difference between the water actually stored in the crop root zone during irrigation (soil moisture replacement) and the water needed to refill the root zone to field capacity (soil moisture deficit) in all or part of the field, expressed as a depth of water in inches or feet.

References

1. ASAE, 1988, “Evaluation of Furrow Irrigation Systems,” ASAE EP 419, 1988 Standards American Society of Agricultural Engineers, St. Joseph, Michigan.

2. Burman, R. D., Nixon, P. R., Wright, J. L., and Pruitt, W. O., 1980, “Water Requirements,” Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, St. Joseph, Michigan.

3. Burt, C. M., Walker, R. E., and Styles, S. W., 1988, Irrigation System Evaluation Manual, Dept. of Agricultural Engineering, Cal Poly, San Luis Obispo, California.

4. Central Valley Water Use Study Committee, 1987, Irrigation Water Use In The Central Valley of California, Division of Agriculture and Natural Resources, University of California, Department of Water Resources, State of California, Sacramento, California.

5. Doorenbos, J. and Pruitt, W., 1984, “Crop Water Requirements,” Irrigation and Drainage Paper 24, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

6. Hoffman, G. J., Ayers, R. S., Doering, E. J., and McNeal, B. L., 1980, “Salinity in Irrigated Agriculture,” Design and Operation of Farm Irrigation Systems, American Society of Agricultural Engineers, St. Joseph, Michigan.

7. Israelsen, O. W. and Hansen, V. E., 1979, Irrigation Principles and Practices, John Wiley and Sons, Ltd., New York, New York.

8. Merriam, J. L. and Keller, J., 1978, Farm Irrigation System Evaluation – A Guide for Management, Agricultural and Irrigation Engineering Department, Utah State University, Logan, Utah.

9. U. S. Salinity Laboratory Staff, 1954, Diagnosis and Improvement of Saline and Alkali Soils, Agricultural Handbook No. 60, United States Department of Agriculture, Washington, D. C.

10. Webster’s New World Dictionary, Third College Edition, 1988, Simon & Schuster, Inc., New York, New York.

11. Westlands Water District, 1985, Water Conservation and Management Handbook, Westlands Water District, Fresno, California.

12. Westlands Water District, 1989, Water Conservation and Drainage Reduction Programs 1987-1988, Westlands Water District, Fresno, California.

Appendix E

WESTLANDS WATER DISTRICT

Groundwater Management Plan (1996)

Introduction

It is the mission of Westlands Water District to provide a timely, reliable, and affordable water supply to its landowners and water users, and to provide drainage service to those lands that need it. To this end, Westlands is committed to the preservation of its federal contract, which includes water and drainage service, and to the acquisition of additional water necessary to meet the needs of its landowners and water users.

In recognition of the vital nature of the District's groundwater resources as part of the total water supply available to landowners and water users, and in light of federal, state, and local issues impacting, or potentially impacting, those resources, the District's Board of Directors has authorized by Resolution (attached hereto as Appendix A), the preparation of a Groundwater Management Plan (Plan).

Authority

AB 3030, the Groundwater Management Act, authored by Assemblyman Jim Costa, became law on January 1, 1993, and was codified as Part 2.75, commencing with Section 10750 of Division 6 of the Water Code. AB 3030 permits local agencies to adopt programs to manage groundwater. The Central Valley Project Improvement Act's criteria for evaluating water conservation plans require all water suppliers overlying a usable groundwater basin to initiate development of a groundwater management plan pursuant to AB 3030.

AB 3030 allows any local public agency which provides water service to all or a portion of its service area and whose service area includes all or a portion of a groundwater basin to adopt a groundwater management program. The law contains 12 components which may be included in a groundwater management plan. Each component may play some role in evaluating or operating a groundwater basin so that groundwater can be managed to maximize the total water supply while protecting groundwater quality.

The District is authorized to adopt rules and regulations to implement and enforce the Groundwater Management Program. The District may not limit or suspend extractions unless the District has determined through study and investigation that groundwater replenishment programs or other alternative sources of water supply have proved insufficient or infeasible to lessen groundwater demand. In adopting the rules and regulations, the District must consider the potential impact of those rules and regulations on business activities, including agricultural operations. In addition, to the extent practicable and consistent with groundwater resource protection, the District must minimize any adverse impacts on these business activities.

Before the District may levy a water management assessment or otherwise fix and collect fees for the replenishment or extraction of groundwater the District must hold an election on the proposition of whether or not the District shall be authorized to levy a groundwater management assessment or fix and collect fees for the replenishment or extraction of groundwater. The District shall be so authorized if a majority of the votes cast at the election is in favor of the proposition.

Plan-Objective and Goals

The District's farmers, being good stewards of their land, are concerned about managing and protecting their resources, including groundwater. Therefore, the objective of this Plan is to preserve and enhance the long-term viability of the groundwater resources within the District with respect to both quantity and quality. To accomplish this objective the District intends to evaluate and/or implement programs which are consistent with the mission statement of the District and will meet the following goals:

Primary Goals

- Preserve and enhance the reliability of groundwater resources of the District.
- Ensure the long-term availability of high quality groundwater.
- Maintain local control of groundwater resources within the District.
- Minimize the cost and impacts of groundwater use.

Secondary Goals

- Prohibit unrestricted export of groundwater from the District and use of groundwater to replace surface water removed from the District as a result of a transfer.
- Minimize impacts of groundwater pumping, including subsidence, overdraft, and soil productivity.
- Prevent unnecessary restrictions on the private use of the District's groundwater resources.
- Ensure coordination between District, local, and regional groundwater management activities.
- Optimize use of groundwater storage conjunctively with surface water.
- Ensure efficient use of the District's groundwater resources and minimize deep percolation and its contribution to the shallow groundwater problem through use of an effective water conservation and management program.
- Ensure that District water users understand the steps they can take to protect and enhance their groundwater supply.

Area to be included in the Groundwater Management Plan

The Groundwater Program shall be effective throughout the entire District. It shall be the District's policy to work cooperatively with all other agencies within the Westside Basin in order to facilitate protection and enhancement of the groundwater resources within the District and to avoid whenever possible duplicative or inconsistent groundwater management efforts. To that end, as a part of its Program, the District may enter into joint powers agreements or memoranda of understanding with public or private entities overlying all or a portion of the same groundwater basins as the District's service area for the purpose of implementing or coordinating groundwater management activities.

Excluded from this Program will be the small domestic wells within the District boundaries which pump groundwater for single-unit residences.

District Background

Westlands consists of nearly 1,000 square miles of prime farmland between the Diablo Range of the California Coast Range Mountains and the trough, or lowest point, of the San Joaquin Valley in western Fresno and Kings Counties. Westlands averages 15 miles in width and stretches 70 miles from Mendota on the north to Kettleman City on the south. Figure 9 shows the general location of Westlands. Figure 10 is a map of Westlands in the western portion of the San Joaquin Valley.

Westlands was formed under California Water District Law in 1952 upon petition of landowners located within the District's proposed boundaries. Nearly all land within the current Westlands' boundaries was at one time farmed using groundwater.

Negotiations between Westlands and the U.S. Bureau of Reclamation began on a contract to provide a dependable, supplemental supply of surface water through the Bureau's Central Valley Project (CVP) shortly after the District's formation. At that time, the federal government was considering the development and construction of the CVP's San Luis Unit (SLU). This involved cooperation between the federal and state governments with regard to shared water storage facilities and conveyance systems.

When the original Westlands was organized, it included approximately 376,000 acres. In 1965 it merged with its western neighbor, Westplains Water Storage District, adding 210,000 acres. Additionally, lands comprising about 18,000 acres were annexed to the District after the merger to form the current 604,000-acre District. The original Westlands is referred to as Priority Area I and Westplains is referred to as Priority Area II, each under a separate CVP agricultural water service contract with the Bureau. Priority Area III currently does not have a firm surface water supply and receives water only when available from other sources including surplus CVP water transfers from within and outside the District.

Climate

Annual precipitation in Westlands averages about seven inches, the majority of which falls during the months of December through March. Summer maximum temperatures frequently exceed 100° F and winter temperatures occasionally fall below freezing. With a mean annual temperature of 62° F, the area has an average frost-free growing season of 280 days.

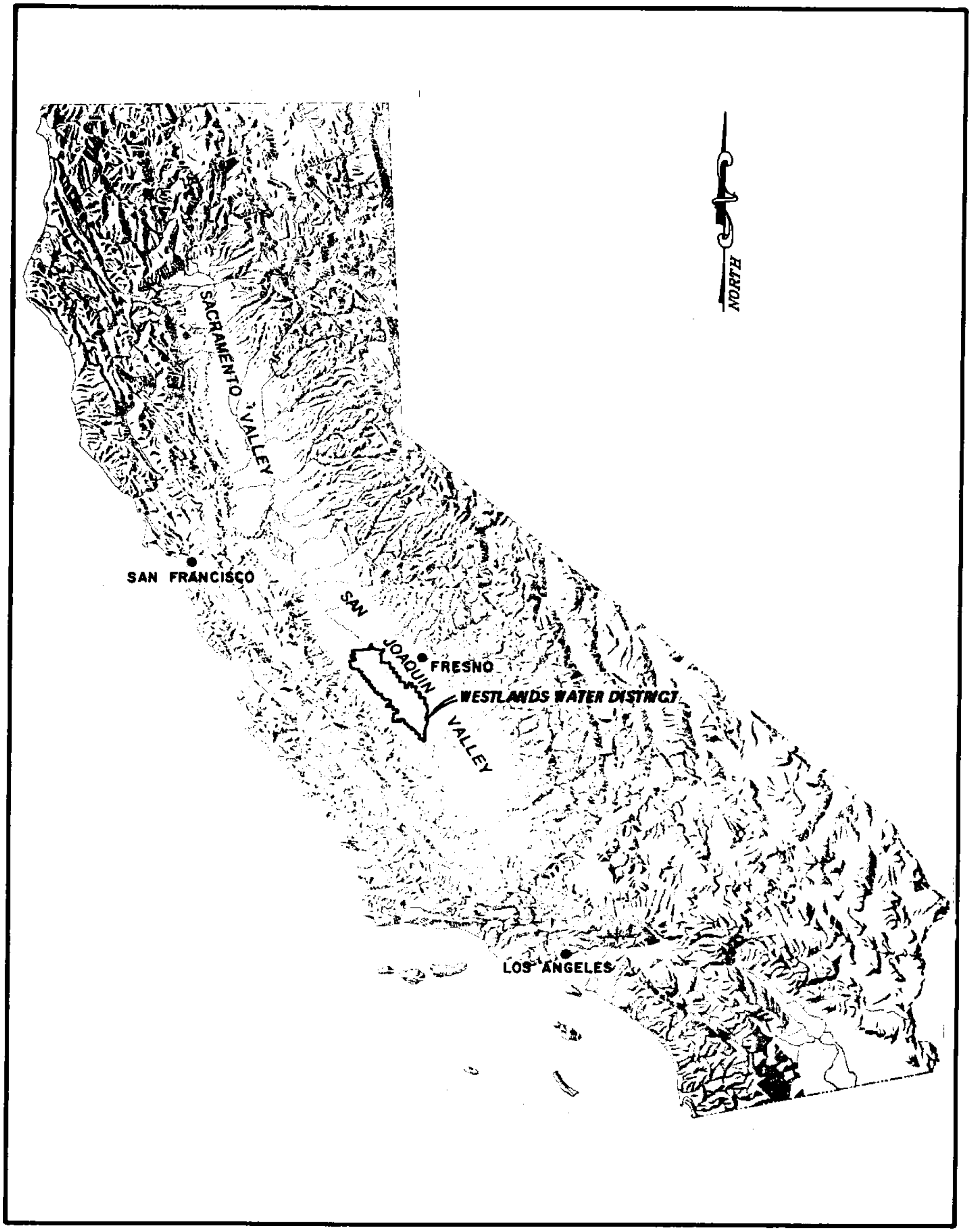

Figure 9: Location of Westlands Water District in California.

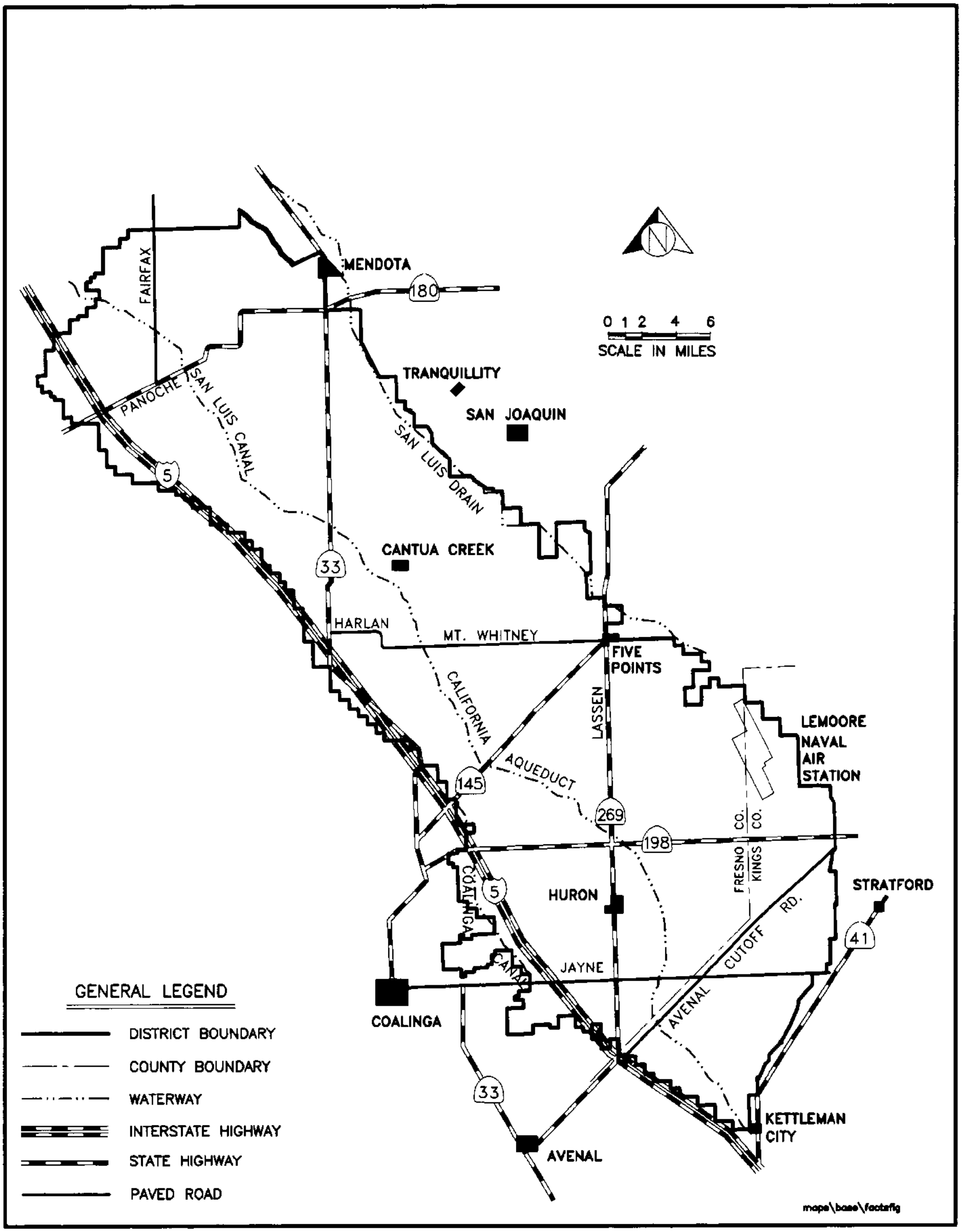

Figure 10: Westlands Water District.

Geology

The San Joaquin Valley is a wide bedrock basin filled with thousands of feet of alluvial sediment deposited by streams and rivers flowing out of the adjacent mountains on both the east and the west. Westlands is located near the centerline of this basin, bordered on the east by the Fresno Slough and on the west by the Diablo Range of the California Coast Ranges.

The Diablo Range consists of complex, folded, and uplifted mountains which are composed predominantly of sandstones and shales of marine origin. Eroded by creeks flowing from the Diablo Range, sediments form gentle sloping alluvial fans. The texture of the Diablo Range deposits depends on the relative position on the alluvial fan and ranges from coarse sand and gravel to fine silt and clay. Generally, those portions of Westlands lying high on the alluvial fans have permeable, medium-textured soils. With decreasing elevation from the west to east, soil textures become finer. These fine textured soils are characterized by low permeability and increased concentrations of water soluble solids, primarily salts and trace elements.

The Sierra Nevada on the east side of the Valley is predominately comprised of uplifted granitic rock overlaid in areas by sedimentary and metamorphic rock. Sierran alluvial deposits in the District consist primarily of well-sorted sands, with minor amounts of clay. The Sierran alluvium decreases in thickness and increases in depth below the surface toward the west. These coarse-textured sediments are characterized by high permeability and a low concentration of water soluble solids.

One of the principal subsurface geological features of the San Joaquin Valley is the Corcoran Clay formation. Formed as a lake bed about 600,000 years ago, this clay layer ranges in thickness from 20 to 200 feet and underlies most of the District. Varying in depths from 200 to 500 feet in the Valley trough to 850 feet along the Diablo Range, the Corcoran Clay divides the groundwater system into two major aquifers--a confined aquifer below and a semi-confined system above.

Westside Groundwater Basin

The groundwater basin underlying Westlands is comprised generally of two water- bearing zones: (1) an upper zone above a nearly impervious Corcoran Clay layer containing the Coastal and Sierran aquifers and (2) a lower zone below the Corcoran Clay containing the Sub-Corcoran aquifer. These water-bearing zones are recharged by subsurface inflow from the east and northeast, percolation of groundwater, and imported and local surface water. A generalized cross section of the District depicting the location of the Corcoran Clay and these water-bearing zones is shown in Figure 11.

The Corcoran Clay separates the upper and lower water-bearing zones in the majority of the District. The Corcoran Clay is not continuous west of Huron. The elevation of the base of the Corcoran Clay is shown in Figure 12.

Groundwater quality in the lower water-bearing zone varies throughout the District as shown in Figure 13. Typically, water quality varies with depth; the poorest quality occurring at the upper and lower limits of the aquifer and the optimum quality somewhere between. The upper limit of the aquifer is the base of the Corcoran Clay. The USGS identified the lower limit as the base of the fresh groundwater. The quality of the groundwater below the base of fresh water exceeds 2,000 parts per million total dissolved solids. The elevation of the base of the fresh groundwater is shown in Figure 14.

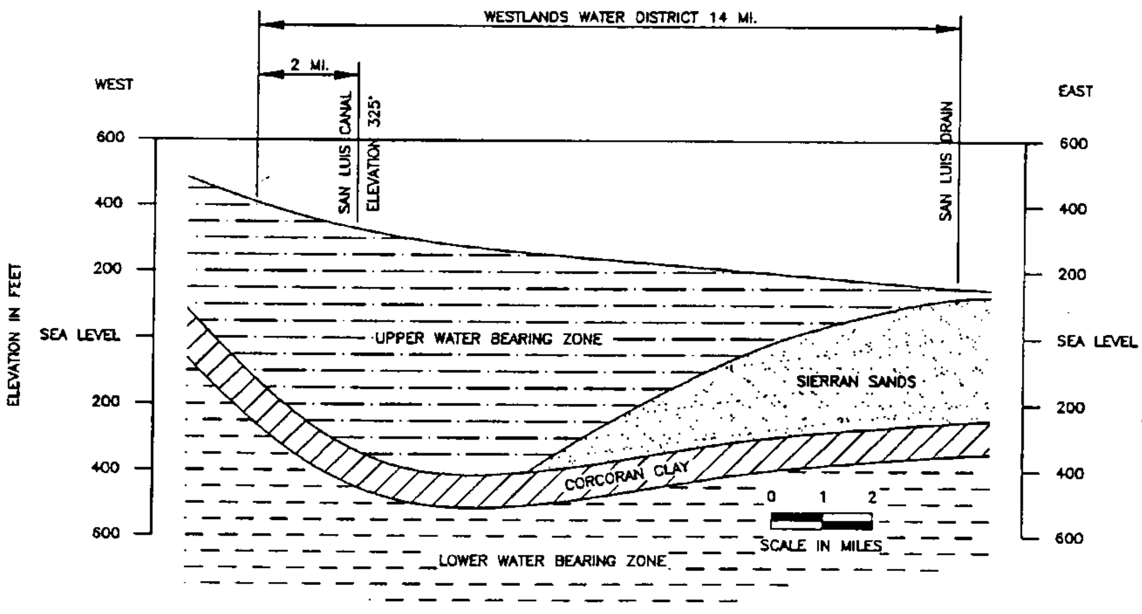

Figure 11: Generalized Hydrogeological Cross Section of Westlands.

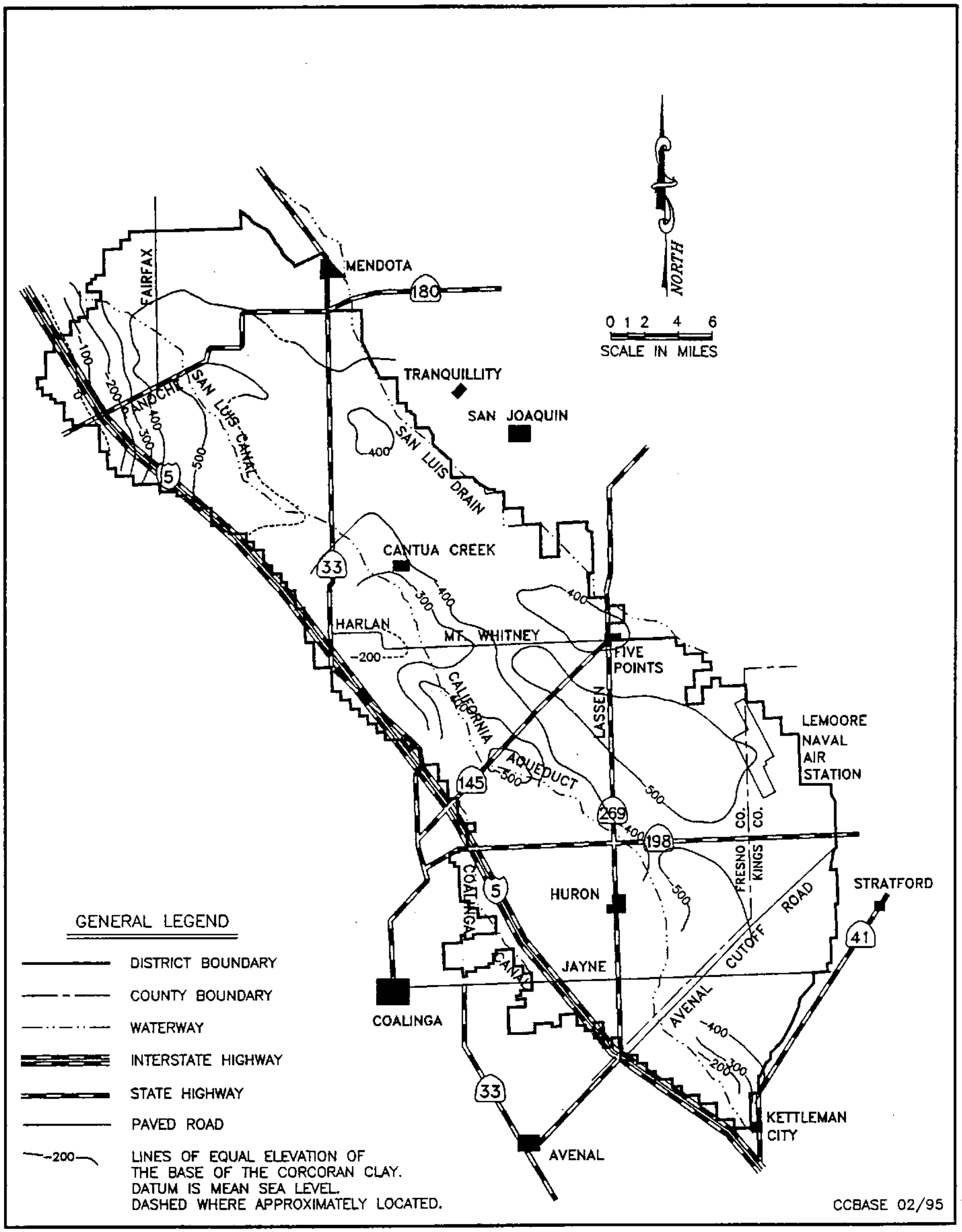

Figure 12: Elevation of Base of the Corcoran Clay.

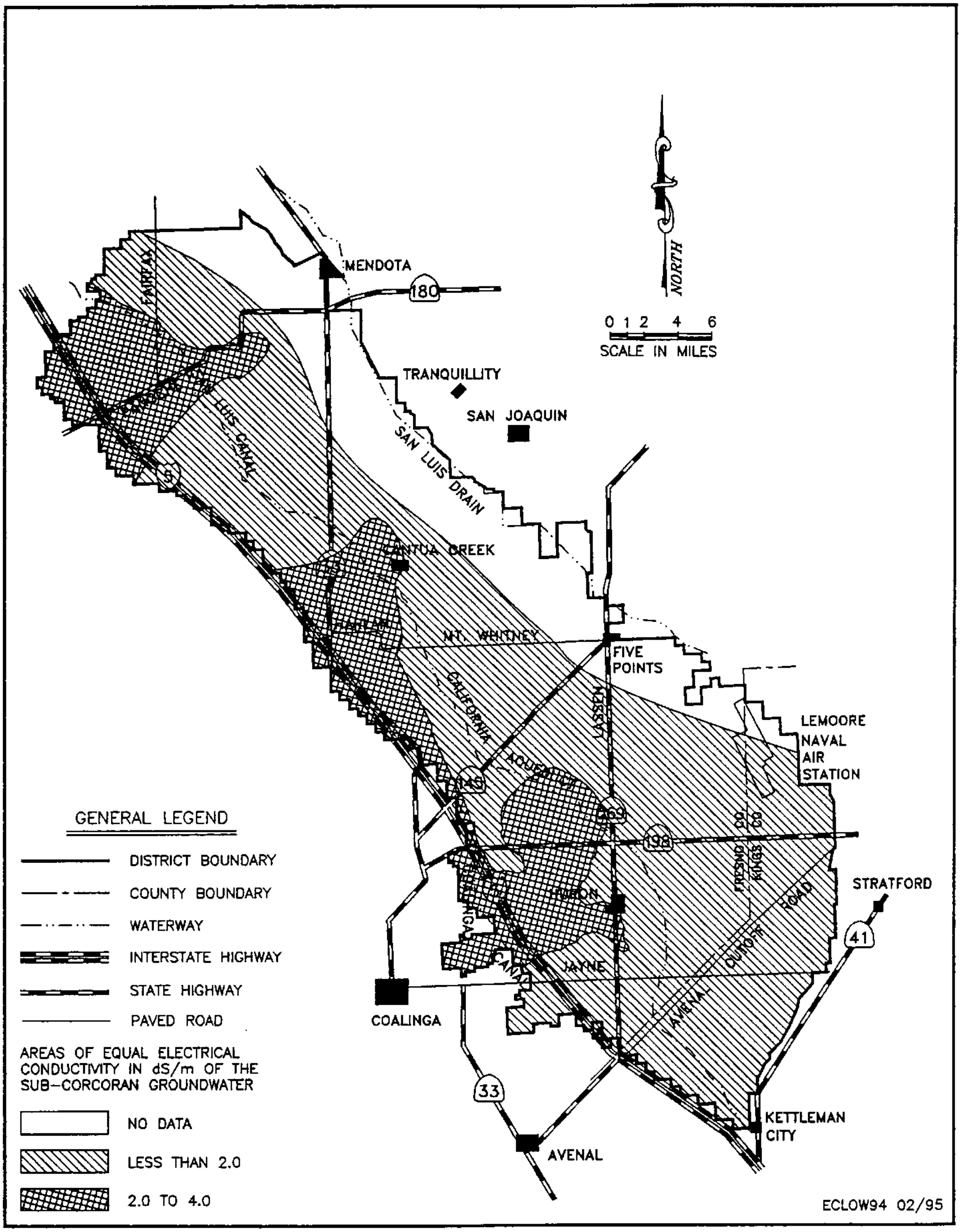

Figure 13: Electrical Conductivity of Sub-Corcoran Groundwater, December 1994.

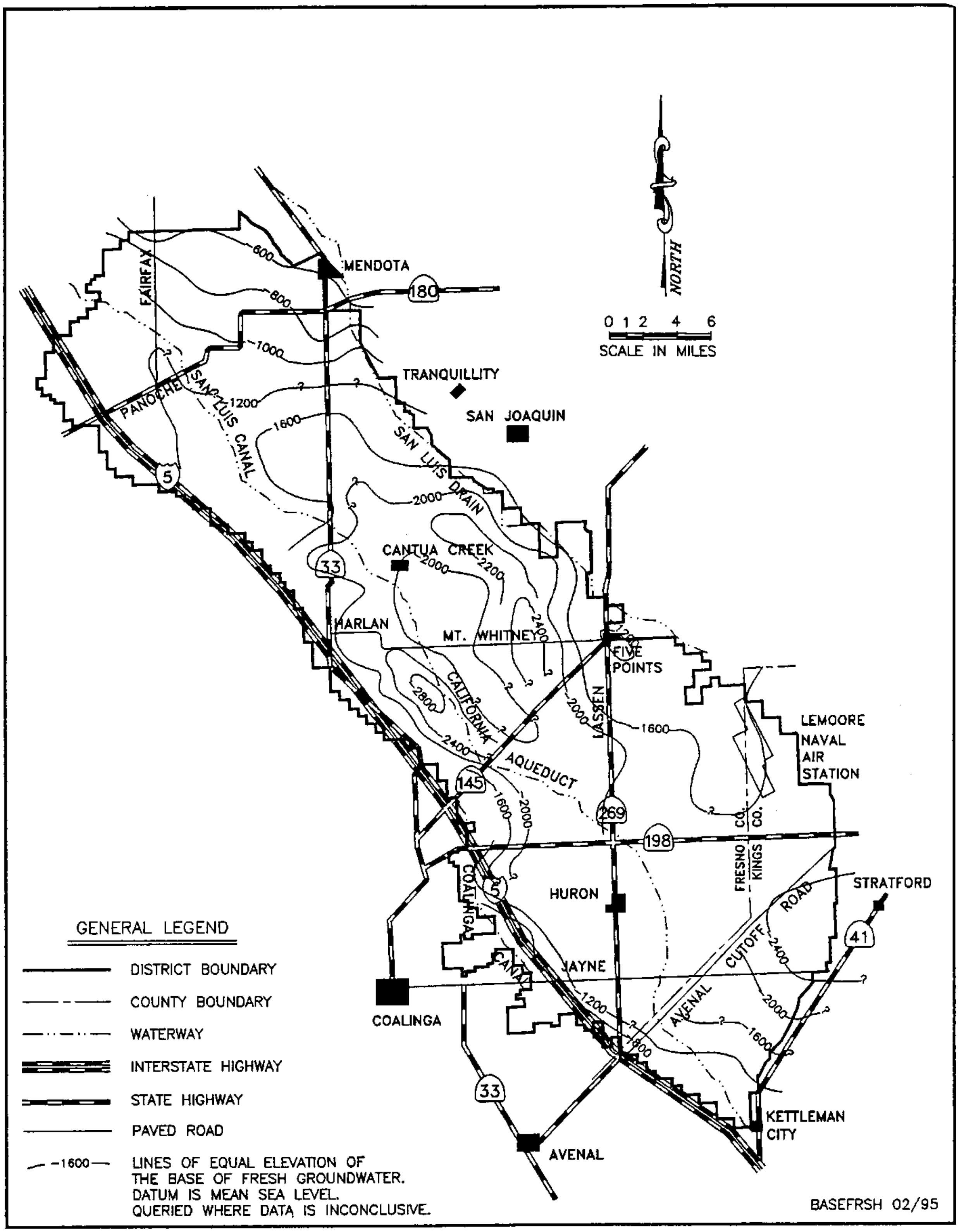

Figure 14: Elevation of Base of Fresh Groundwater.

Groundwater Monitoring Program

Project water supplies are carefully allocated and all surface deliveries are metered, yielding accurate water use data with which to manage the supply and recoup water delivery costs. Surface water quality is monitored by state and federal agencies and the District. On the other hand, pumping from private wells is at the discretion of the landowners.

Groundwater measurement and quality testing have proved useful to individual farmers to help them better manage water supplies, facilitate more accurate irrigation scheduling, monitor pump efficiency, and participate in District groundwater programs. Such measurement and testing also enable the District to better monitor groundwater supplies, calculate drought effects, and determine water needs.

The shortage of Project water since 1990 has necessitated the construction of many new wells so that groundwater could be used to help supplement surface supplies. More than 150 wells were drilled during the 1990-1995 period, bringing the total number of operational wells within the District to about 750. About 60 percent of the operational wells were metered in 1995. Many farmers participated in District Groundwater Exchange and Integration Programs during the 1990-94 period. These programs were implemented to increase the District's available water supply and enhance the flexibility in the use of groundwater in terms of timing and location.

Groundwater monitoring is an essential part of managing any conjunctive use program. This information is vital to determine the effect of groundwater pumping on (1) groundwater overdraft, (2) water quality, (3) pumping costs, and (4) subsidence. Without effective monitoring, the short- and long-term impacts of conjunctive use programs cannot be assessed.

The wells in Westlands are monitored annually for water level and quality by District staff. This is done by sounding each well while in a static condition and measuring the electrical conductivity of the water while the well is operating. The results appear in various District reports and maps. This information enables the District to monitor groundwater trends, report the results to farmers, and estimate District-wide pumped groundwater quantities. This also enables the District to calculate seasonal application efficiency more accurately.

Groundwater Conditions

Prior to the delivery of CVP water to Westlands, the annual groundwater pumpage ranged from 800,000 to 1,000,000 acre-feet (AF) during the period of 1950-1968. The majority of this pumping was from the aquifer below the Corcoran Clay causing the sub-Corcoran piezometric groundwater surface to reach the lowest recorded average elevation of more than 150 feet below mean sea level by 1968. The large quantity of groundwater pumped prior to delivery of CVP water compacted water bearing sediments and caused land subsidence which ranged from 1 to 24 feet between 1926 and 1970 (U.S. Geological Survey, 1988).

With the beginning of CVP water deliveries in 1968, the groundwater surface rose steadily until reaching 89 feet above mean sea level in 1987, the highest average elevation of record dating back to the early 1940s. The only exception during this period was the increase in pumping and accompanying drop in the groundwater surface elevation due to the 1977 drought and reduced CVP water supply. An increase in pumping to approximately 472,000 AF during 1977 caused a dramatic drop in the groundwater surface elevation of approximately 97 feet.

During the 1990s, groundwater pumpage quantities have increased tremendously because of the reduced CVP water supplies caused by the extended drought and regulatory actions related to the Central Valley Project Improvement Act, the Endangered Species Act, and Bay/Delta water quality. Groundwater pumpage quantities are estimated to have reached 600,000 AF annually during 1991 and 1992 when the District received only 25 percent of its contractual entitlement of CVP water. This increased pumping caused the groundwater surface to decline to 62 feet below mean sea level, the lowest elevation since 1977.

An abundant surface water supply due to record precipitation in 1995 reduced the estimated quantity of groundwater pumped to 150,000 AF, allowing the average groundwater surface elevation to increase 78 feet to an average elevation of 27 feet above mean sea level. Overall, due to the mostly water-short years since 1990, the average piezometric water surface elevation has declined approximately 36 feet from December 1989 to December 1995. Another impact of reduced surface water deliveries is an increase in subsidence in areas of the Central Valley. The Department of Water Resources estimates the amount of subsidence since 1983 has been up to two feet in some areas of the District with the majority occurring since 1989. The estimated amount of groundwater pumpage from 1976 through 1995 is shown in Table 39. Table 39 also shows the average elevation of the groundwater in the lower water bearing zone and the average change in elevation from the prior year.

The average elevation of the Sub-Corcoran piezometric groundwater surface and the estimated amount of groundwater pumped in Westlands are shown in Figure 15.

Table 39: Groundwater Pumpage.

Crop Year[1/]	Pumpage	Elevation	Elevation Change	Crop Year[1/]	Pumpage	Elevation	Elevation Change
	AF	FT	FT		AF	FT	FT
1976	97,000	-2	9	1986	145,000	71	8
1977	472,000	-99	-97	1987	159,000	89	18
1978	159,000	-4	95	1988	160,000[2/]	64	-25
1979	140,000	-13	-9	1989	175,000[2/]	63	-1
1980	106,000	4	17	1990	300,000[2/]	9	-54
1981	99,000	11	7	1991	600,000[2/]	-32	-41
1982	105,000	32	21	1992	600,000[2/]	-62	-30
1983	31,000	56	24	1993	225,000[2/]	1	63
1984	73,000	61	5	1994	325,000[2/]	-51	-52
1985	228,000	63	2	1995	150,000[2/]	27	78

[1/] October 1 to September 30
[2/] District Estimate

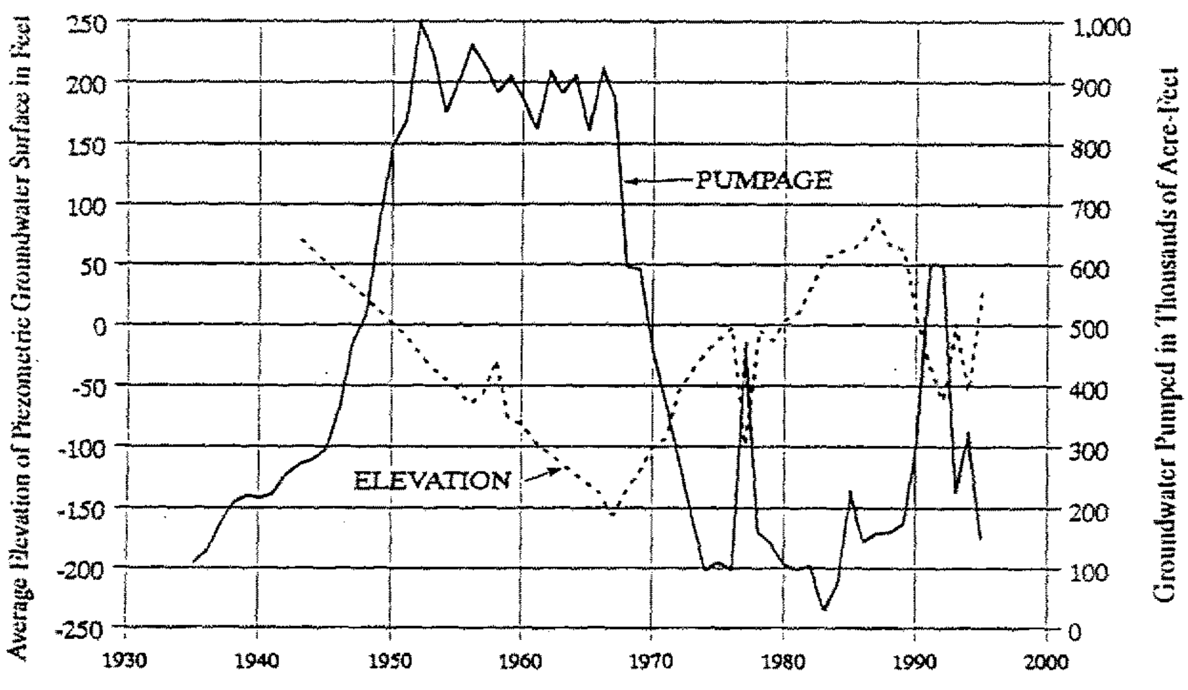

Figure 15: Historical Average Elevation of Sub-Corcoran Piezometric Groundwater Surface and Groundwater Pumpage.

The depth to the piezometric groundwater surface in the lower water-bearing zone during December 1989, December 1994, and December 1995 is shown in Figures 16, 17, and 18 respectively. The change in depth to the piezometric groundwater surface from December 1989 to December 1994 is shown in Figure 19. The change in depth to the piezometric groundwater surface from December 1994 to December 1995 is shown in Figure 20.

In addition to monitoring the water levels of wells pumping from the lower aquifer, the wells pumping from the upper aquifer are also monitored. The majority of the wells pumping from the upper aquifer had groundwater surface levels 100 to 200 feet below ground surface during December 1995 as shown in Figure 21.

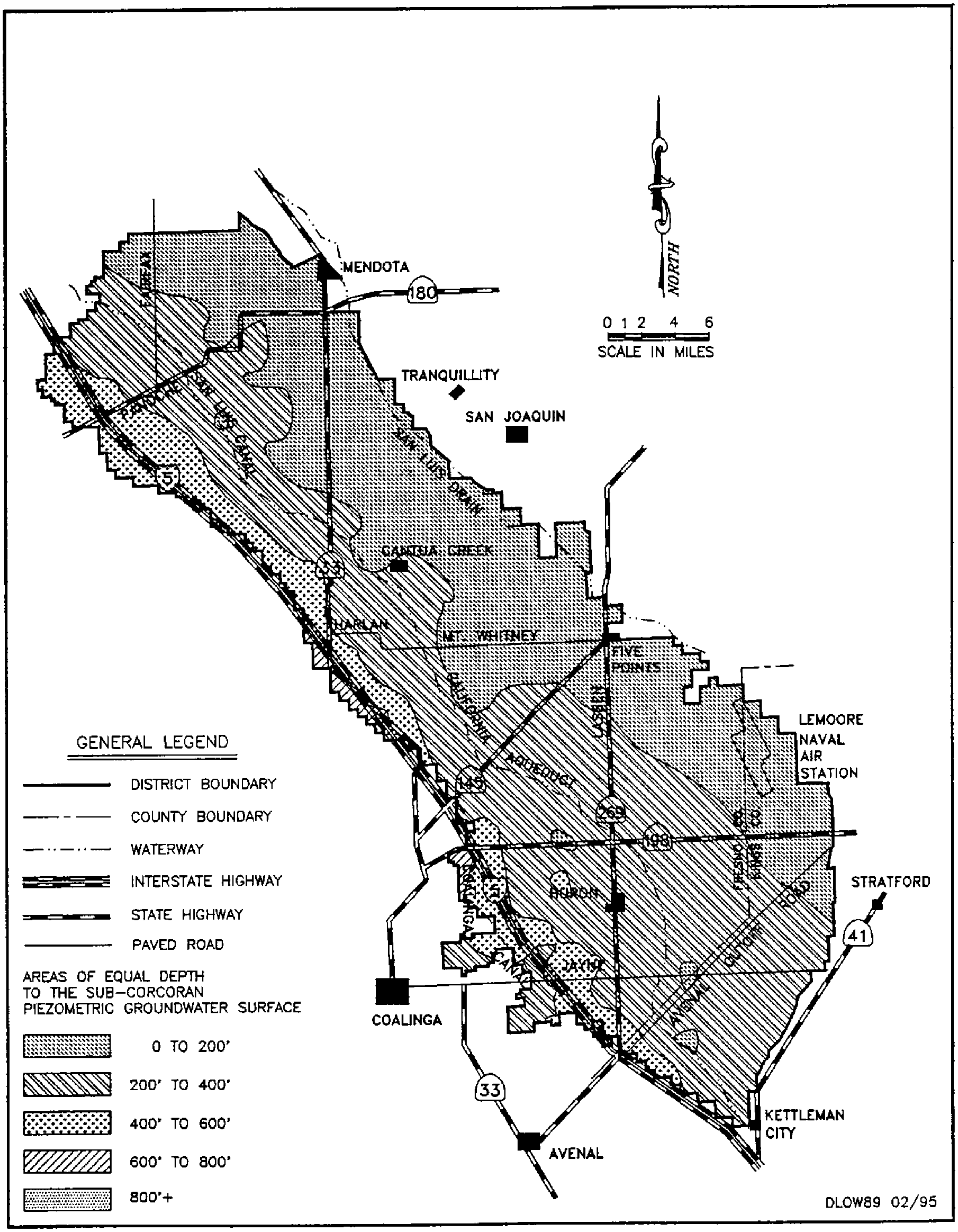

Figure 16: Depth to Sub-Corcoran Piezometric Groundwater Surface, December 1989.

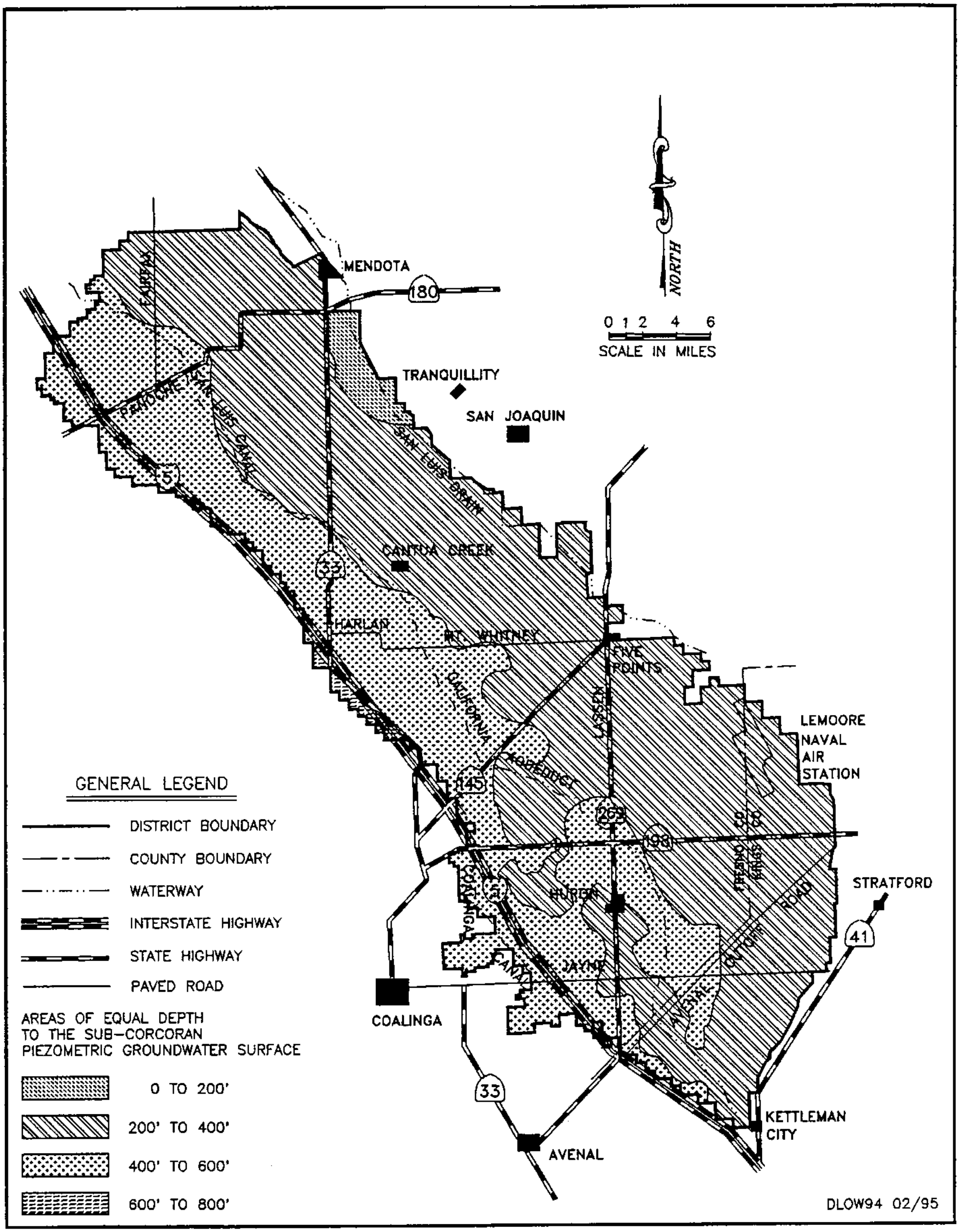

Figure 17: Depth to Sub-Corcoran Piezometric Groundwater Surface, December 1994.

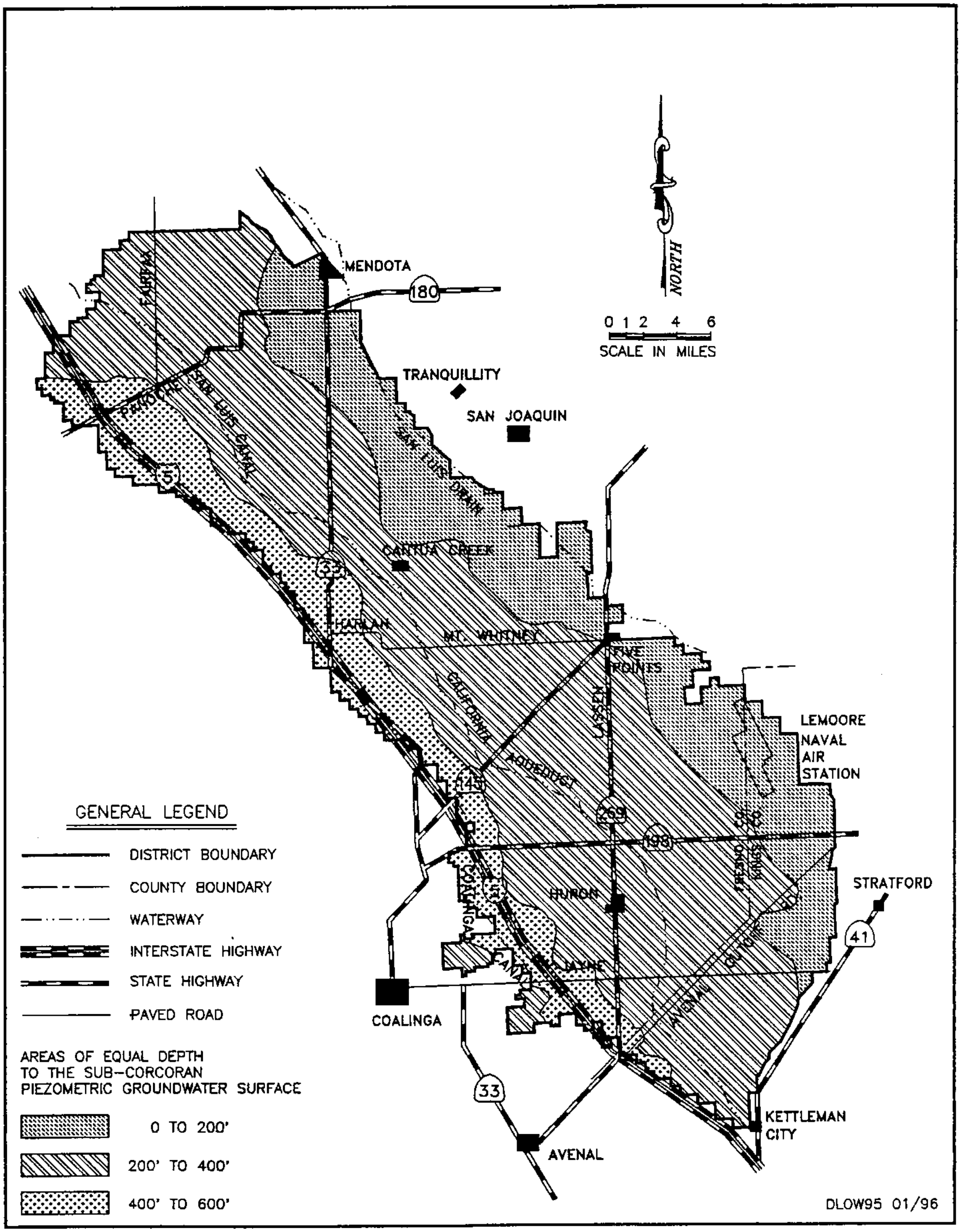

Figure 18: Depth to Sub-Corcoran Piezometric Groundwater Surface, December 1995.

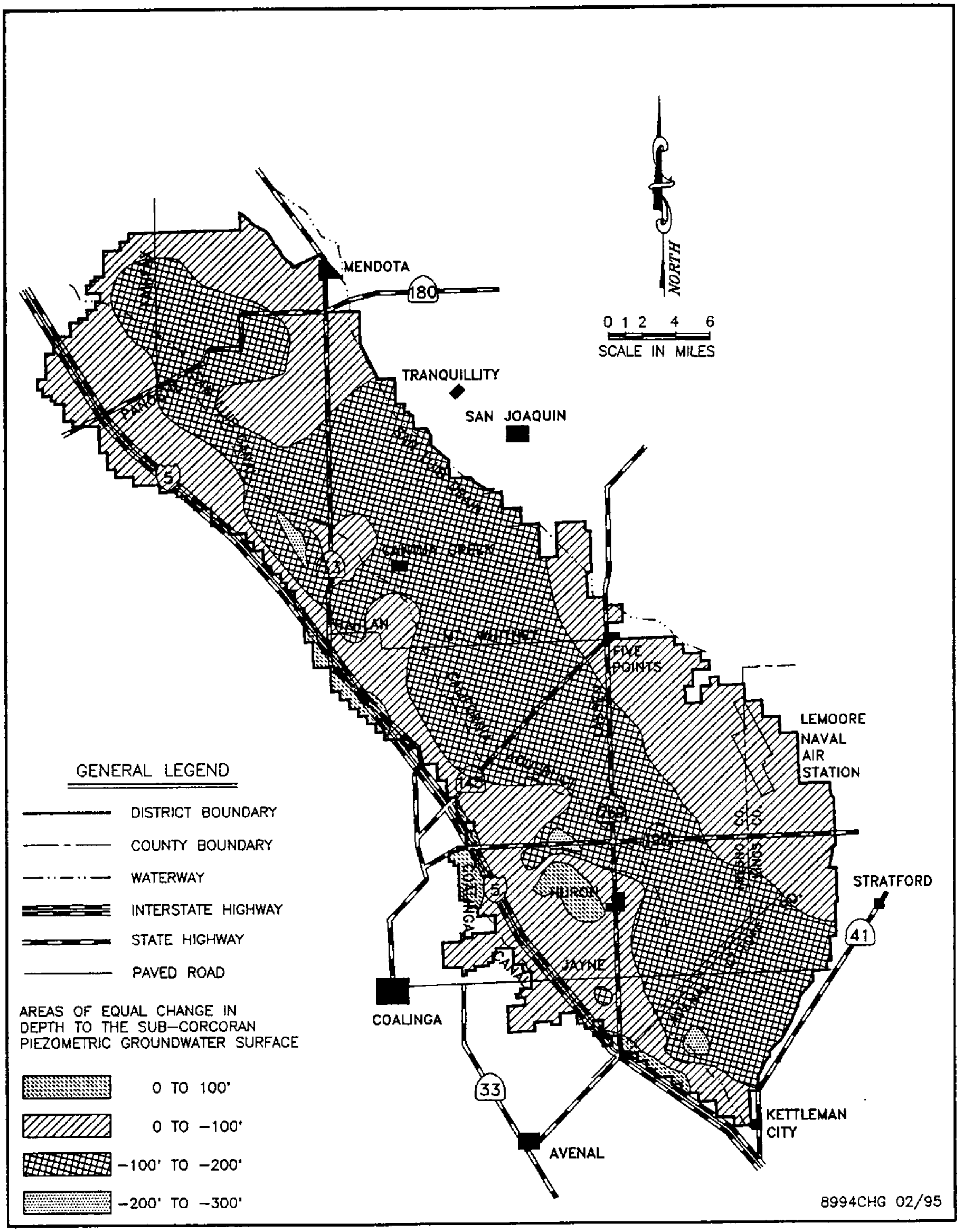

Figure 19: Change in Depth to Sub-Corcoran Groundwater, December 1989 to December 1994.

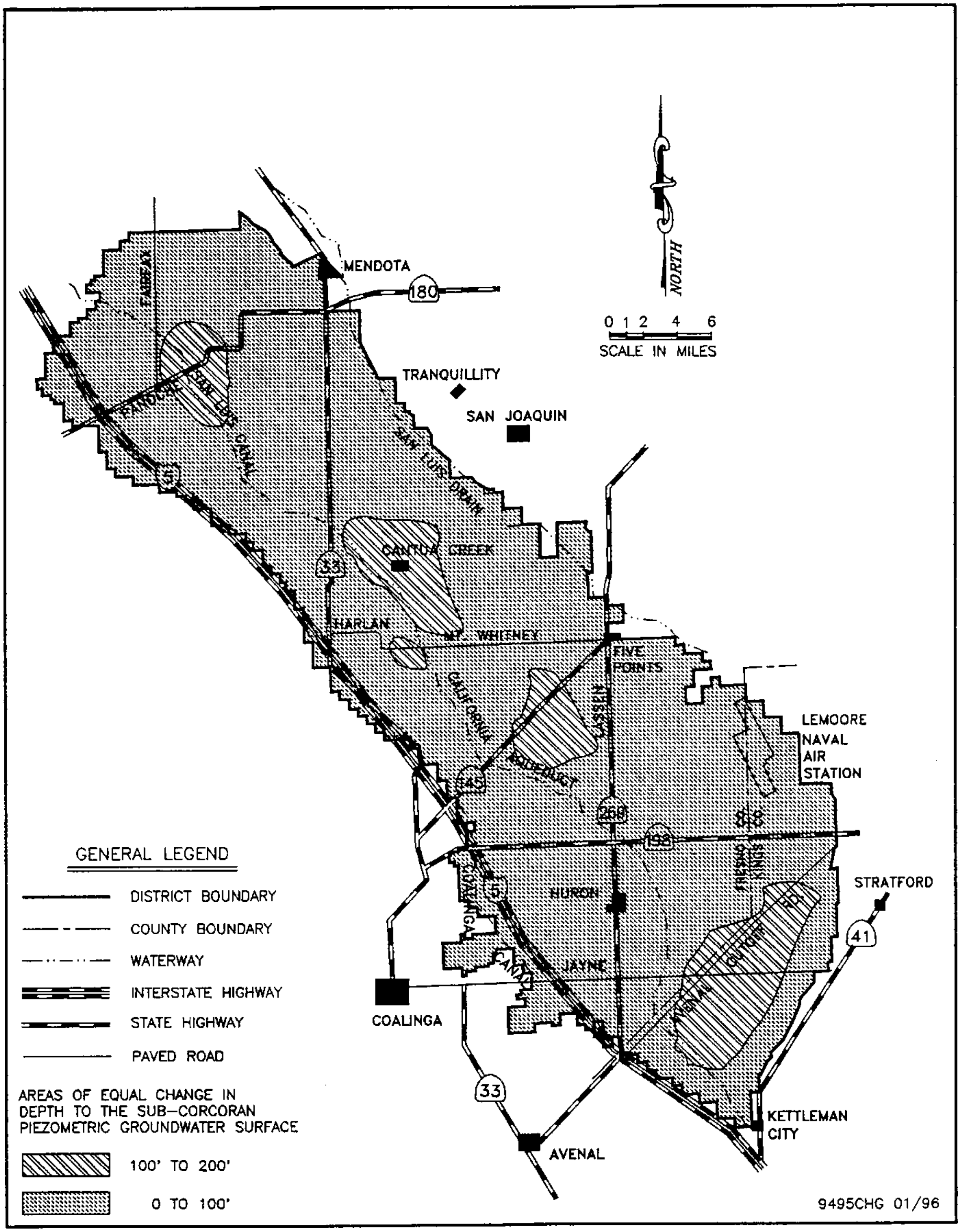

Figure 20: Change in Depth to Sub-Corcoran Groundwater, December 1994 to December 1995.

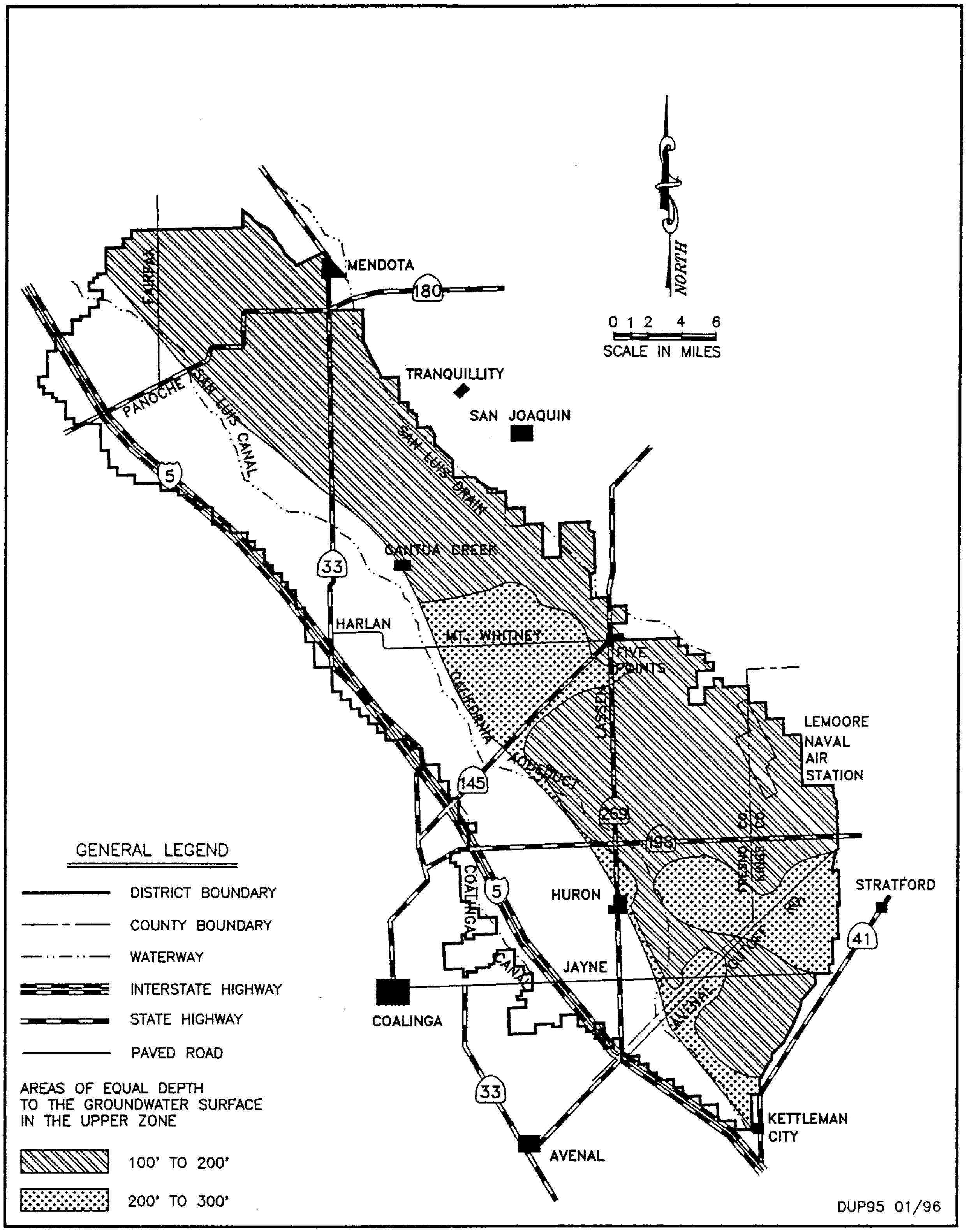

Figure 21: Depth to Groundwater in the Upper Zone, December 1995

Safe yield or current perennial yield is the maximum quantity of water that can be annually withdrawn from a groundwater basin over a long period of time (during which water supply conditions approximate average conditions) without developing an overdraft condition. Annual amounts of water extracted will vary below and above the prennial yield with water levels declining during times of increased pumping due to poor water supply conditions and water levels increasing or recovering during periods of decreased pumping, above normal precipitation, and good water supply conditions.

Current perennial yield can be estimated by plotting the amount of groundwater pumped in one year versus the average change in groundwater level in the basin for that year. Data for 1974 to present were plotted and a "best fit line" was drawn. The intersection of the best fit line with the line showing zero groundwater level change as shown in Figure 22 indicates the current perennial yield of groundwater to be approximately 200,000 AF.

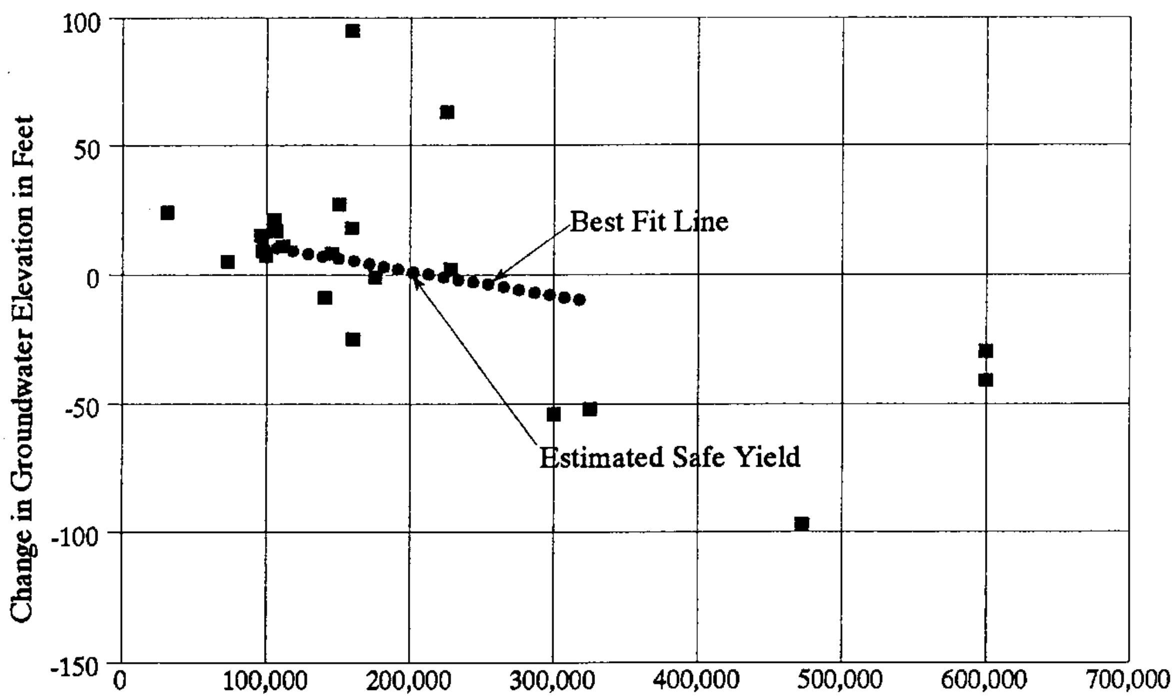

Figure 22: Change in Groundwater Elevation Versus Pumpage - Estimate of Safe Yield.

Proposed Programs

Westlands Water District's Groundwater Management Plan includes, but is not limited to, the following items. Each item below contains a brief description of past and present District programs and potential future policies and projects.

1. Monitoring and Analysis: The District has monitored groundwater conditions for over 20 years. District staff will continue to monitor and analyze groundwater conditions in Westlands. Water user wells will be monitored each winter to determine static groundwater elevations and salinity monitoring will be performed during the periods of high groundwater pumpage to ensure a representative sampling. The data will be analyzed by District staff to determine trends in groundwater elevation and quality. In addition, pumping estimates will be made along with estimates of the change in groundwater storage. Also, the District will recommend to the landowners and water users that all new wells be equipped with an access tube to accommodate sounding of the well to monitor groundwater elevations.

2. Development and Importation of New Surface Supplies: Westlands will continue to explore opportunities to increase the importation of surface water to stabilize water supplies and reduce the demand for water users to pump groundwater to satisfy their irrigation needs. District staff will seek both short-term and long-term agreements with other agencies which have temporary or sustainable surpluses in water supply. This includes exploring opportunities to negotiate exchange agreements with other agricultural and urban water suppliers in which the District would provide a portion of its allocation during drought years in exchange for a like or greater amount of surface water in normal or wet years.

Finally, Westlands will continue to encourage and facilitate wherever possible the importation of surface water by District water users. The District realizes that in addition to benefiting the individual water user, transfers into the District will reduce the need for groundwater extractions.

3. Restriction in the Exportation of Groundwater: The District will oppose increased levels of groundwater exportation from the District unless the exportation is mitigated by the importation of an equal or greater amount of non-Project water into the District. Those water users who have historically exported pumped groundwater outside the District's boundaries shall within two years of the adoption of this plan, submit an operational plan to the District. This plan shall include the location of the water user's existing wells in Westlands and an estimate of the amount of groundwater which the water user has exported outside the District boundaries from 1986-1995. The water user shall also identify any non-Project surface water supplies which they have imported into the District during that time. Also, the District will oppose any export of surface water from the District which will result in a net increase in the amount of groundwater pumped.

4. Water Conservation: Westlands will continue to have an active water conservation program designed to maximize efficient use of water in the District. District staff will continue to provide District specific information that water users need to effectively manage their irrigations.

This includes providing real-time crop water use information and information on water management techniques such as irrigation scheduling and evaluations. The District's water conservation coordinator will continue to be available to provide water users with technical assistance to meet their irrigation needs.

In addition, the District will continue to maintain its distribution system through preventive maintenance of District pumping facilities, pipelines, and water meters. The District will also maintain a flexible water ordering system to ensure that water users can best manage their water resources.

Westlands implemented the Irrigation System Improvement Program which provided low interest loans to District water users for irrigation system improvements. Funds for this program were provided by the State Water Resources Control Board. This program is intended to reduce the amount of deep percolation losses in the District by increasing irrigation efficiencies. The District will evaluate the Program to determine whether or not to provide funding for additional irrigation system improvements.

5. Water Management Information Program: The District will continue to conduct a program to provide water users with information on groundwater conditions and conservation activities. This information will be contained in the *Irrigator* newsletter through special reports and through water user workshops.

The District's Water Conservation Department developed an Irrigation Handbook in 1985 and continues to distribute copies to new District water users. Water Conservation staff also will continue to make available to District water users an in-house computer with irrigation management software. This software provides water users with an opportunity to explore various irrigation practices and schedules to learn their effects on irrigation efficiency and timing.

In addition, maps and reports on groundwater conditions and trends will continue to be made available to District water users. Workshops will also be conducted periodically to inform District water users on changes in the groundwater conditions and the status of the Groundwater Management Program.

6. Cooperation with Other Agencies: Westlands will work with other state and local agencies to better identify groundwater conditions and to exchange information. Data collected through the District's monitoring efforts will be provided to others so that conditions in the basin and other basins can be tracked. The District will also facilitate studies by agency and university personnel to model groundwater conditions in the basin. District will continue to participate on local and state committees which focus on groundwater conditions, issues, and policies which oversee local groundwater modeling efforts.

In addition, the District will work with other state and local agencies to more precisely identify the location and magnitude of subsidence. To the extent possible, the District will determine if specific actions in addition to those identified in this plan would have positive impacts on subsidence.

7. Groundwater Meters: The District will recommend to landowners and water users that all groundwater wells extracting groundwater within the District boundaries be equipped with a water meter. The District may develop and implement a program to maintain groundwater meters similar to the program which already exists for the District's surface water meters.

8. Well Construction and Abandonment: The administration of a well construction and well abandonment or destruction program has been delegated to the Counties by the California State Legislature. Fresno and Kings Counties have adopted programs consistent with Department of Water Resources Bulletin 74-81 and administer permit programs to assure proper construction, abandonment, or destruction of groundwater wells within the Counties. The District will continue to support Fresno and Kings Counties' policies regarding construction and abandonment of groundwater wells. The District will continue to work with these counties to make information on well construction and abandonment policies available to its water users.

9. Conjunctive Use: The District will explore potential conjunctive use projects within and outside of Westlands. This may include identifying possible recharge sites within the District boundaries or purchasing or leasing lands adjacent to the District. Other options may include entering into a long-term arrangement to bank water with another agency or district which would be extracted during times of water shortages.

In addition, the District will continue to operate its Distribution System Integration Program (DIP). This program allows water users to use the District's water distribution system to convey groundwater to other points of use within the District. This program allows for the improved use of groundwater resources.

Westlands will continue to work with local, state, and federal authorities to provide for the long-term use of the San Luis Canal/California Aqueduct to store and transport ground-water pumped from within and outside the District. This program has been authorized on a year-to-year basis in the past by the state as a drought relief measure. As with the DIP program, this program would allow for much greater flexibility in both the timing and location of groundwater use.

APPENDIX A

RESOLUTION NO. 107-95

WESTLANDS WATER DISTRICT

INTENT TO PREPARE A GROUNDWATER MANAGEMENT PLAN

WHEREAS, groundwater resources are an important component of the District's overall water supply and vital to the viability of farming in Westlands Water district; and

WHEREAS, California Water Code Sections 10753, et seq., (AB 3030) provide that any local agency whose service area includes a groundwater management pursuant to other provisions of law or a court judgment or decree, may be ordinance or by resolution adopt and implement a groundwater management plan for all or a portion of its service area; and

WHEREAS, the U.S. Bureau of Reclamation has developed and adopted "Criteria for Evaluating Water Conservation Plans," pursuant to Public Law 102-575 Section 3405(e) which require districts receiving federal water in California to develop a groundwater management plan pursuant to California Water Code Section 10750 (AB 3030): and

WHEREAS, to satisfy this requirement, Westlands Water District in its Water Conservation Plan Update, December 1993, has committed to the development of a groundwater management plan subject to the landowners' decision on whether to adopt such a plan; and

WHEREAS, there has been no public objection to the District preparing a groundwater management plan for approval by the Board of directors.

NOW, THEREFORE BE IT AND IT IS HEREBY RESOLVED that Westlands Water District intends to prepare a groundwater management plan for the purpose of implementing the plan and establishing a groundwater management program, in accordance with Water Code Section 10750, et seq., subject to final approval by the Board of Directors and the landowner protest provision of Water Code Section 10753.6.

AYES: Directors Dingle, Borba, Coelho, Devine, Errotabere, Gardner, Hurlbutt, Schmiederer, and Souza
NOES:
ABSENT:

ADOPTED: March 20, 1995

APPENDIX B

RESOLUTION NO. 112-96

WESTLANDS WATER DISTRICT

ADOPTION OF GROUNDWATER MANAGEMENT PLAN

WHEREAS, the Board of Directors adopted a resolution of intent to prepare a groundwater management plan on March 20, 1995; and

WHEREAS, the District has prepared a draft groundwater management plan entitled "Westlands Water District Groundwater Management Plan;" and

WHEREAS, the District has made copies of the plan available to the public and notice of the public hearing on whether to adopt the draft Groundwater Management Plan was given in the manner prescribed by law; and

WHEREAS, all persons desiring to be heard at the public hearing were given the opportunity to present their views to the Board of Directors and any written communications received by the District concerning adoption of the plan were publicly presented at the public hearing; and

WHEREAS, the District has considered all protests to the adoption of the plan and has determined that a majority protest under Section 10753.6 of the Water Code does not exist.

NOW, THEREFORE, BE IT AND IT IS HEREBY RESOLVED by the Board of Directors of Westlands Water District that it is in the best interest of the District to adopt the Groundwater Management Plan pursuant to Part 2.75 (commencing with Section 10750) of Division 6 of the Water Code and that the General Manager is authorized to take all actions reasonably necessary to carry out the intent of Westlands Water District Groundwater Management Plan.

AYES: Directors Dingle, Borba, Coelho, Devine, Errotabere, Gardner, Hurlbutt, Schmiederer, and Souza

NOES:

ABSENT:

ADOPTED: September 16, 1996

WESTLANDS WATER DISTRICT

Groundwater Conditions Report (December 2011)

March 16, 2012

Introduction

Westlands Water District (District) located on the west side of the San Joaquin Valley in Fresno and Kings Counties. The District receives water for irrigation from surface sources delivered through the Delta-Mendota Canal and the San Luis Canal (SLC) and from groundwater.

Agricultural production in the District area was originally developed and sustained with groundwater for irrigation. Surface water deliveries from the San Luis Unit of the Central Valley Project (CVP) began in 1968 with the goal to reduce historical groundwater pumping. However, the District's contractual entitlements for CVP water were and are not sufficient to irrigate the entire District thus some groundwater pumping is still required. Since 1990, CVP water supplies have been severely reduced due to drought and/or regulatory actions resulting from the Central Valley Project Improvement Act (CVPIA), the Endangered Species Act (ESA), Bay/Delta water quality requirements and Court orders. As a result, groundwater pumping has increased together with other conjunctive use programs to increase water users' flexibility in efficiently managing their groundwater and surface water supplies to meet crop water demands.

This increased reliance on groundwater resources to supplement surface water resulted in the development of the District's Groundwater Management Plan in 1996, which includes continuation of this groundwater monitoring and reporting program.

Geology

The San Joaquin Valley is a wide bedrock basin filled with thousands of feet of alluvial sediment deposited by streams and rivers flowing out of the adjacent mountains on both the east and the west. Westlands is located near the centerline of this basin, bordered on the east by the Fresno Slough and on the west by the Diablo Range of the California Coast Ranges.

The Diablo Range consists of complex, folded, and uplifted mountains, which are composed predominantly of sandstone and shale of marine origin. Eroded by creeks flowing from the Diablo Range, sediments form gentle sloping alluvial fans. The texture of the Diablo Range deposits depends on the relative position on the alluvial fan and ranges from coarse sand and gravel to fine silt and clay. Generally, those portions of Westlands lying high on the alluvial fans have permeable, medium-textured soils. With decreasing elevation from the west to east, soil textures become finer. These fine textured soils are characterized by low permeability and increased concentrations of water-soluble solids, primarily salts and trace elements.

The Sierra Nevada on the east side of the Valley is predominately comprised of uplifted granite rock overlaid in areas by sedimentary and metamorphic rock. Sierran alluvial deposits in the District consist primarily of well-sorted sands, with minor amounts of clay. The Sierran alluvium decreases in thickness and increases in depth below the surface toward the west. These coarse-textured sediments are characterized by high permeability and a low concentration of water-soluble solids.

One of the principal subsurface geological features of the San Joaquin Valley is the Corcoran Clay formation. Formed as a lakebed about 600,000 years ago, this clay layer ranges in thickness from 20 to 200 feet and underlies most of the District. Varying depths from 200 to 500 feet in the Valley through to 850 feet along the Diablo Range, the Corcoran Clay divides the groundwater system into two major aquifers—a confined aquifer below and a semi-confined system above.

Westside Groundwater Basin

The groundwater basin underlying the District is comprised generally of two water-bearing zones: (1) an upper zone above a nearly impervious Corcoran Clay layer containing the Coastal and Sierran aquifers and (2) a lower zone below the Corcoran Clay containing the Sub-Corcoran aquifer. These water-bearing zones recharged by subsurface inflow from the west, east, and northeast, and by percolation of applied surface water. A generalized cross section of the District showing the Corcoran Clay and these water-bearing zones is shown in Figure 23.

The Corcoran Clay separates the upper and lower water bearing zones in the majority of the District; however, it is not continuous and diminishes near the San Luis Canal. The United States Geological Survey (USGS) lines of equal elevation for the base of the Corcoran Clay shown in Figure 24.

Groundwater quality, measured as electrical conductivity, in the lower water-bearing zone varies throughout the District in Figure 25.[59] Typically, water quality varies with depth with poorer quality existing at the upper and lower limits of the aquifer and with the optimum quality somewhere between. The upper limit of the aquifer is the base of the Corcoran Clay with the USGS identifying the lower limit as the base of the fresh groundwater. The quality of the groundwater below the base of fresh water exceeds 2,000 parts per million total dissolved solids (TDS) which is too high for irrigating crops. The elevation of the base of the fresh groundwater is shown in Figure 26.

[59] 2010 EC map used because lack of groundwater wells found pumping in 2011 survey.

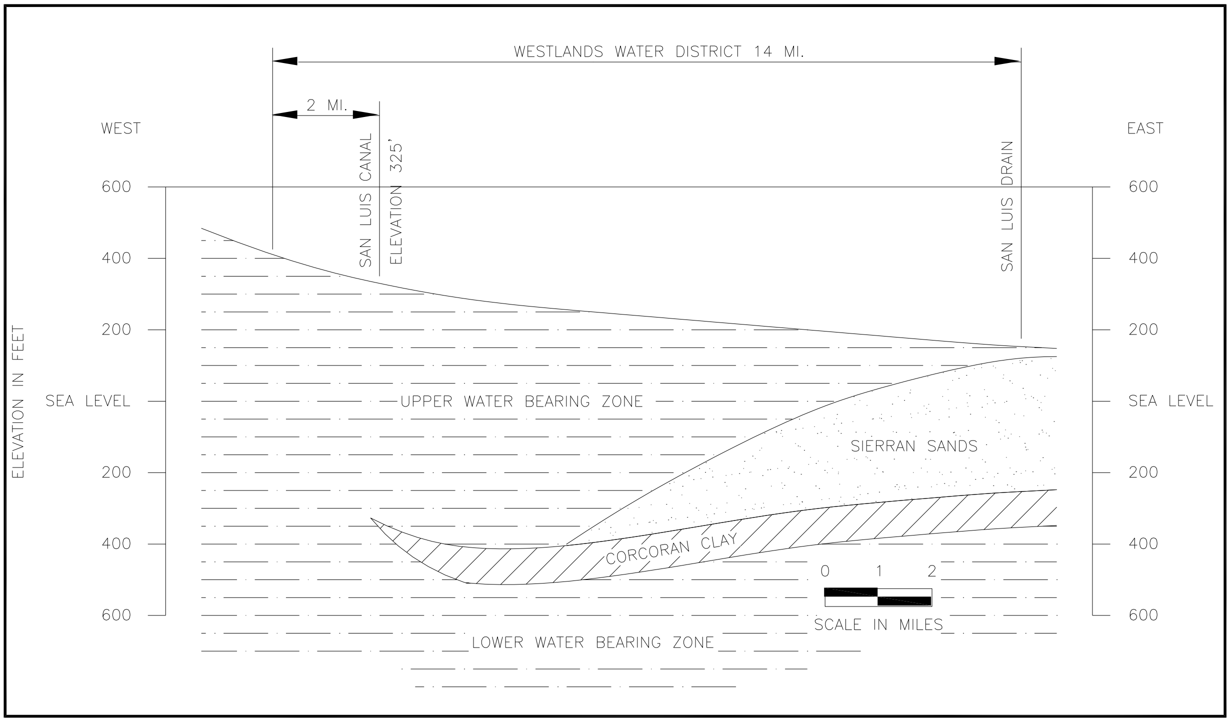

Figure 23: A generalized Hydro-geological Cross Section of the District.

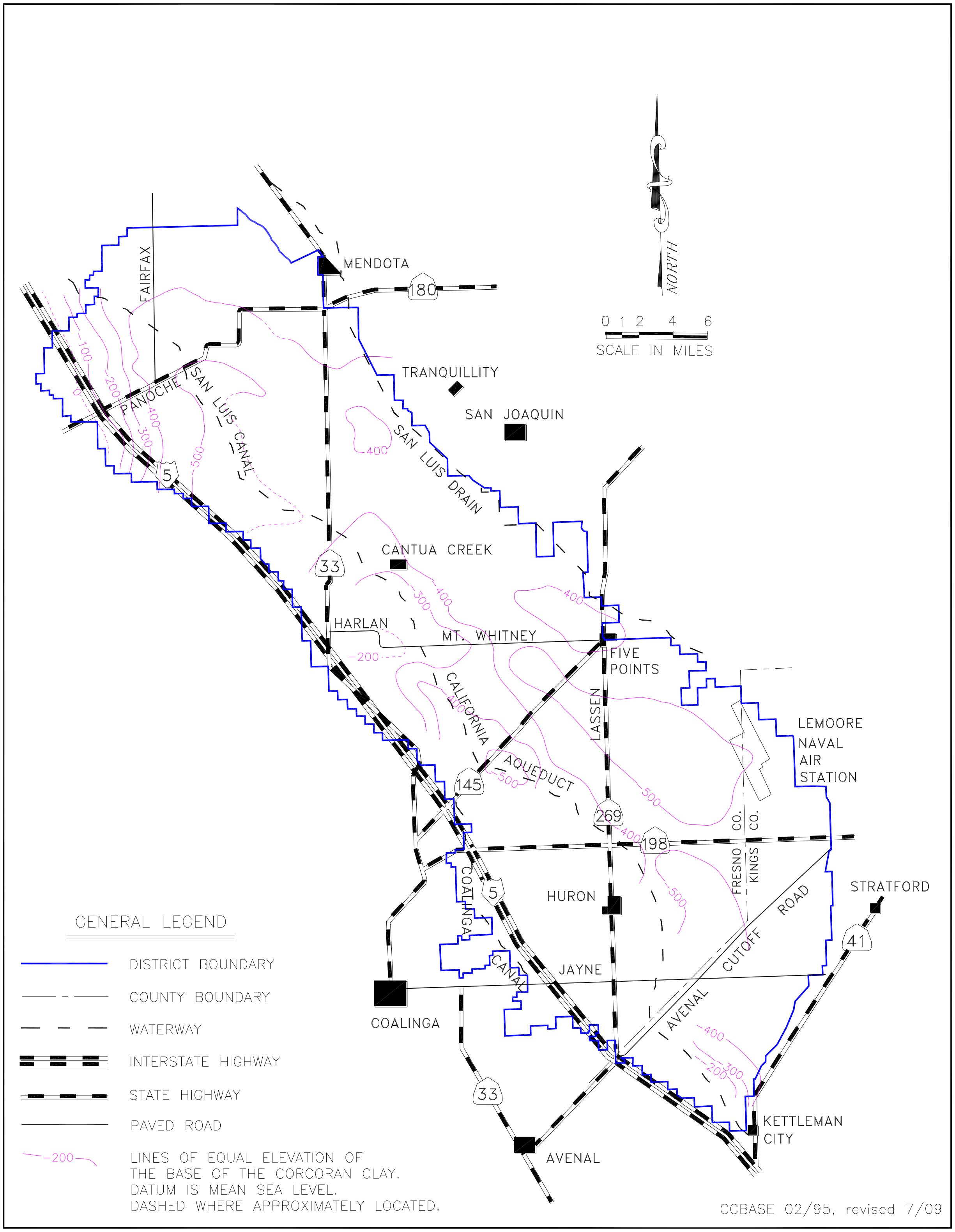

Figure 24: Elevation of the Base of the Corcoran Clay (USGS Lines of Equal Elevation).

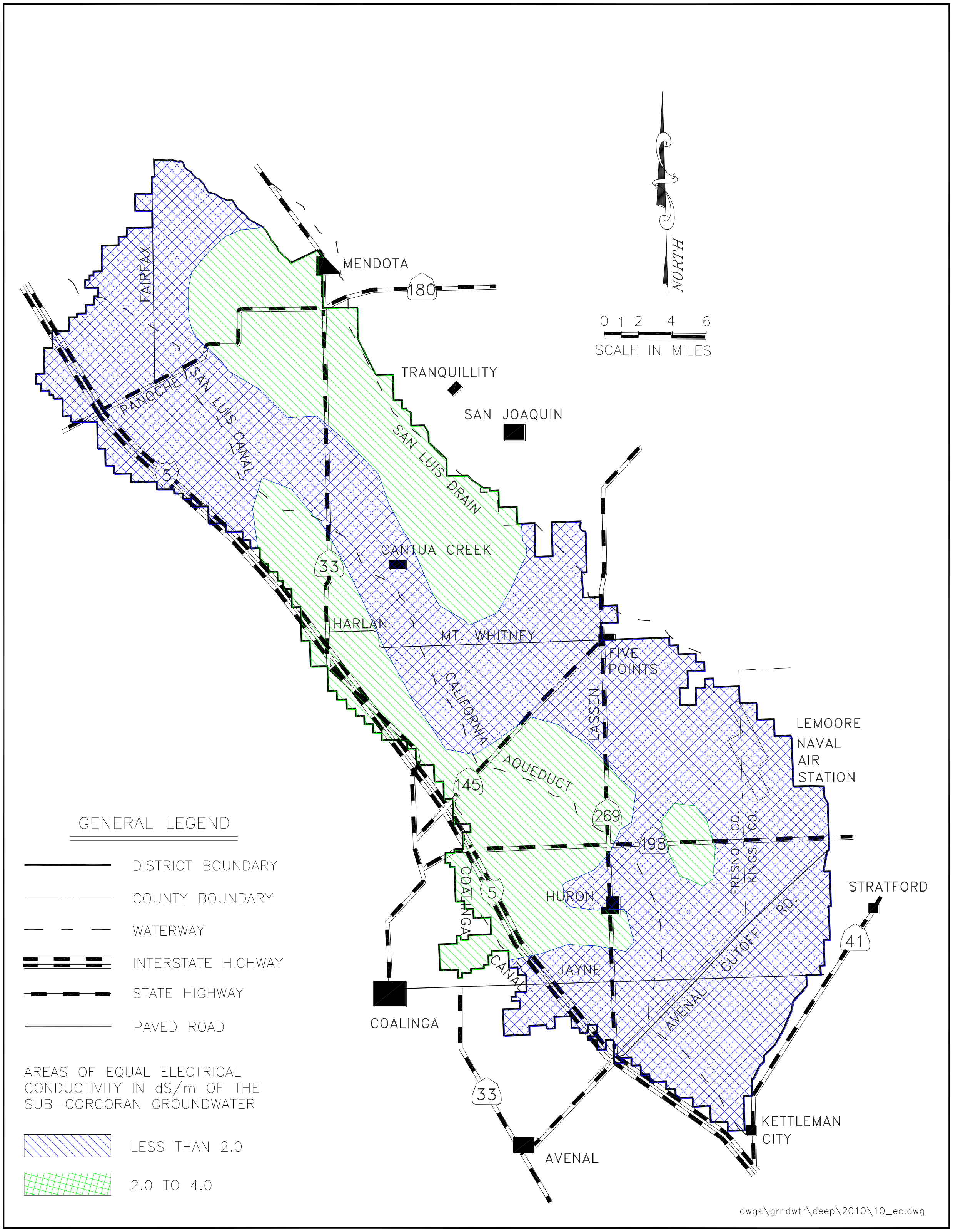

Figure 25: The Sub-Corcoran Groundwater, Electrical Conductivity (dS/m), December 2010.

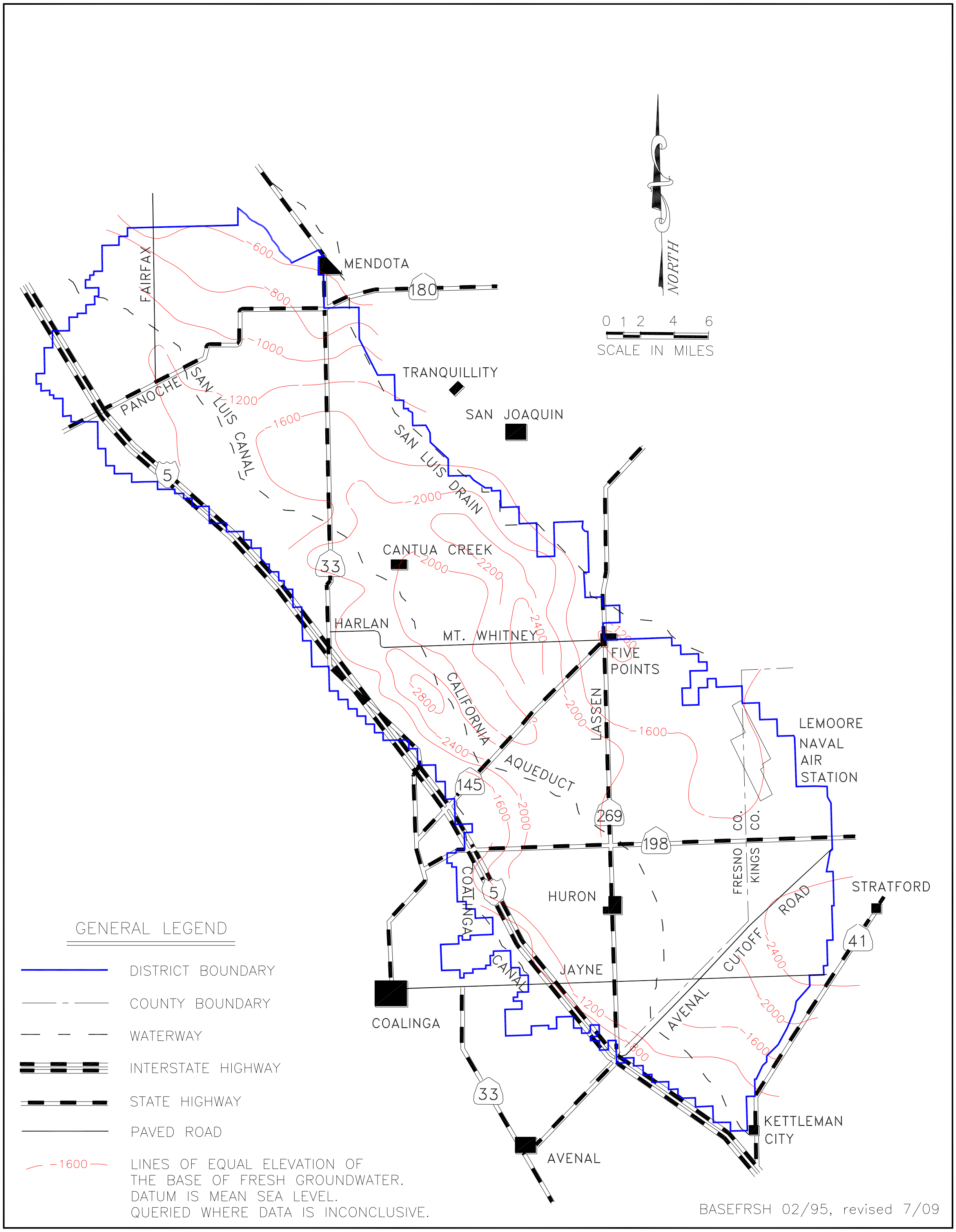

Figure 26: The elevation of the Base of Fresh Groundwater-USGS Lines of Equal Elevation.

Groundwater Monitoring Program

CVP Project water and other surface water supplies are carefully allocated and all deliveries are metered resulting in accurate water use data to manage the supplies and determine water delivery costs. Surface water quality is monitored by state and federal agencies.

Groundwater measurements and quality testing have proved useful to water users in helping them manage water supplies, facilitate accurate irrigation-scheduling, monitor pump efficiency and participate in District groundwater programs. It also enables the District to better monitor groundwater supplies, calculate drought impacts, and determine long-term water needs.

Groundwater monitoring is an essential part of managing any conjunctive use program. This information is vital to determine the affect of groundwater pumping on the aquifer, aquifer water quality, pumping costs, and subsidence. Without effective monitoring, the short and long-term impacts of conjunctive use cannot be determined.

Annually, District wells are monitored by sounding each well while in a static condition for depth or measuring the electrical conductivity of the water while the pump is operating. Results from the annual survey are stored in a Groundwater database and used to formulate District reports and maps. The survey information enables the District to monitor groundwater trends, provide reports to water users, estimate District-wide pumped groundwater quantities, and calculate seasonal application efficiency more accurately.

Many of the District water users participated in the Canal Integration Program (CIP) and the District Groundwater Integration Program (DIP) during the 1990-1994, which allowed groundwater to be pumped into the SLC and into the District's distribution system. The water users received surface water credits for the volume of groundwater pumped into the system, which then used to meet their crop demand schedule. However, in 1995, the California Department of Water Resources (DWR) suspended the discharge of groundwater into the SLC, due to concerns that groundwater could degrade the water quality. The DIP program has continued throughout this period except in years when the District received full water supply. Briefly, in 2008, DWR allowed the District to pump groundwater into the SLC for the period June through September because of restricted pumping from the Delta.

The reduction of CVP water and other surface water supplies has resulted in the construction of many new wells, to obtain additional water to make up for the shortfall in surface irrigation water. During 2000-2009, two hundred thirteen wells were constructed within the District, and from 2010 to present an additional 28 wells were constructed.

In December 2011, District staff conducted the annual Deep Groundwater Survey. The total number of operational wells within the District was 629 with 94.6% having meters, 82 non-operational wells with 43.9% having meters. Additionally, the District monitors eighty-two wells outside its boundaries; 51 operational wells with 80.4% having meters; 7 non-operational wells with one meter. The majority (90%) of non-District wells are located in the Five-Points area.

General Conditions

Prior to the delivery of CVP water into the District, the annual groundwater pumping ranged from 800,000 to 1,000,000 acre-feet (AF) during the period of 1950-1968. The majority of this pumping was from the aquifer below the Corcoran Clay causing the sub-Corcoran piezometric groundwater surface to reach the lowest recorded average elevation of 156 feet below mean sea level in 1967. The USGS calculated that the large quantity of groundwater pumped prior to delivery of CVP water compacted water bearing sediments and causing land subsidence ranging from one to twenty-four feet between 1926 and 1972.

After CVP water deliveries began in 1968, the groundwater surface rose steadily until reaching 89 feet above mean sea level in 1987, the highest average elevation on record dating back to the early 1940's. The only exception during this period was in 1977 when a drought and drastic reduction of CVP deliveries resulted in groundwater pumping of approximately 472,000 AF and accompanying drop in the groundwater surface elevation of approximately 97 feet.

During the early 1990's, groundwater pumping increased due to reduced CVP water supplies caused by drought and regulatory actions related to the Central Valley Project Improvement Act, the Endangered Species Act, and Bay/Delta water quality requirements. Groundwater pumping reached an estimated 600,000 AF annually during 1991 and 1992 when the District received only 25 percent of its contractual entitlement of CVP water. This increased pumping caused the groundwater surface to decline to 62 feet below mean sea level, the lowest elevation since 1977. Because of the groundwater pumping, increased subsidence occurred in the District and other areas in the western Central Valley. The Department of Water Resources estimated the amount of subsidence since 1983 to be almost two feet in some areas of the District with the most of that subsidence occurring since 1989.

Current Conditions

Over the last five years, five years, 2007 to 2011, CVP allocations averaged 45% (517,500 acre-feet) total groundwater pumped was 1,435,000 acre-feet and the groundwater surface elevation decreased 47 feet. In 2011, the CVP allocation was 80% (920,000 acre-feet) and accompanying decrease in groundwater pumped (45,000 acre-feet), the groundwater surface increase 40 feet to an average elevation of 49 feet above mean sea level.

The Groundwater elevations and the estimated amount of groundwater pumped from last sixty years are shown in Table 40. This table shows the average elevation of the groundwater in the lower water bearing zone and the change in elevation for each year.

Crop[60] Year	Pumped AF	Elevation FT	Elevation Change FT	Crop Year	Pumped AF	Elevation FT	Elevation Change FT
1952	1,000,000			1982	105,000	32	21
1953	952,000	-35		1983	31,000	56	24
1954	852,000	-9		1984	73,000	61	5
1955	904,000	-52		1985	228,000	63	2
1956	964,000	-65	-13	1986	145,000	71	8
1957	928,000	-56	9	1987	159,000	89	18
1958	884,000	-29	27	1988	160,000	64	-25
1959	912,000	-77	-48	1989	175,000	63	-1
1960	872,000	-81	-4	1990	300,000	9	-54
1961	824,000	-96	-15	1991	600,000	-32	-41
1962	920,000	-77	-48	1992	600,000	-62	-30
1963	883,000	-81	-4	1993	225,000	1	63
1964	913,000	-96	-15	1994	325,000	-51	-52
1965	822,000			1995	150,000	27	78
1966	924,000	-134		1996	50,000	49	22
1967	875,000	-156	-22	1997	30,000	63	14
1968	596,000	-135	21	1998	15,000	63	0
1969	592,000	-120	15	1999	20,000	65	2
1970	460,000	-100	20	2000	225,000	43	-22
1971	377,000	-93	7	2001	215,000	25	-18
1972		-54	39	2002	205,000	22	-3
1973		-37	17	2003	160,000	30	8
1974	96,000	-22	15	2004	210,000	24	-6
1975	111,000	-11	11	2005	75,000	56	32
1976	97,000	-2	9	2006	15,000	77	21
1977	472,000	-99	-97	2007	310,000	35	-42
1978	159,000	-4	95	2008	460,000	-11	-46
1979	140,000	-13	-9	2009	480,000	-31	-20
1980	106,000	4	17	2010	140,000	9	40
1981	99,000	11	7	2011	45,000	49	40

Table 40: 60-years of estimated groundwater pumpage.[61]

Figure 27 shows in graphical format the historical average elevation of the Sub-Corcoran piezometric groundwater surface and the estimated amount of groundwater pumped in the District. The Figures 28 and 29 shows the depth to the piezometric groundwater surface in the lower water-bearing zone during December 2008 and during December 2011, respectively. Change in depth to the piezometric groundwater surface from December 2008 to December 2011 shown in Figure 30.

[60] Crop year is from 1 October (previous year) to 30 September (current year) for the year in question.

[61] Data compiled from PG&E power records by USBR through 1971 and USGS 1974-1987, District estimates 1988-present. Elevation data for 1943-1961 and 1977 from Bill Coor, USBR (requested by the District and received on 4/20/1978) and elevation for 1966-1976 from Plate 5 of "Project Effects on Sub-Corcoran Water Layers" (April 1977).

In addition to monitoring the water levels of wells pumping from the lower aquifer, the wells pumping from the upper aquifer are also monitored. The majority of the wells pumping from the upper aquifer had groundwater surface levels 100 to 300 feet below ground surface during December 2011 as shown in Figure 31.

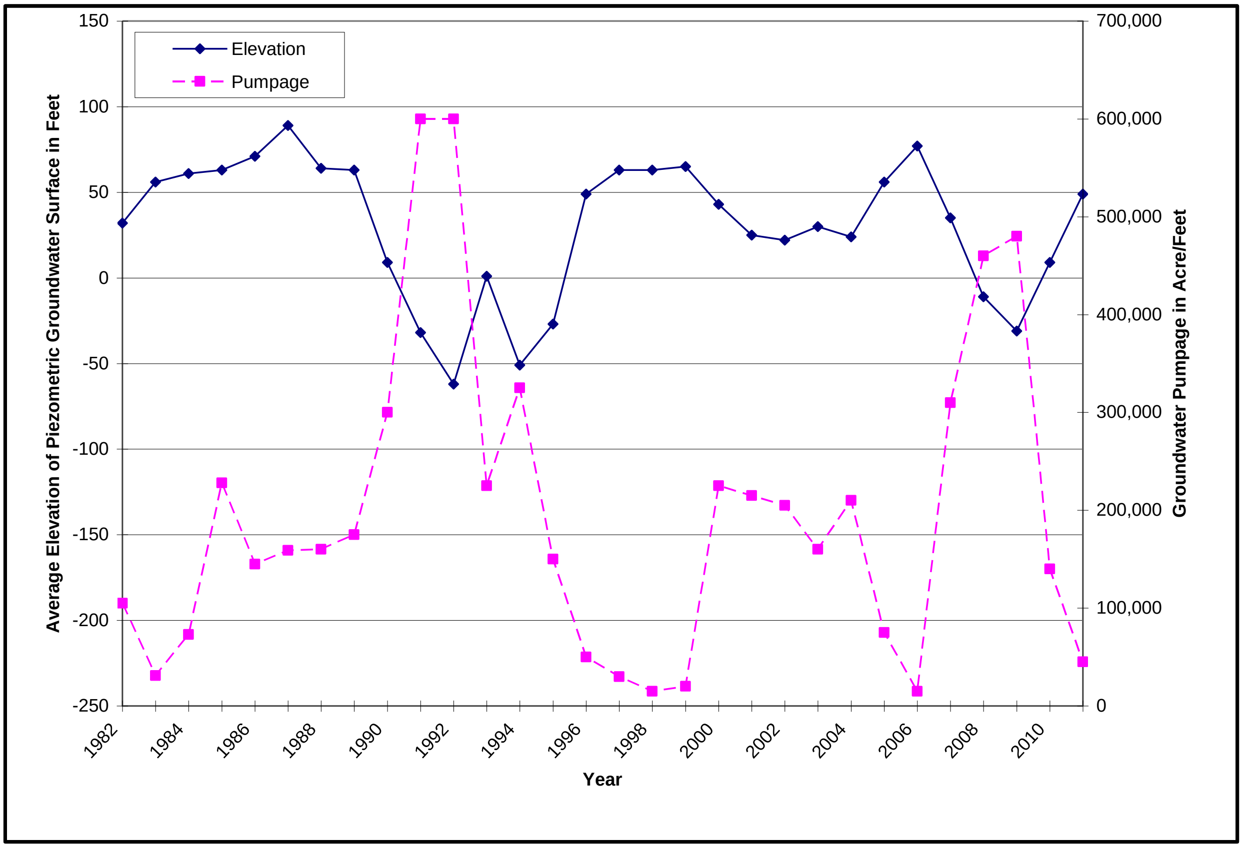

Figure 27: The historical 30-year Average Elevation of Sub-Corcoran Piezometric Groundwater Surface and Groundwater Pumpage.

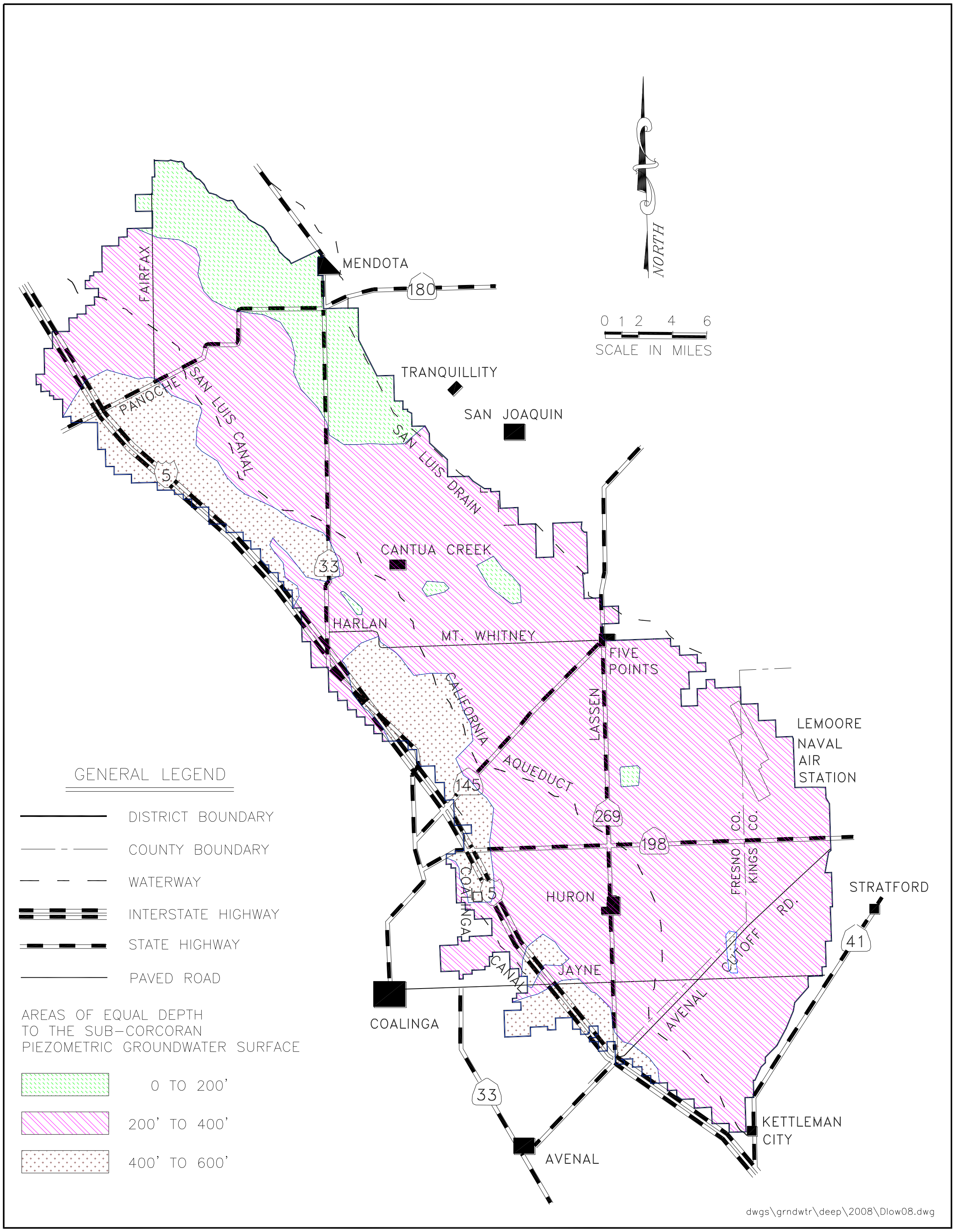

Figure 28: Depth to Sub-Corcoran Piezometric Groundwater Surface, December 2008.

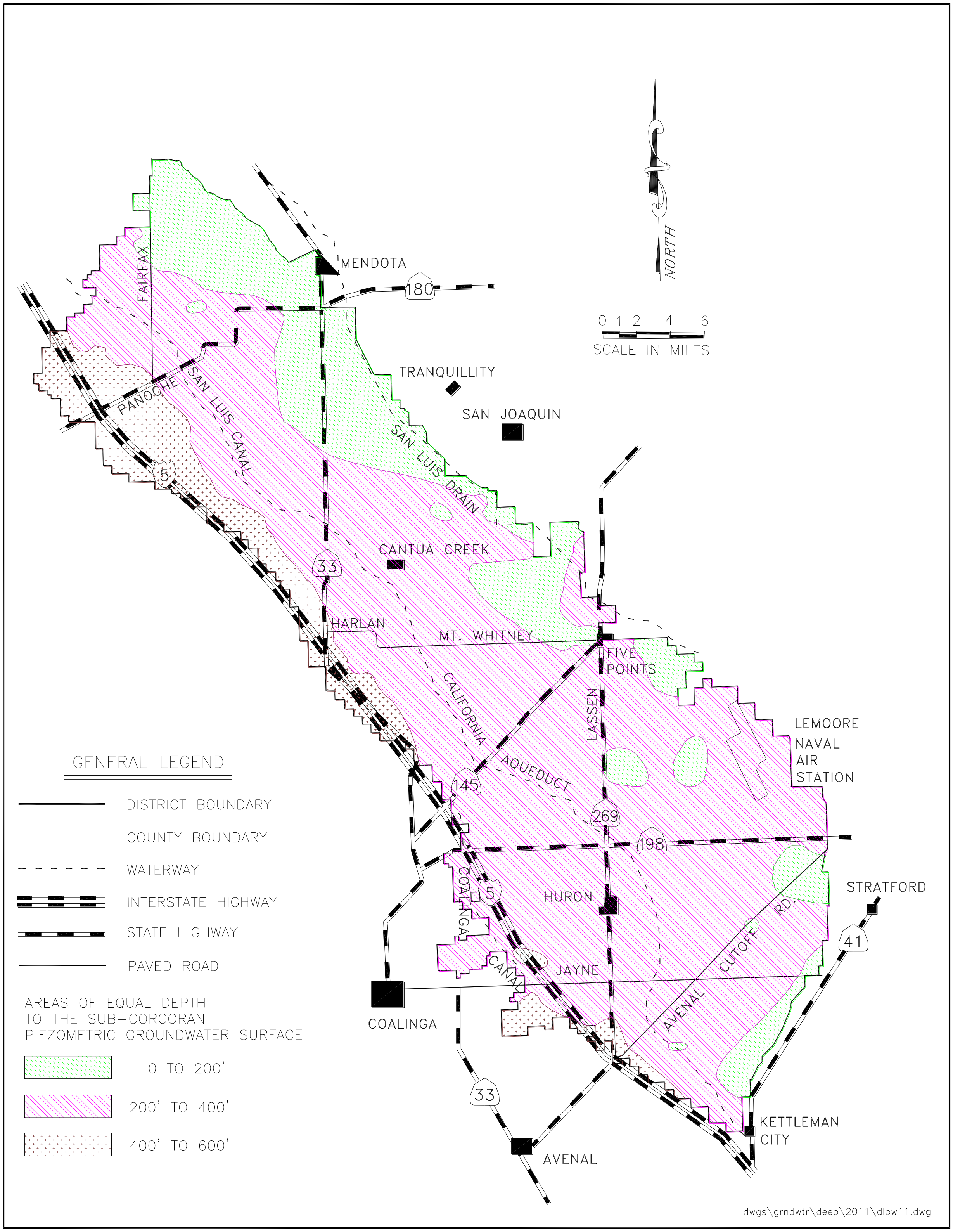

Figure 29: Depth to Sub-Corcoran Piezometric Groundwater Surface December 2011.

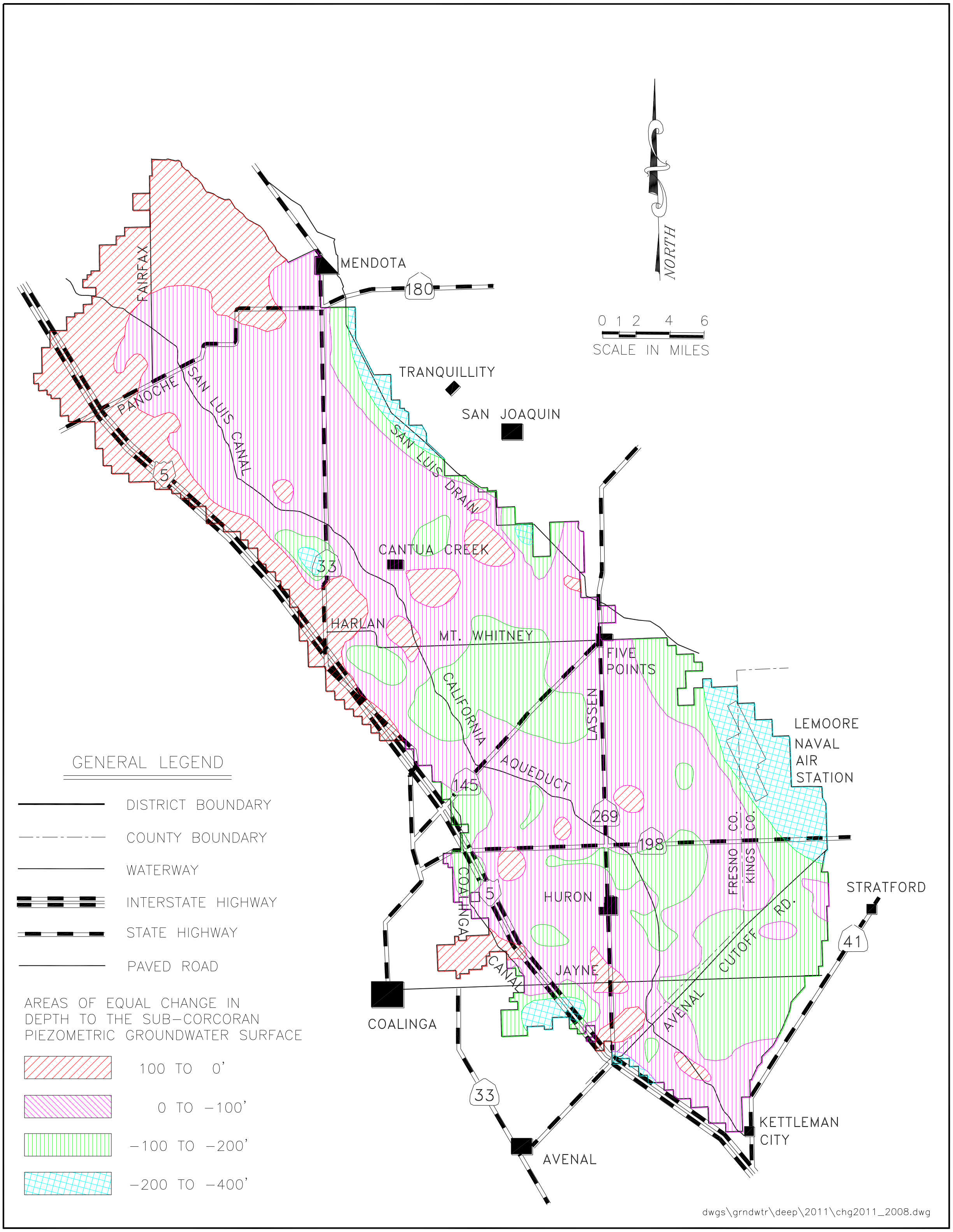

Figure 30: 2011 – 2008 Change in Depth to the Sub-Corcoran Piezometric Groundwater Surface.

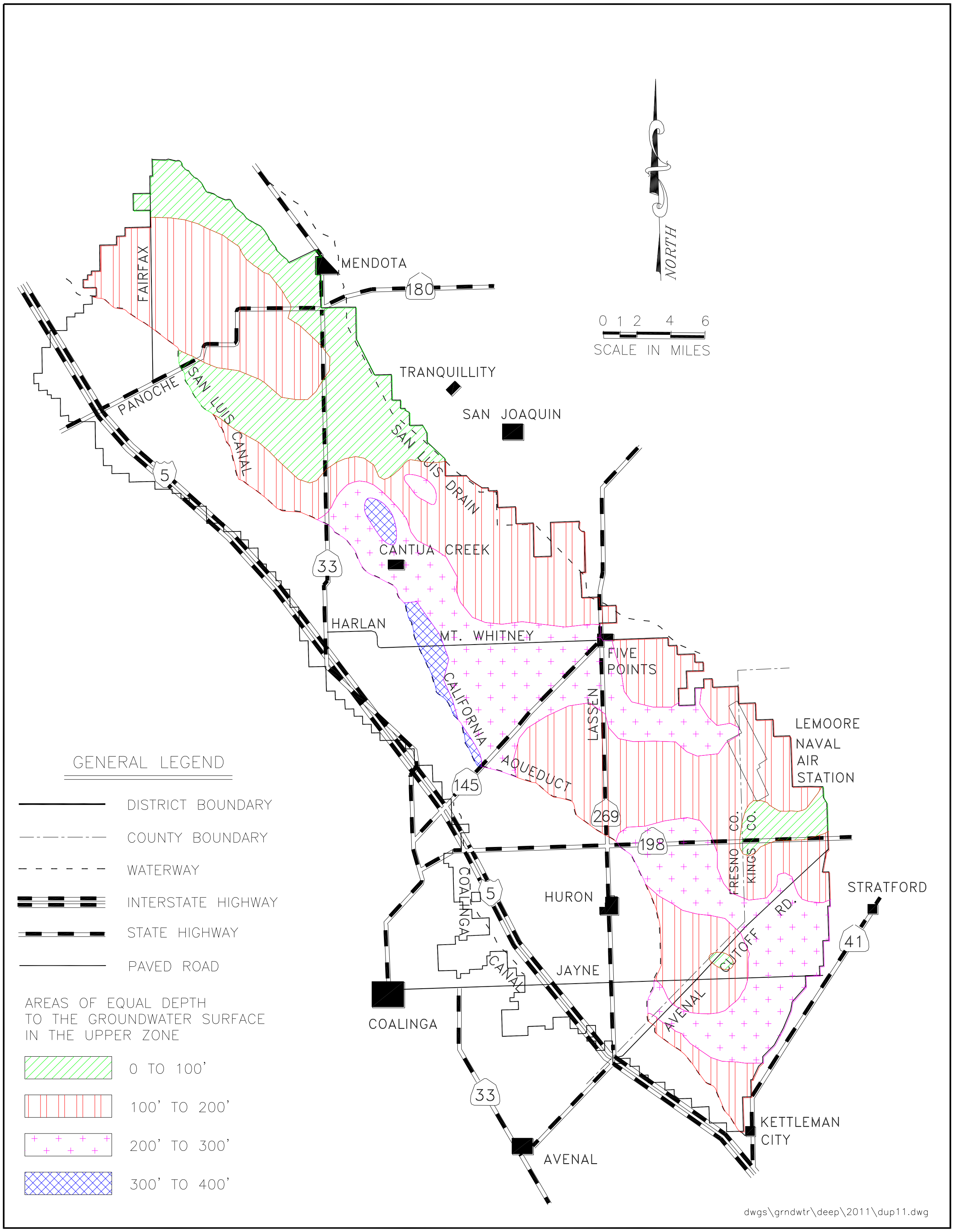

Figure 31: Depth to Groundwater in the Upper Zone, December 2011.

Safe Yield

Safe yield or current perennial yield is the amount of groundwater that can be extracted without lowering groundwater levels over the long term. Current perennial yield can be determined by plotting the amount of groundwater pumped in one year versus the average change in groundwater level in the basin for that year. Data for 1976 to present were plotted and a "best fit" was drawn. The intersection of the best fit with the line showing zero groundwater level change as shown in Figure 32 indicates the current perennial yield of groundwater to be approximately 200,000 AF.

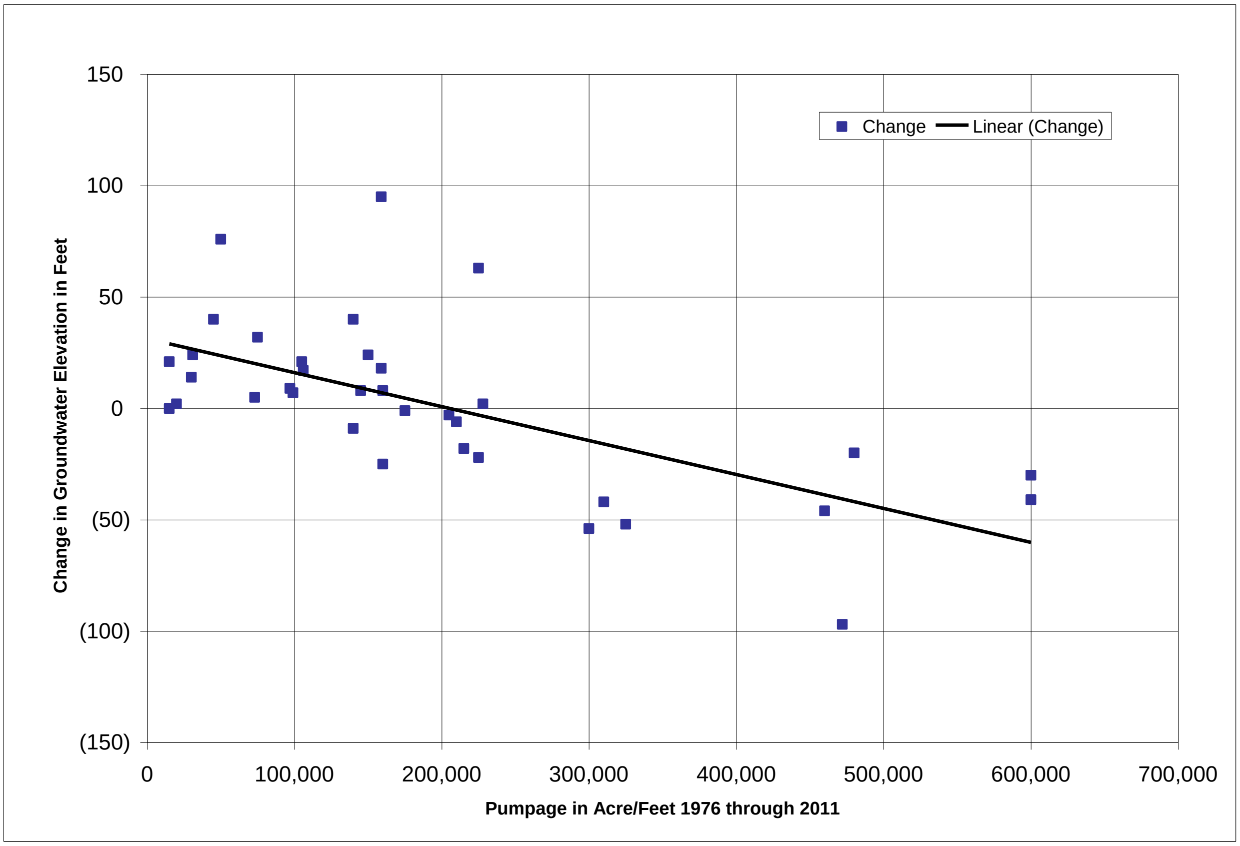

Figure 32: Change in Groundwater Elevation versus Pumping.

Appendix F

Planned Annual Budgeted Expenditures for Best Management Practices

Agricultural best management practices are broken down into two categories:

1. Critical Best Management Practices
2. Exemptible Best Management Practices.

The District believes that it is in compliance with all applicable BMP's. This appendix presents expected typical budget expenditures for the implementation of applicable BMP's. A single average hourly rate of $36 per hour is utilized as a billable rate for hours expended. The following categories are keyed to the order of presentation in the Plan.

<u>Critical BMP's:</u>

1. Water Measurement – This BMP covers the maintenance and calibration of the District water measurement devices. All meters in the district are tested and calibrated on a 5-year cycle. Two full time personnel are responsible for calibrating all meters in the district with an annual cost of $200,500. The cost for new metered deliveries is born by the water user requesting new facilities.

2. District Water Pricing Structure – No direct costs are involved.

3. Water Conservation Coordinator – One full time staff Associate Resource Analyst works in support of the Coordinator to implement the District Water Management Plan. Total time expended annually is equivalent to 1.1 full time personnel, for a cost of $81,370 per year.

4. Water Management Services Support
   a. On-Farm Irrigation and Drainage System Evaluations support is provided in part by the Natural Resources Conservation Service (NRCS) through the EQIP program, which covered 4,317 acres, comprised of 35 fields. Irrigation evaluations will be available from a Mobile Lab operated by the San Luis Delta Mendota Water Authority for the benefit of its members.
   b. Normal Year and Real-Time Irrigation Scheduling and Crop ET Information staff time is provided by District personnel identified under BMP 3, above. Direct costs for mailing the weekly Irrigation Guide are $4,500. Another $1,200 per year is expended to FAX the weekly Irrigation Guide to water users who have FAX machines.
   c. Shallow Groundwater Monitoring information is provided to district water users in the form of maps prepared for April and October each year. Total annual cost to prepare and distribute maps is $2,400.
   d. Water Management Information Program information is undergoing a shift toward being primarily a Web Site based program. Information and

publications previously developed as the WMIP will be updated and expanded into this new format.

Exemptible BMP's

1. Distribution System Lining/Piping – Canal lining has been shown to be infeasible and so the District is exempted from this BMP. No costs are budgeted.

2. Line Regulatory Reservoirs – All reservoir lining has been shown to be infeasible and so the District is exempted from this BMP. No costs are budgeted.

3. Distribution Control – No improvements needed, closed pipeline system. No costs are budgeted.

4. Reuse Systems--No operational spills necessary. No costs are budgeted.

5. Incentive Pricing – The District is in compliance with this BMP. The annual cost of administering the District water transfer program is $30,000 for time equivalent to .5 full time personnel.

6. On-Farm Program Incentives – The low interest improved irrigation system improvement lease program is supported by a State Revolving Fund loan and administrative costs are covered by an additional ½ % interest rate component. Over the 20 year life of the program it is expected that administrative costs will average $5,000 per year.

7. Conjunctive Use – Deep Groundwater Monitoring maps are prepared as part of the Ground Water Management Plan once each year at a cost of $20,000 to cover total staff time of .33 full time personnel.

8. Land Management – The District has purchased 88,067 acres of drainage affected lands within the District and added the water allocation into the water supply available to remaining lands in the District. The purchased lands are retired from irrigated agriculture and dry farmed. The annual cost of administering these lands is $100,000 for time equivalent to .25 full time personnel. This program is over and above any USBR land retirement programs.

9. Pump Efficiency Testing – Pump testing is an integral part of the District pump maintenance program. In 2011/12, the District tested 350 pumps. These tests were used to schedule maintenance on which and when pumps should be rebuilt based on efficiency. Based on these tests 52 pumps were overhauled at a cost of $307,396.91.

Total District budgeted expenditures are expected to remain stable at current levels for the scope of this Water Management Plan but are dependent on the yearly contract water supply that has been severely affected by regulatory actions that have reduced the reliability in recent years. Total budgeted District expenditures for the efforts previously discussed are $974,267 per year in staff time, supplies and costs for 2011. 3% per year inflation is projected for the next 2 years. The following table summarizes current and projected budgeted expenditures for the next 2 years:

Critical BMP's	**2011**	**2012**	**2013**
1. Water Measurement	200,500	200,500	200,500
2. District Water Pricing Structure	0	0	0
3. Water Conservation Coordinator	81,370	81,370	81,370
4. Water Management Services Support	30,000	30,000	46,000
Exemptible BMP'			
1. Distribution System Lining/Piping	0	0	0
2. Line Regulatory Reservoirs	0	0	0
3. Distribution Control	0	0	0
4. Reuse Systems	0	0	0
5. Incentive Pricing	30,000	30,000	30,000
6. On-Farm Program Incentives	5,000	5,000	5,000
7. Conjunctive Use	20,000	21,000	21,000
8. Land Management	300,000	300,000	300,000
9. Pump Efficiency Testing	307,397	310,000	315,000
Annual Total	974,267	984,000	1,005,000

Appendix G

Canal Lining

Westlands operates three pumping plants that draw water from Mendota Pool via 7.4 miles of unlined canal (see Figure 33). The Mendota Wildlife Management Area (MWMA) which borders 3.9 miles of the canal also draws water from the Mendota Pool. The majority of the canal (those portions serving Pumping Plants 6-1 and 7-2), as well as the MWMA lands adjacent to the canal, operate at the same water elevation as the Mendota Pool.

Seepage Loss Estimates

The District has not conducted actual seepage loss tests on this canal. However, other data is available and was used to develop estimates of losses. These data include: (1) ditch and reservoir seepage loss tests of textually similar soils, (2) hydraulic conductivity tests in the vicinity of Pumping Plant 7-1, and (3) published soil surveys with permeability data covering the area between Pumping Plants 7-1 and 7-2.

District engineers conducted field surveys to determine the existing cross sections of the canal to estimate its wetted perimeter. These data were then combined with the soil properties and other data to develop the estimated canal seepage loss. This analysis indicates an average seepage loss of 0.25 acre-feet/day/mile in the 2.9 mile reach between Pumping Plants 7-1 to 7-2. The seepage rate for the remaining one-half mile not adjoining the MWMA is assumed to be similar based on the available data and field inspection

The remaining 3.9 miles of canal abutting the MWMA probably has a lower loss rate due to high groundwater conditions brought about by the long-term flooding of the wetlands refuge areas with the MWMA. Also, since both this reach of the canal and the MWMA ponds operate at or near the same water surface elevation, hydraulic gradients are at or near zero. Therefore, canal seepage, to the extent it occurs, probably reduces losses from the MWMA ponds. Alternatively, if the canal is empty, the ponds will likely seep into the canal.

In summary, seepage from this reach is likely negligible and less than other reaches. Further, canal seepage is probably beneficial to the MWMA.

Lining Cost

Detailed estimates of the cost to concrete slip form line the canal were developed for the reach between Pumping Plants 7-1 and 7-2. Unit costs are based from the USBR San Luis Drainage Feature Re-Evaluation (2008).

The analysis assumes that the existing channel would first be backfilled, then excavated and lined to the original design cross section which calls for: (1) a total lined depth of 6 feet, (2) a flow depth of 5 feet, (3) a bottom width of 12 feet, (4) a side slope ration of 1.5 to 1, and (5) a lining thickness of 2.5 inches.

Table 41 shows the estimated costs to line and maintain the 2.9 mile reach. The annual cost is $1,457,328 or more than $95 per lined foot per year. The total estimated annual seepage loss is 275 acre-feet which equates to a cost of approximately $5,300 per acre-foot per year.

It should be noted that this analysis assumes that concrete lining has zero seepage loss. Therefore, the analysis above can be considered a best-case scenario since some seepage will occur.

Table 41: Lining Cost.

Item No.	Work or Material	Quantity	Unit Price	Amount
1	Backfill and compact existing channel	147,000 c.y.	$ 15.00	$2,205,000
2	Excavate new channel [1]	96,624 c.y.	5.50	531,432
3	Slip form lining with fiber reinforcement [1]	570,240 s.f.	10.00	5,702,400
4	Trim and grade soil	15,840 l.f.	4.00	63,360
5	Road crossing	3 ea.	50,000	150,000
6	Rock and chip seal 16-foot service road	253,440 s.f.	5.00	1,267,200
	Subtotal			$9,919,392
	Engineering, surveying, and administration	15%		1,487,909
	Contingencies	20%		1,983,878
	Total Cost			$13,391,179
	Annualized Cost:			1,189,504
	Maintenance at 2% of initial cost			267,824
	Total Annual Cost			$1,457,328

Estimated Seepage Loss

.25 AF/mi./day x 3 mi. x 365 days/yr.

.75 AF/day x 365 days/yr.

Cost of Conserved Water

$$\frac{\$\mathbf{1,457,328/Yr.}}{\mathbf{275AF/Yr.}} = \$\mathbf{5,299.37}\ \boldsymbol{per\ AF}$$

[1] Canal Cross Section: b = 12 feet; D = 6 feet; ss = 1.5 to 1

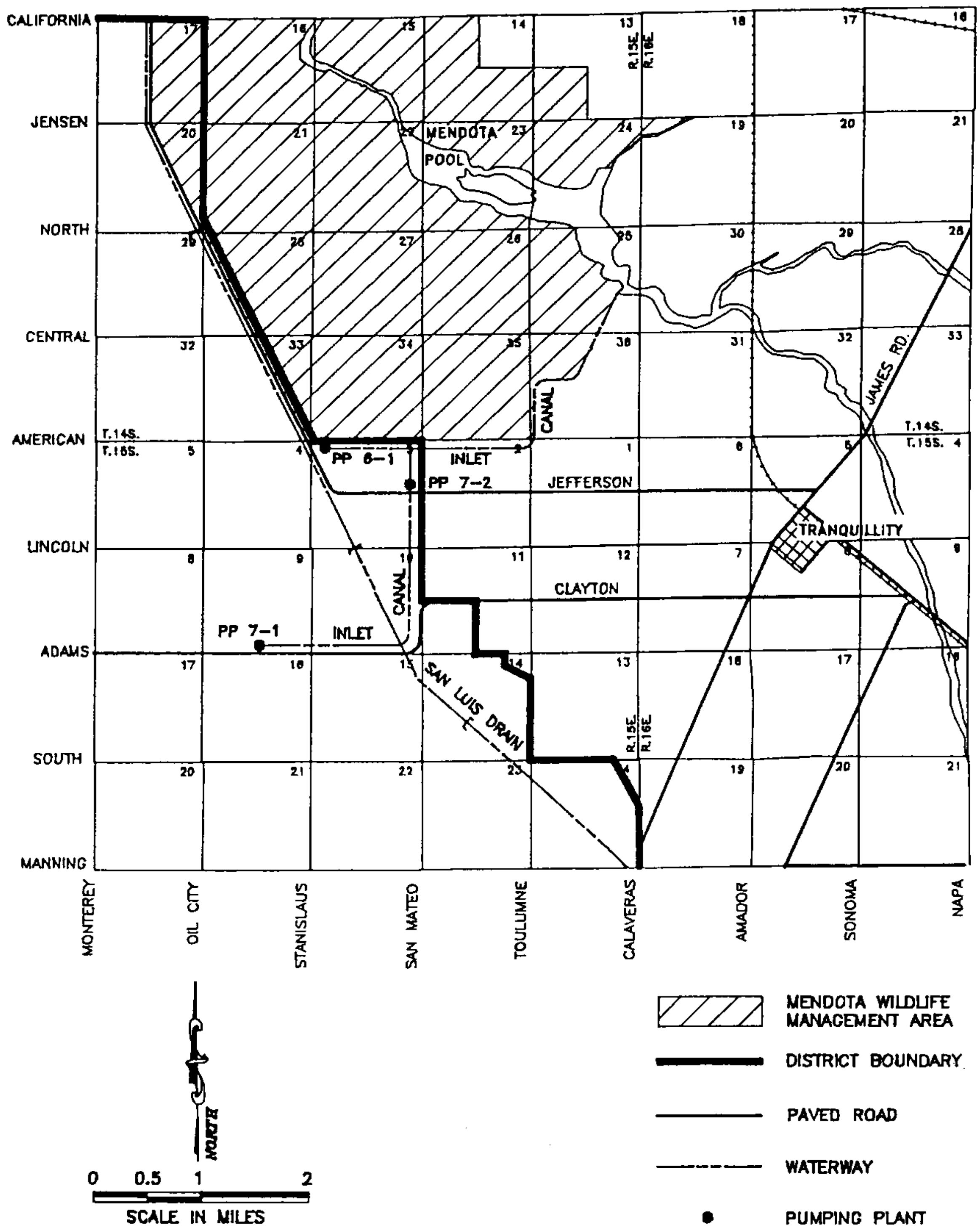

Figure 33: Location of unlined Canals.

Appendix H

RESOLUTION NO. 104-09, 2007 Water Management Plan adopted

RESOLUTION NO. 104-09

WESTLANDS WATER DISTRICT

A RESOLUTION OF THE BOARD OF DIRECTORS ADOPTING THE WESTLANDS WATER DISTRICT WATER MANAGEMENT PLAN FOR THE PURPOSE OF COMPYING WITH WATER CONSERVATION PROVISIONS OF THE WATER SERVICE CONTRACT BETWEEN WESTLANDS WATER DISTRICT AND THE UNITED STATES

WHEREAS, Section 210 of the Reclamation Reform Act of 1982 (Public Law 97-293; 43 US § 390jj) requires districts with repayment or water supply contracts to develop and maintain water conservation plans containing definite goals, appropriate water conservation measures, and time schedules for meeting conservation objectives; and

WHEREAS, Section No. 3405(e) of the Central Valley Project Improvement Act of 1992 (Title XXXIV, Public Law 102-575, 106 Stat. 4713) requires the Secretary of the Interior to establish an office to develop criteria for evaluating water conservation plans developed by CVP contractors, and that said plans be updated every five years; and

WHEREAS, Westlands Water District has a federal water service contract and has, therefore, prepared a Water Conservation Plan; and

WHEREAS, Westlands Water District's Board of Directors adopted Westlands' 1999 Water Conservation Plan with the 2002 Supplemental M&I Urban Plan in May 2002; and

WHEREAS, Westlands Water District has prepared a 2007 Water Management Plan in accordance with the law, which updates the District's Water Conservation Plan and which satisfies the criteria for evaluation of water conservation plans developed by the U.S. Bureau of Reclamation; and

NOW, THEREFORE, BE IT AND IT IS HEREBY RESOLVED that the 2007 Water Management Plan is adopted.

Adopted at a regular meeting of the Board of Directors at Fresno, California, this 20th day of January, 2009.

AYES:	Directors Coelho, Devine, Diener, Errotabere, Esajian, Enos, Sagouspe, Sheely and Peracchi
NOES:	None
ABSENT:	None

Dave Ciapponi, Secretary