



AGRICULTURAL WATER MANAGEMENT PLAN

Prepared Pursuant to Water Code Section 10826

**Prepared for
WHEELER RIDGE-MARICOPA WATER
STORAGE DISTRICT**

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SUBMITTED TO THE
CALIFORNIA DEPARTMENT OF WATER RESOURCES
IN ACCORDANCE WITH THE
**AGRICULTURAL WATER MANAGEMENT PLANNING
ACT OF 2009 (SBx7-7)**

Adopted February 2015

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Acronyms

AF	acre-feet
AWMC	Agricultural Water Management Council
AWCP	Agricultural Water Conservation Plan
AWMP	Agricultural Water Management Plan
Cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DWR	Department of Water Resources
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
ET _c	Crop Evapotranspiration
ET _o	Reference Evapotranspiration
EWMP	Efficient Water Management Practice
ID	Irrigation District
ILRP	Irrigated Lands Regulatory Program
ITRC	Irrigation Training & Research Center (Cal Poly)
GWMP	Groundwater Management Plan
KCWA	Kern County Water Agency
KRWCA	Kern River Watershed Coalition Authority
NWKRCDD	North West Kern Resource Conservation District
M&I	Municipal and Industrial
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System (EPA)
OCAP	Operations Criteria and Plan for CVP Deliveries (USBR)
Ppm	parts per million
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
SBx7-7	Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
WSD	Water Storage District
WRM/WSDD	Wheeler Ridge-Maricopa Water Storage District

1 Introduction

1.1 Overview

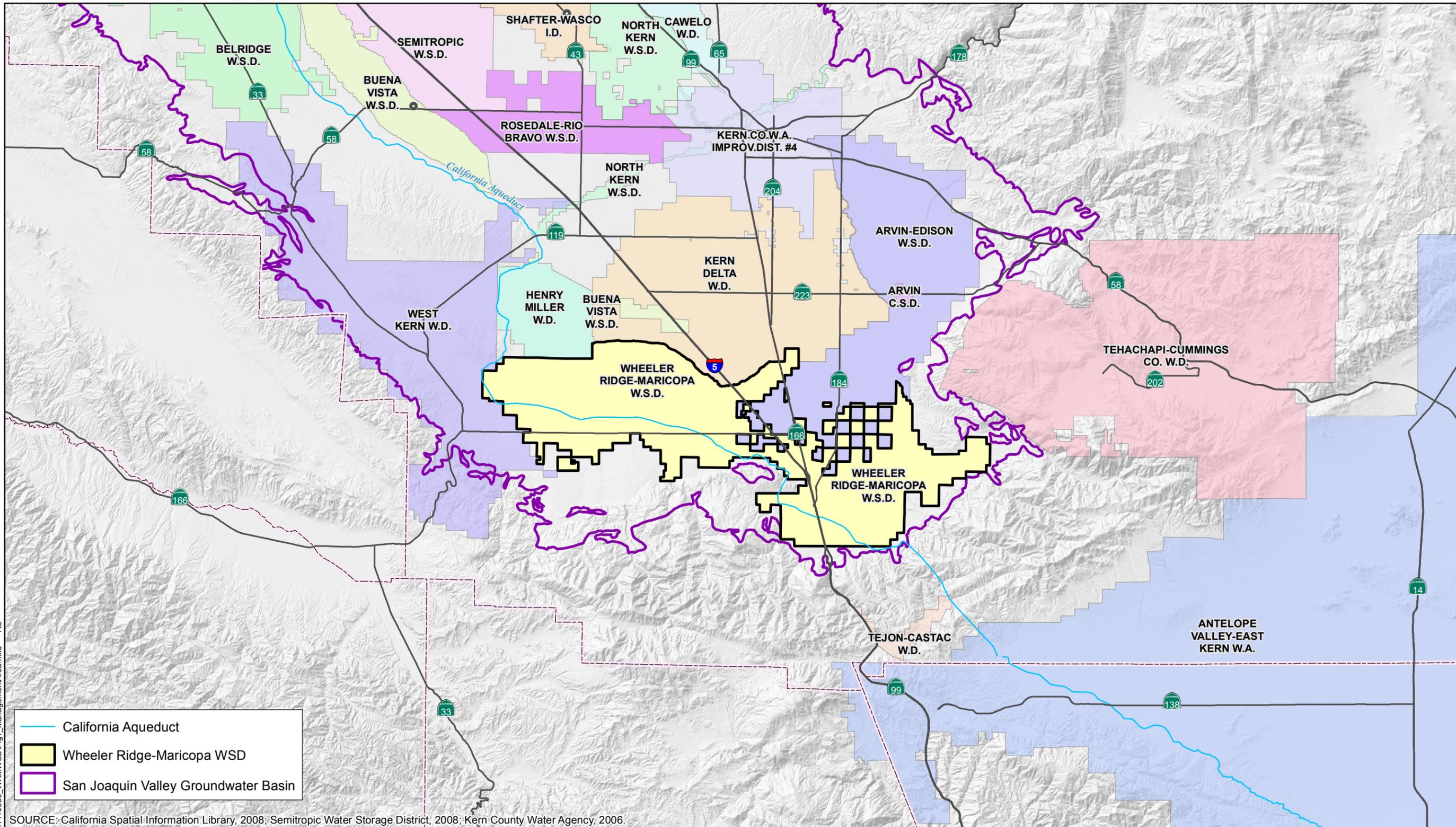
The Agricultural Water Management Plan (AWMP) describes district planning and implementation activity of the Wheeler Ridge-Maricopa Water Storage District (WRMWS or District) for the purpose of providing reliable agricultural water supply for its landowners. The District covers approximately 147,646 acres in the southern end of the San Joaquin Valley in Kern County. The District delivers a combination of imported water from the State Water Project (SWP), previously imported water recovered from several Kern County banking projects, local groundwater to agricultural customers using District facilities, and other water supplies as necessary for banking project recharge and to mitigate water shortages from the State Water Project. In addition, some agricultural water users in the District provide their own irrigation water through groundwater pumping.

This AWMP document conforms to the framework presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan* (Guidebook) that was issued by the California Department of Water Resources (DWR) on October 24, 2012 to aid water suppliers in preparing AWMPs in accordance with the requirements of SBx7-7.

Much of this AWMP is based on information contained in the District's *2007 Groundwater Management Plan* (GWMP), the District Engineer-Manager's monthly and annual reports, and information based on a number of studies the District has undertaken over time. The past studies are related to increasing the reliability and quality of the water supply for the benefit of District customers. An example of a past regional study relied upon for this AWMP is the Report on Investigation of Optimization and Enhancement of the Water Supplies of Kern County (Associated Engineering Consultants, 1983).

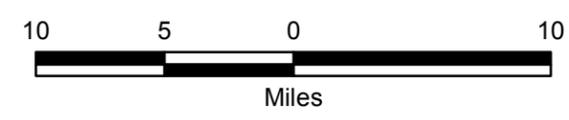
The past studies, the 2007 GWMP, and this AWMP are collectively intended as documentation of the District's efficient water management practices, the efficient distribution and use of all District water supplies, and as a guide for the development of additional water sources.

The District's location and service area are shown on Figure 1.



- California Aqueduct
- Wheeler Ridge-Maricopa WSD
- San Joaquin Valley Groundwater Basin

SOURCE: California Spatial Information Library, 2008; Semitropic Water Storage District, 2008; Kern County Water Agency, 2006.



Wheeler Ridge-Maricopa Water Storage District
Kern County, California

2014 Agricultural Water Management Plan



MANAGEMENT AREA AND
NEIGHBORING WATER AGENCIES

DECEMBER 2014

FIGURE 1

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1.2 Purpose

The purpose of the AWMP is to describe and document the District's existing and proposed agricultural water management programs and activities. In addition, the AWMP is used to assess compliance with the requirements of the SBx7-7, the Agricultural Water Management Planning Act (Section I, Part 2.8, Division 6 (commencing at Section 10800) of the Water Code), and the subsequent Agricultural Water Measurement Regulation requirements (described in Title 23 California Code of regulations), notwithstanding such regulations go beyond that required by the statute and in many instances are not applicable to areas such as this District

We understand the requirements of SBx7-7 include Efficient Water Management Practices (EWMP) intended for agricultural water suppliers to document current efficient water management practices, to identify and consider additional practices that may conserve water, and to document the accurate measurement of water. This AWMP describes the District's status with regard to implementation of the two new mandatory EWMPs and includes a discussion of the potential impacts of climate change on District operations.

Also included in this AWMP is a section describing the District's information regarding the implementation EWMPs presented in the Guidebook. The EWMPs are grouped into the following categories: Critical Efficient Water Management Practices and Conditional Efficient Water Management Practices.

1.3 Description of Previous Water Management Activities

The District and growers within the District have continually improved on-farm water management practices since formation of the district in 1959. Improvements have been driven by technology improvements, increased crop values, and increasing scarcity and costs of State Water Project supplies. The District's water management has also improved over time with the advancement of technology, conjunctive use facilities and practices, and Grower's on-farm irrigation application method improvements. In 2007, the District prepared a groundwater management plan to better manage their various water sources.

This AWMP identifies several previously implemented and ongoing water management activities, which include:

- a. Acquire surface water supplies from the State Water Project, and construct irrigation distribution system facilities to lands which previously relied exclusively on pumped groundwater for the purpose of District delivery of surface water.

- b. Secure additional dry year water supplies from groundwater banking and recovery projects (Kern Water Bank, Pioneer Project, and Berrenda Mesa Project) and local groundwater supplies (District wells and private wells).
- c. Secure additional water supplies to mitigate water shortages from the State Water Project.
- d. Manage imported water and groundwater conjunctively to increase water supply reliability.
- e. Promote water use efficiency through:
 - 1. Metered and tiered water pricing, and
 - 2. Financial support of the North West Kern Resource Conservation District's (NWKRCDD) Mobile Laboratory and encouraging landowners to take advantage of this resource by requesting field irrigation evaluations.
- f. Actively participate in local water resource management forums, including the Water Association of Kern County, Kern County Integrated Regional Water Management Plan (Kern IRWM Plan), the Kern River Watershed Coalition Authority (KRWCA), and the Kern Groundwater Management Committee (now Kern Groundwater Authority).
- g. Require installation of flow meters on private landowner wells that pump into the District facilities.

1.4 Coordination Activities

The District notified public entities of the AWMP preparation and adoption as shown in Table 1. Public participation requirements associated with preparation of an AWMP are identified in SBx7-7; however it does not specify how much advance notice is required to cities and counties regarding plan preparation, does not require notification to any other agency(s), and does not require that comments from any city, county or other agency must be solicited and considered.

Table 1. Summary of Plan Coordination, Adoption, and Submittal Activities

Interested Parties	Notified (Prep)	Assisted	Rec. Draft	Notified (Public Meetings)	Notified (Adopted)	Copy of Plan
California Dept. of Water Resources	X			X		X
Kern County Water Agency	X			X		X
Arvin Edison Water Storage District	X			X		
Kern Delta Water District	X			X		
Henry Miller Water District	X			X		
California State Library						X
GEI Consultants, Inc.	X	X	X	X	X	X

1.5 Plan Adoption and Submittal

The AWMP, once adopted by the District following a public hearing, will be submitted to DWR within 30 days of adoption by the District. In addition, the District will send a copy of the AWMP to the Kern County Water Agency (KCWA or Agency) and the California State Library. A copy of the AWMP will also be available from the District by request.

Appendices to the AWMP include: 1) proof of publication documenting notice of a public hearing, 2) a signed resolution of AWMP Adoption by the District’s Board of Directors, 3) notification letters indicating a copy of the AWMP was sent to the three interested parties indicated in Table 1, 4) WRMWSD Rules and Regulations for Distribution of Water, and 5) the DWR AWMP Checklist.

2 Description of the Agricultural Water Supplier and Service Area

2.1 Physical Characteristics

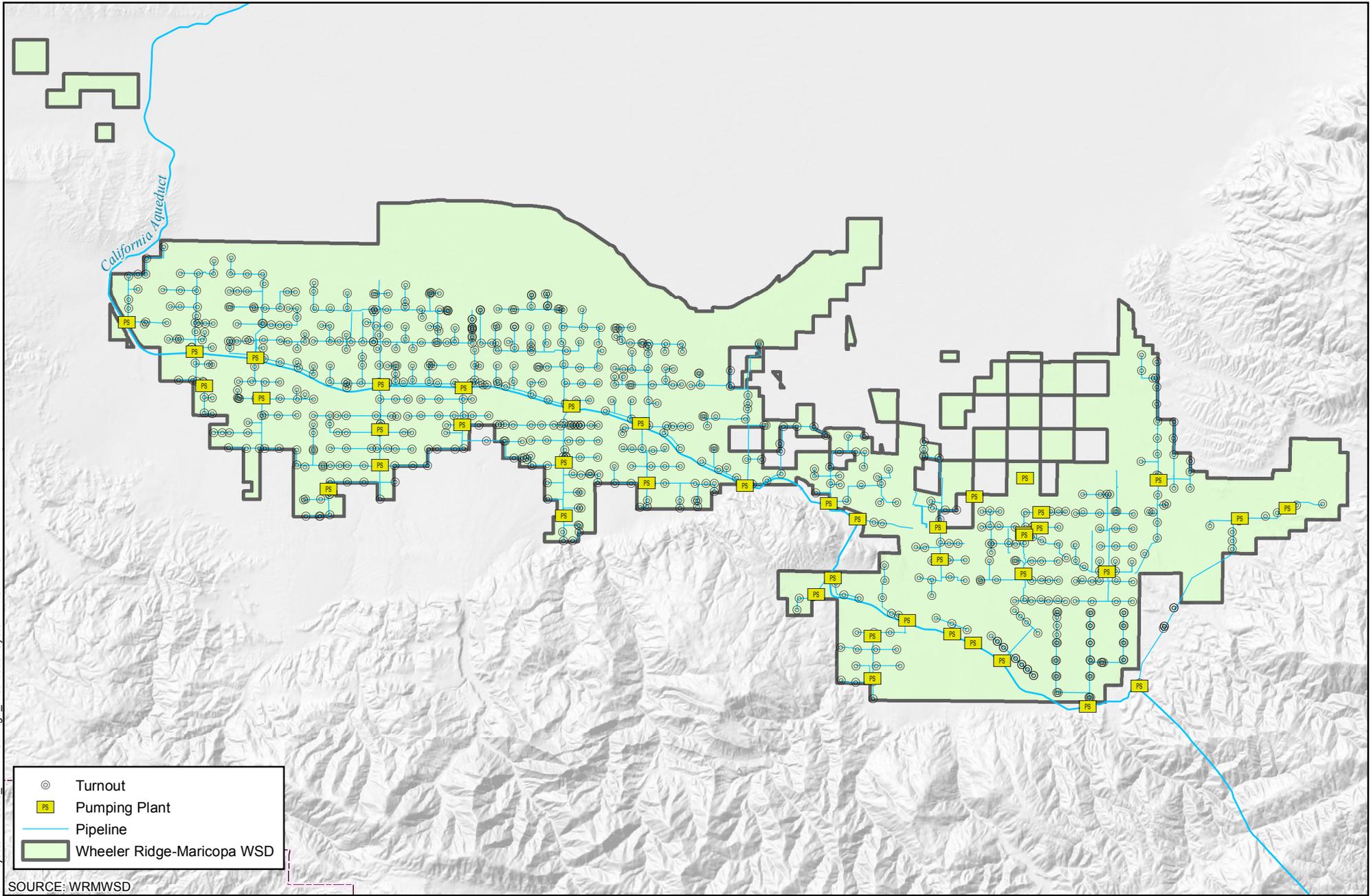
2.1.1 *Size of Service Area*

The District was formed on August 11, 1959 under California Water Storage District law for the purpose of securing a surface water supply for agricultural purposes from the Feather River Project (presently known as the State Water Project). The District's Project, including authority to execute a water supply contract for SWP supplies, and construct a water distribution system, was approved by the District's landowners at an election on November 14, 1967.

The location and size of the District is shown on Figure 1. The District's distribution system and service areas are shown on Figure 2. The District is governed by an elected nine-member Board of Directors, and operated by a staff of approximately 40 employees.

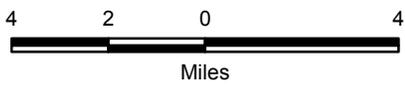
The District receives SWP through a contractual agreement with the KCWA. KCWA was formed to contract with the State of California for delivery of SWP to 13 water districts in Kern County. Delivery to the District from the SWP began in 1971. The District receives and delivers untreated surface water from the SWP to landowners within the District.

Since the 1990's the District's SWP supply has become increasingly unreliable. To compensate for this loss of reliability, the District acquires and delivers several sources of water through the California Aqueduct in addition to their SWP Table A contract amount. Since the 1990's the District has secured additional dry year water supplies for its landowners from the Kern Water Bank, Pioneer Project, Berrenda Mesa Project, new District wells, and its Blanca Rosa Improvement District. Additional water supply reliability and cost reliability were also secured through the Monterey Amendments to the SWP contracts.



- ⊙ Turnout
- PS Pumping Plant
- Pipeline
- Wheeler Ridge-Maricopa WSD

SOURCE: WRMWSD



Wheeler Ridge-Maricopa Water Storage District
Kern County, California

2014 Agricultural Water Management Plan



DISTRIBUTION SYSTEM

DECEMBER 2014

FIGURE 2

The District’s water supplies are comprised of the SWP (197,088 acre-feet of Table A allocation), groundwater banking projects, local groundwater and other imported supplies. The District delivers on average 169,000 acre-feet annually, totalling 7.2 million acre feet delivered from 1971 to 2013. Current Grower demands vary from 175,000 to 185,000 acre-feet per year of supply to farm lands within the District's Surface Water Service Area (SWSA) (under the terms of recorded long-term agricultural water service contracts). In 2013, about 87,422 acres of farm land within the District were irrigated. Approximately 60,512 acres were irrigated acres within the SWSA and 26,910 acres were irrigated acres outside of the SWSA, but within the District’s boundaries. Approximately 28,000 acres are undeveloped and used primarily for grazing. Except for a few locations along Interstate 5, the District is exclusively rural. There are no cities or towns within the District's boundaries. Table 2 provides an overview of the District history and size.

Table 2. Water Supplier History and Size

Date of Formation	1959
Sources of Water	State (DWR) Regulated Water, Local Surface Water ³ , Local Groundwater
Gross Acreage (at Formation¹)	134,190
Gross Acreage (Current²)	147,347
Irrigated Acreage (Current²)	60,512 SWSA; 26,910 Groundwater Area; 87,422 Total.

¹ Kern County Water Agency Report 1969-1971, by KCWA

² WRMWSD GIS and 2013 Crop and Land Use Survey, by WRMWSD, shown in Table 22A.

³ Occasional surface water supplies and runoff from the Southern Stream Group, local creeks (e.g. El Paso, Tunis, and Pastoria) and Tejon Reservoir releases that occur during wet hydrologic years and some normal hydrologic years.

2.1.2 Location of the Service Area and Water Management Facilities

The District is located at the southern end of the San Joaquin Valley approximately 30 miles south of Bakersfield. The San Joaquin Valley is the southern half of the larger Great Valley, an elongated trough extending about 400 miles through the heart of the state. The San Joaquin River and its tributaries drain the northern two-thirds of the San Joaquin Valley northward toward San Francisco Bay. The southern third of the valley drains to several terminal lakebeds, and has done since the Pleistocene Epoch. Two of these lake beds, Buena Vista Lake and Kern Lake, lie adjacent to the northern boundary of the District and are the terminus of surface water drainage in the southernmost

portion of the valley. Ephemeral streams from uplands south, east and west of the District flow across District lands toward these lake beds.

Neighboring districts include West Kern Water District to the west, Henry Miller Water District and portions of Buena Vista Water Storage District and Kern Delta Water District to the north, Arvin-Edison Water Storage District to the north and east, and Tejon-Castac Water District to the south, which partially overlaps a portion of the District. The southern boundary of district abuts the foothills of the Tehachapi Mountains. The California Aqueduct traverses the District west to east for about 34 miles, beginning about midway between the District’s northern and southern boundaries and exiting the south eastern boundary. Most of the land within the District slopes to the north. Elevations range from 295 feet above sea level at its northwesterly boundary to 1,865 feet at its eastern boundary. Access is obtained via State Route 99 and Interstate 5 highways in the north-south direction, and State Route 166 (Maricopa Highway) in the east-west direction.

Farm lands in the District are approximately 30 miles or more from any urban areas, such as the City of Bakersfield, and there is limited interest to convert these lands to urban uses. However, some urbanization is occurring in other areas of Kern County resulting in the conversion of agriculture lands to urban use. The current irrigated land area within the District is expected to remain relatively stable for the foreseeable future, as indicated in Table 3. While there is a minor potential for some increase in the amount of irrigated acreage since there are undeveloped or un-irrigated lands within the District, the District expects the more likely change would be a decrease in irrigated acreage due to the decreasing reliability of imported supplies from the SWP.

Table 3. Expected Changes to Service Area

Change to Service Area	Estimated Magnitude of Change	Cause(s) of Change	Estimated Effect on Water Supplier
Reduced Service Area	Negligible	Change in District Contract Acres	No substantial impact
Increased Service Area	Negligible	Change in District Contract Acres	None
Reduction in Irrigated Acreage	Negligible	Potential reduction in available water supply.	None
Increase in Irrigated Acreage	Negligible	Limited water supply may limit potential increase in Irrigated Acreage.	None

The District has constructed extensive facilities for the purpose of conveyance and distribution of imported surface water supplies to lands within the District, including canals, pipelines and pumping

plants. The District owns and operates a distribution system of 294 miles of pipelines, 137 booster pumps, 16 wells and over 7 miles of concrete-lined canal. Depending on land leasing patterns in a given year, the District serves between 50 and 60 customers. A summary of the existing irrigation distribution facilities located within the District is identified in Table 4.

Table 4. Water Conveyance and Delivery System

System Type	Number of Miles²	Percentage of System
Unlined Canals	None	0%
Lined Canals ¹	7.05 miles	2.2%
Pipelines	294 miles	97.8%
Drains	None	0%
Total	301.05 miles	100%

¹ Specifications No. WRM 620 for constructing 850 Canal, 1971.

² Based on Wheeler Ridge GIS data and the District Engineer-Manager's Inventory Binder.

The District delivers the SWP water through 15 turnouts within Reaches 14, 15 and 16 of the California Aqueduct. Water is transported through District owned lined canals and pipelines to farm turnouts.

The District's delivery system is automated with pressurized pipelines delivering to 746 farm turnouts, basically eliminating operational spills. Pumps are monitored and controlled remotely through the District's Supervisory Control and Data Acquisition (SCADA) system. Each turnout is equipped with a totalizing and indicating flow meter. Since surface water is delivered from the California Aqueduct into pressurized pipeline delivery systems regulating reservoirs are not necessary for the system to operate efficiently.

Table 5. Water Supplier Reservoirs

Reservoir	Capacity (AF)	Storage Rights (AF)
None	n/a	n/a

The majority of land within the District's service area is well drained which reduces surface runoff. Also, as shown in Table 22A, virtually all on-farm irrigation in the District's service area is made with high-efficiency irrigation systems (micro drip, micro sprinkler, and sprinkler). Therefore, the need for on-farm surface tail-water recovery systems is low. A few vegetable growers use surface tail-water recovery systems to capture and reuse runoff from sprinkler systems.

The District owns one 12 acre Spill Basin (reservoir) to capture operational spills at the end of its 7 mile 850 Canal system. However, as described in Table 49, real-time SCADA control systems on the 850 Canal result in virtually no spill, and operation of the pumps at the Spill Basin for recovery of any spilled water has not been necessary for many years.

Table 6 summarizes the existence of tail water recovery systems.

Table 6. Tail-water Recovery System

System Type	Yes/No
District Operated Tail-water Recovery	Yes
Landowner Operated Tail-water Recovery	Yes

As previously stated in Section 1, and described further in Section 7, the District is continually improving water management practices. District Programs are focused on the goal of providing an annual surface water supply to the landowners within the surface water service area to extend the sustainability of local groundwater resources underlying the District.

Due to the extensive plantings of permanent crops within the District, growers have converted on-farm distribution systems to sprinkler, drip and fan-jet systems, which provide highly efficient irrigation operations. The District also provides funds annually to the NWKRCDD to support the evaluation of the efficiency of on-farm irrigation systems. In addition, the District maintains and operates its own weather data station that allows water users to base irrigation decisions on locally provided information.

2.1.3 Terrain and Soils

Most of the land within the District covers the valley floor and the gently sloping foothills at the valley’s southern edge, where the Coast Ranges and Tehachapi Mountains meet. Elevations within the District range from 295 feet above mean sea level (msl) at the northwesterly boundary to 1,865 feet msl at its eastern boundary. The land surface within the District generally slopes from the foothills along its southern and eastern boundaries to the lower elevation along its northern boundary near historical dry lake beds in the west-central portion of the valley. Grades are generally less than 4 percent and the topography can generally be characterized as flat. The California Aqueduct crosses the District from west to east along an approximate ground surface elevation of 500 feet msl, rising to 1,250 feet msl as it extends over Wheeler Ridge and eventually exits the basin to the southeast (Figure 2). The Tehachapi Mountains and San Emigdio Mountains rise up from the valley floor to the south of the District, while the Temblor Range of the Coast Ranges and the Sierra Nevada Foothills

rise up to the west and east of the District, respectively. Ground surface elevations within the contributing watershed of the District rise to above 7,000 feet msl in the San Emigdio Mountains south of the District boundary.

Table 7. Landscape Characteristics

Topography Characteristic	Approx. % of District	Effect on Water Operations and Drainage
Flat Land	95%	Land is adaptable to sprinkler and micro irrigation systems.
Rolling Land	5%	Land is adaptable to sprinkler and micro irrigation systems.

The primary land use within the District is agriculture. About 97% of the land within the District is irrigable, with 90% of the soils within the Surface Water Service Area classified as having wide crop adaptability with no limitations. A wide variety of crops are grown. Crops with a total acreage of over 1,000 acres within the District are cotton, safflower, wheat, alfalfa, carrots, lettuce, melons, onions, peppers, potatoes, tomatoes, wine and table grapes, almonds, pistachios, lemons, and oranges. Among other crops grown are asparagus, walnuts, plums, and grapefruit.

The soil types in Kern County vary in structure, texture, and chemistry with geographical location. Valley floor soils are derived mostly from mixed granitic and sedimentary rocks and are characterized as saline-alkaline. The generalized soils map units or soil associations underlying the area, shown in Figure 3, are described in the soil surveys for Kern County, prepared by the U.S. Natural Resources Conservation Service.

A general soil map unit consists of one or more major soil types and some minor soils that occur together in a recognizable pattern. Soils within the District do not have any identifiable impacts upon water operations and management in the service area.

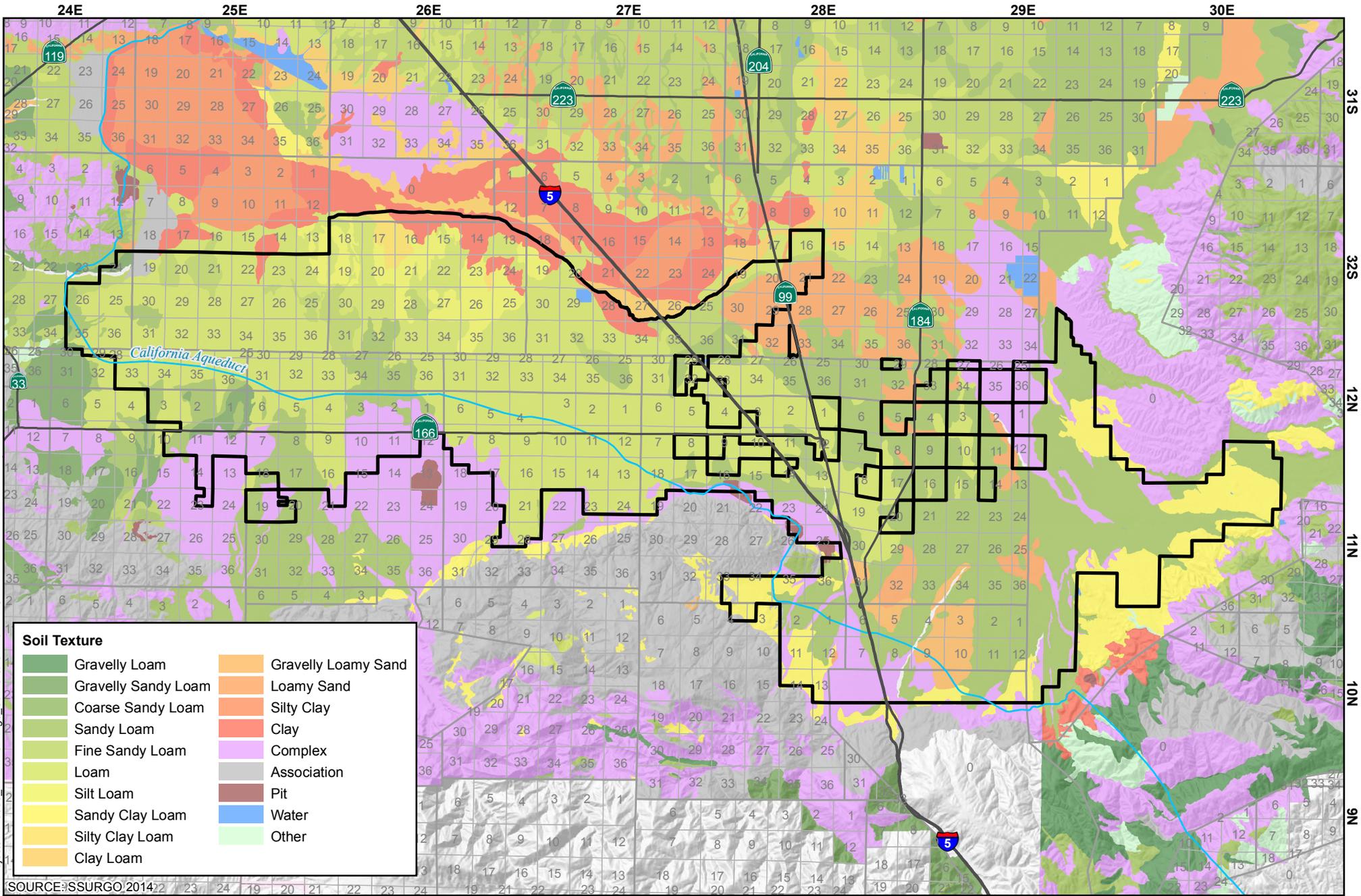
2.1.4 Climate

The District experiences a semi-arid climate. The growing season is among the longest in the San Joaquin Valley, averaging about 300 days above 32 degrees Fahrenheit (°F) and almost 365 days above 28°F. Temperatures exceed 90 degrees Fahrenheit about 110 days per year. The average precipitation of about 7 inches per year falls almost entirely in the winter and spring.

Given the District’s location at the southern end of the San Joaquin Valley in a portion of the valley that is partially surrounded by a horseshoe-shaped ring of mountains, the Sierra Nevada Mountains to

the east shut out most of the cold air that flows southward over the continent in the winter. Summers in the southern portion of the valley are typically hot and dry. Winters are typically cooler and are characterized by frequent fog or low clouds which occur mostly at night. These conditions prevail when cold, moist air is trapped in the valley by high pressure systems. The depth of fog or clouds is usually less than 3,000 feet above ground level. There are usually clear skies and mild temperatures in the surrounding foothill and mountain areas.

Table 8 summarizes climate conditions as measured by the District. Annual precipitation typically ranges between five to seven inches, with most of the rainfall occurring during the “Wet Season” of November through March. The order of magnitude of the annual rainfall that falls on the San Joaquin Valley floor area where irrigation occurs is comparable low even between dry, typical, and wet year types. The precipitation over the District area is based on a Thiessen average of six weather stations maintained by the District. The irrigated area has received an average annual precipitation of less than 7.11 inches per year. However, the west side of the district is consistently drier than the east. Climate characteristics for the District service area are presented in Table 9.



Soil Texture	
	Gravelly Loam
	Gravelly Sandy Loam
	Coarse Sandy Loam
	Sandy Loam
	Fine Sandy Loam
	Loam
	Silt Loam
	Sandy Clay Loam
	Silty Clay Loam
	Clay Loam
	Gravelly Loamy Sand
	Loamy Sand
	Silty Clay
	Clay
	Complex
	Association
	Pit
	Water
	Other



Wheeler Ridge-Maricopa Water Storage District
 Kern County, California

2014 Agricultural Water Management Plan



GENERALIZED SOIL TEXTURE

DECEMBER 2014

FIGURE 3

25-Nov-2014
 Z:\Projects\1410930_WRM\MSD\Fig3_SoilTexture.mxd
 RS

Table 8. Summary Climate Characteristics

Climate Characteristic (Basis)	Units	Value
Avg. Precipitation (annual) ¹	In	7.11
Max. Precipitation (annual) ¹	In	17.46 ⁽⁶⁾
Min. Precipitation (annual) ¹	In	3.09 ⁽⁷⁾
Avg. Mean Daily Temperature (winter season) ²	deg-F	48.3
Avg. Daily Min. Temperature (winter season) ³	deg-F	38.1
Avg. Mean Daily Temperature (summer season) ⁴	deg-F	80.3
Avg. Daily Max. Temperature (summer season) ⁵	deg-F	94.1

¹ Based on Thiessen average precipitation as computed from observations at six District-operated weather stations over the 30-year period from 1984 to 2013, all measurements made by Wheeler Ridge staff.

² Average of mean daily average air temperature during the months of December through February using CIMIS Station #125 (Arvin-Edison) data during the period 2004-2013.

³ Average of daily minimum air temperature for the months of December through February using CIMIS Station #125 (Arvin-Edison) data for the period 2004-2013.

⁴ Average of mean daily average air temperature during the months of June through August using CIMIS Station #125 (Arvin-Edison) data during the period 2004-2013.

⁵ Average of daily maximum air temperature for the months of June through August using CIMIS Station #125 (Arvin-Edison) data for the period 2004-2013.

⁶ Occurred in 1998.

⁷ Occurred in 2008.

Table 9. Detailed Climate Characteristics

Month/Time	Season	Avg. Precipitation (in) ¹	Avg. Ref ET(in) ²	Avg. Min Temperature (deg-F) ³	Avg. Max Temperature (deg-F) ⁴
January	Wet	1.29	1.52	37.9	57.1
February		1.39	2.29	40.6	63.4
March		1.10	4.02	45.1	69.0
April	Dry	0.54	5.64	48.2	73.7
May		0.30	7.70	55.1	82.2
June		0.06	8.64	61.2	89.5
July		0.02	9.18	67.3	97.3
August		0.00	8.57	64.4	95.5
September		0.10	6.40	59.2	90.6
October		0.33	3.97	49.7	77.8
November	Wet	0.84	2.11	42.1	66.9
December		1.09	1.43	35.9	58.5
Wet Season Total ⁵		5.71	2.27	-	-
Dry Season Total ⁵		1.35	7.16	-	-
Annual Total		7.06	61.47	-	-

¹ Based on Thiessen average precipitation as computed from observations at six District-operated weather stations over the 29-year period from 1985 to 2013, all measurements made by Wheeler Ridge staff.

² Based on daily ET_o data at CIMIS Station #125 (Arvin-Edison) during the period 2004 to 2013.

³ Based on daily minimum air temperature using CIMIS Station #125 (Arvin-Edison) data during the period 2004 to 2013.

⁴ Based on daily maximum air temperature using CIMIS Station #125 (Arvin-Edison) data during the period 2004 to 2013.

⁵ "Wet" season constitutes total values for November through March; "Dry" season covers April through October.

2.2 Operational Characteristics

2.2.1 Operating Rules and Regulations

The District has adopted Rules and Regulations for Distribution and Use of Water (“Rules and Regulations”; copy included in Appendix A) that serve as the guideline for District operations and delivery of water. The Rules and Regulations cover the procedures which are followed to distribute irrigation water in an orderly, efficient, and equitable manner.

The District’s Rules and Regulations are established pursuant to the requirements of the California Water Code by the Board of Directors of the Wheeler Ridge-Maricopa Water Storage District for the distribution and use of water within the District. The District’s Rules and Regulations expand upon the contracts between the District and Water Users for water service.

The adopted Rules and Regulations enable the District to perform its functions efficiently, to deliver water to Water Users at the least possible cost, and are the Rules and Regulations mentioned in water service contracts between the District and various landowners within the District. These Rules and Regulations were first adopted July 8, 1970, and have been amended from time to time.

Several of the terms and expressions employed in the Rules and Regulations are defined in the Water Service Contracts executed by the District and its landowners. As defined in the District Rules and Regulations for Distribution of Water, Contract Water Service is provided only to lands in the District’s **Surface Water Service Area**. Note that there are rules for addition of land to and exclusion of lands from the Surface Water Service Area. When available, **Unscheduled Water Service** in excess of the Contract Amount is offered to Water Users.

Since the District is a member of the KCWA, which is a State Water Contractor, it receives an annual allocation of SWP water in addition to other contracted water supplies that are delivered via the California Aqueduct. Each year, the District endeavors to provide the contract amount of water on a demand basis as requested by Water Users, but, does not assume any obligation if it is unable to do so. It is recognized that the District’s delivery capability is limited in the month or months of maximum demand by the capability of the District’s distribution facilities, SWP facilities, and such limitations must be considered in meeting Water Users’ requests.

Table 10. Supplier Delivery System

Delivery System Type	Type Used? Yes/No	Approx. Percentage of System
On Demand	No	
Arranged Demand	Yes	100%
Rotation	No	

¹ Arranged Demand type based on 24-hour notice given to District for water user activities.

The District’s Contracts and Rules and Regulations contain the procedures for allocation of available water supplies and establishing water rates. Such allocations and rates are adopted annually by the Board of Directors. Water Users within the District hold contracts with the District that specifically detail the Contract Acres, Allocation Acres, and Contract Amount of Water (CAW) for each contract. If the total available District supply is greater than 2.0 acre-feet per allocation acre, then the District supply is allocated per CAW. If the total District supply is less than 2.0 acre-feet per allocation acre then the District supply is allocated per allocation acre. The total District Contract Acres, Allocation Acres, and CAW are 72,081 acres, 71,082 acres and 200,818 acre-feet, respectively. The District’s SWP contract amount through the KCWA is 197,088 acre-feet of the total 200,818 CAW.

Table 11. Water Allocation System

Basis of Water Allocation¹	Allocation Type	Normal Year Allocation²	Percentage of Water Deliveries
Lands within the Service Area	Volume	200,818 AF ³	100%
Other ⁴	Equitable Allocation by Volume or by Acre		

¹ Water allocation to users is by volume determined in various contract conditions.

² District sets an annual water allocation target.

³ Total water held by all contract users in the District (i.e. contract numbers, not physical water); actual allocation in a given year determined based on actual supply

⁴ Equitable allocations by volume or by acre depending on quantity of contract water supplies available.

The District Rules and Regulations provide as follows: *“Daily orders to turn on or to turn off water, or orders to increase or decrease the rate of water delivery, shall be made at the District office through telephone communication, facsimile transmission, e-mail or personal communication from Water User or his designee as provided in these Rules and Regulations. Water orders shall be placed before 8:00 AM for water service for the following day, and water orders placed after 8:00 AM will be for water service the second succeeding day. In the event of an emergency, or when a change is in the delivery point within the service area of the same lateral, or when it may otherwise be practical to do so, changes in deliveries may be approved on lesser notice but the District assumes no obligation to do so. Although the District will make every reasonable effort to comply with the requested water orders, there may be*

times when, because of system capacity limitations, or limitations in the amount of water available, such compliance may not be possible, and the District assumes no obligation therefor. Orders shall normally be made on the basis of continuous use of water during the 24-hour period commencing between 7:00 AM and 9:00 AM. Provided however, that the Board may establish special conditions for short-run deliveries and/or for deliveries at lower flow rates than for normal irrigation practices.” Although the Rules provide for continuous 24-hour use, current practice is for Water Users to order water with specific start and stop times, including changes in flows. This flexibility allows Water Users to deliver only that quantity required for crop needs, avoid overwatering because of required 24-hour use, and thereby improve on-farm irrigation efficiency.

Table 12. Actual Lead Times

Operations	Hours/Days
Water Orders	24-hr notice
Water Shut-Off	No notice needed. ¹

¹ Landowners can shut-off incoming water and notify district will little to no lead time needed.

2.2.2 Water Delivery Measurements or Calculations

All farm delivery points, or “turnouts”, for water delivered by the District to the landowner are equipped with flowmeters that indicate instantaneous flow and accumulate the quantity delivered with a totalizer. District Staff read the meters every Tuesday and observe each meter for any sign of abnormal reading. Figure 4 is a photograph of a typical farm turnout.



Figure 4. Typical Farm Turnout

Since all propeller meters used by the District are equipped with totalizers, the District can equate the calibrated accuracy of the flow meter to volumetric accuracy. According to the publication SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts by the Irrigation Training & Research Center (ITRC) of the California Polytechnic Institute, San Luis Obispo, devices with totalizers provide measurements that are sufficiently precise (in monitoring flow duration) to assume that the flow rate accuracy is equivalent to the calibrated volumetric accuracy. As a result, the devices used by the District to measure delivery rates provide data that enables reliable computation of volumes of water delivered at each turnout.

The DWR maintains flow measurement devices that measure the quantity of water delivered through each of the turnouts from the California Aqueduct. A discussion is provided in Section 8 of this AWMP regarding how the District makes a comparison between the total volume delivered as determined by the DWR measurement off of the California Aqueduct and the total volume delivered to the landowners as determined by the flow meters at farm turnouts read by the District Staff.

Based on the District's operation and maintenance procedures, the District is confident the DWR and District meters provide a very accurate method of measuring both the flow rate and the volume of water delivered into the District and at the District's turnouts. As documented herein, the District's existing water measurement devices perform substantially better than the ± 12 percent accuracy standard and new meters perform substantially better than the ± 5 percent accuracy

standard. District Staff routinely monitor each meter for abnormalities and District policy is to replace a meter if the abnormal reading cannot be rectified in the field (see Section 8 of the plan). The District uses the same manufacturer for all meters to help with consistency in measurement. In addition to District Staff monitoring for any abnormal performance, landowners can request the meter be tested.

Table 13 provides District flow meter information in tabular form, along with the typical levels of accuracy for typical types of measurement devices.

Table 13. Water Delivery Measurements

Measurement Device	Frequency of Measure	Frequency of Calibration	Frequency of Typical Maintenance	Est. Level of Accuracy
Propeller Meters with Totalizers ¹	Read Weekly	Infrequently	As needed	± 2%
Venturi Meters ²	Continuous	As needed	As needed	± 2%

¹ Propeller Meter manufacturer (MC Model MG900; McCrometer, Hemet, CA) specifies ±2% accuracy reading guaranteed, throughout range of 40 gpm to 8500 gpm depending on nominal pipe size (±1% accuracy over reduced range), and a repeatability 0.25% or better. See specification sheet for Propeller Meter in Appendix F.

² Venturi Meters are used for deliveries off the California Aqueduct to the Districts conveyance system. These meters are operated and maintained by the DWR.

2.2.3 Water Rate Schedules and Billing

The District Board of Directors annually establishes water rates. The District has several service areas that have different energy charges associated with them resulting in some variation in rate based on the pumping lifts required to deliver water to service areas.

Although the District pricing structure is quite complicated, it is basically split into two areas; fixed charges (typically based upon Contract Acres), and variable charges based upon the quantity of water ordered or delivered. The costs associated with the District infrastructure and personnel are charged through the acreage charge, and the water costs and power costs associated with the delivery are charged on a per acre-foot basis.

Table 14. Water Rate Basis

Type of Billing Rate Basis	Type Used? Yes/No	Approx. % of Water Deliveries	Description
Volume of Water Delivered	Yes	100%	A portion of each water bill is based on volume of water delivered.
Area (acres)	Yes	100%	A portion of each water bill is based on an acreage charge.
Land Assessment	Yes		Lands benefitting from the District's Project that are outside the Surface Water Service Area pay a small fixed per acre charge regardless of availability of surface water delivered by the District.
Crop	No		

Under conditions of Contract Water Service, Water Users pay the Water Availability Charge and Water Use Charge as provided in the Water Service Contract. On or before July 1 of each year, the District mails to each Contract Water User a final accounting of water charges for the previous year which corrects the budgeted rates and deliveries to actual values

Table 15. Rate Structure

Type of Billing Rate Structure	Type Used? Yes/No	Description
Declining Block Rate	No	
Uniform	Yes	Varies from year-to-year based on availability of SWP and other scheduled, contracted water or supplemental water supplies in addition to the contract water supply.
Increasing Block Rate	No	

On or before December 1 of each year, District will notify each Water User in writing of the estimated total amount of water charges for the year. The total amount shall be paid by Water User in eight equal installments due and payable on the tenth day of the months of February through September of each year, which includes all water allocated for the year. The frequency of billing is shown in Table 16.

Table 16. Frequency of Billing

Billing Frequency
8 equal monthly installments.

2.2.4 Water Shortage Allocation Policies

The District's Water Shortage Allocation Policy is stated in Section 3(l) of the Water Service Contracts and Section 8 Water Shortages of the District's Rules and Regulations. Section 8 provides as follows:

Pursuant to powers granted by Section 43003 et seq., of the California Water Code, the Board has established the water shortage policy to provide for the sharing of the burden of any shortages in the quantity of water available for distribution to Water Users and the cost of thereof during any year.

Allocation of Water: The water supplies available to the District will be allocated to the District's Agricultural Contract Water Users as follows:

i. If the District's available water supply in any year is less than the total of Contract Amount of Water for all Water Users, but more than two acre-feet per acre when averaged for all lands in the Surface Water Service Area, the available supply will be apportioned to all Water Users in the proportion that each Water User's Contract Amount of Water for that year bears to the total of Contract Amount of Water for all Water Users.

ii. If the District's available supply in any year, averaged for all lands in the Surface Water Service Area, is less than two acre-feet per acre, the available supply will be apportioned among all Surface Water Service Area lands on an equal acre-feet per acre basis provided that Water User shall not be apportioned more water under this paragraph (ii) than Water User would receive under paragraph (i) above. Notwithstanding the above, in the event of a severe long-term water shortage, the Board reserves the right to make such other allocations as it deems appropriate, taking into consideration the type of crop, critical water needs, and the economic effect of losses which may occur as a result of such allocations and may provide for adjustments of charges as a result of such allocations.

Supplemental Water: The District during years of short supply may obtain water supplies in addition to that available under the KCWA Contract, including District wells and Banking Programs. Such water supplies are allocated first to provide the full Contract Amount of Water provided for in the contracts for Agricultural Water Service under terms as the Board then determines appropriate and the costs thereof borne by the beneficiaries of such supplies. The method of allocation of Supplemental Water is as set forth in the contracts for Agricultural Water Service and recited in paragraph 8(a) above.

Industrial Water: Apportionment of water under an Industrial Water Service Contract is governed by the terms of that Contract.

Conveyance of Ground Water: In any year the District declares a water shortage exists, District facilities may be used to convey ground water for use upon land within the District for agricultural purposes [whether or not the lands to be served are within the common ownership or Farming Operation of the land from which the water is pumped], provided the affected parties enter into an Agreement in a form provided by the District...”

Under its contract with the Kern County Water Agency, the District receives an annual allocation of SWP water which is delivered from the California Aqueduct. The amount of water available from this source varies with the type of year (“dry” versus “wet”) and any judicial and administrative constraints on the amount of pumping allowed from the Sacramento-San Joaquin River Delta. Similarly, additional contract water supplies vary from year-to-year, as additional contract supplies are dependent on purchases made by the District.

During years of short supply, the District may supplement available surface water through purchases of surface supply and the operation of District-owned wells. Table 17 lists the measures that the District Board has exercised in responding to water shortages.

Table 17. Decreased Water Supply Allocation

Allocation Method	Method Used? Yes/No
Decrease Allocated Water	Yes
Shorten Irrigation Season	No
Restrict Water to Specific Crops	No

Table 18 summarizes enforcement methods available to curtail wasteful water use.

Table 18. Enforcement Method of Allocations Policy

Enforcement Method	Method Used? Yes/No
Shut-Off of Water Supplies	Yes
Refuse Service	No
Fines/Penalties	No

2.2.5 Basis for Reporting Water Quantities

The District annually receives an allocation of its contract amount of SWP water via the California Aqueduct that is referred to as the SWP “Table A” allocation, which is expressed as a percentage of

the District’s contract amount. Accordingly, this allocation becomes an indicator of the hydrologic year type. The annual allocation is a function of hydrology and any regulatory constraints on the amount of pumping allowed from the Sacramento-San Joaquin River Delta. Since the degree of variability in the District’s surface water supplies is heavily based on the reliability of water deliveries from the SWP, recent years representing each of three year types (wet, intermediate/in-between, and dry) were selected to illustrate the District’s operations for annual SWP Table A allocations ranging from 40 to 80 percent. The selection of multiple years illustrates the variability in District operations from year to year. Since the selected years are recent years, they also reflect the “current” level of development, modernization, and delivery capability.

In particular, 2013 was selected as the dry year with 35 percent Final Table A Allocation and since the monthly precipitation levels for this year were below normal. Moreover, there was a significant amount of additional water supplies purchased or previously banked water recovered by the District due to limited SWP surface water supplies. Conversely, 2011 was selected as the wet year with 80 percent Final Table A Allocation and since precipitation levels were above average. To illustrate operations in between these two years, 2012 was selected, with a Final Table A Allocation of 65 percent and since weather patterns and surface water supplies were in between the wet- and dry-year scenarios. The District’s cropping pattern evidenced some minimal changes between these three years, as shown later in Tables 21a through 21c. The three calendar years which were selected illustrate recent District operations in consecutive years leading into the significant drought year of 2014. The selected representative years are identified in Table 19.

Table 19. Representative Years

Calendar Years	2011	2012	2013
Water Year Type	Wet	Typical	Dry
SWP Allocation Percentage	80%	65%	35%

3 Quantification of District Water Uses

The total demand for District water use from year to year is fairly consistent; however, it varies a little for industrial uses and for agricultural water use depending on the irrigated acres, types of crops, and the local climate. Regarding agricultural water use, “Applied water” refers to the amount of water that must be applied in addition to rainfall to meet crop water requirements. The applied water requirement which is not met with supplies delivered into the District is met with pumped groundwater.

3.1 Agricultural Water Use

The primary land use within the District is agriculture. Historically, the District’s agricultural development expanded significantly in the 1940’s, peaked in total acres by the mid-1970’s, and since the 1990’s shifted from field crops to more permanent crops. Permanent crops, primarily nut trees, citrus, and grapes, account for around 70 percent of the total area of the crops planted in the District’s service area. The crop makeup of the District is largely the result of the conversion of annual crops to high value permanent crops over time, which has led to a “hardening” of the total water requirement.

Table 20 summarizes the surface water deliveries (not identified as transfers or exchanges) to agricultural water use within the SWSA of the District for each of the three selected representative year types. Surface water delivered as a transfer or exchanges to the District are included in Table 28 of this AWMP to maintain separate accounting of these deliveries in the water accounting tables. An estimate of overall agricultural demand is tabulated in Tables 21A, 21B, and 21C; and the estimate of the difference between the total water uses (water demand) and the District-delivered water supplies for each of the selected years is identified as the water balance closure term in the Water Budget, shown in Table 48. Regarding the Water Budget calculation, it is recognized as an estimated water balance closure term, calculated to meet the requirements of the DWR’s AWMP Guidelines, and does not represent all the components necessary for determining the long term water balance for the District. For instance, the DWR’s water balance closure term does not capture all components of the change in groundwater storage over time nor does it include all groundwater sustainability components, such as, an annual contribution or allocation of groundwater based on the safe yield of the basin.

Table 20. Agricultural Water Use for Representative Years

Water Source	SWSA Water Deliveries, per Year (AF)		
	2011	2012	2013
Surface Water	161,805	144,062	114,361
Groundwater (District)	1,037	14,579	16,474
Groundwater (Private)	1,230	5,853	14,177
Total	164,072	164,494	145,012

Tables 21A through 21C represent the water requirement for specific crops grown on the irrigated lands within the service area of the District during each of the three years. Total crop acreage is based on the District’s annual crop survey for the each of the selected years. District has an overlap area with neighboring AEWS D that appears as a checkerboard pattern as shown in Figure 2. Accordingly, the District’s crop survey acres necessarily include some AEWS D acres in the overlap area. Water requirements are calculated for all of the WRMWS D acres, although AEWS D could potentially “double count” some of these crop water needs when it prepares its Agricultural Water Management Plan. Moreover, the overlap area includes roughly 1,666 acres of AEWS D surface water service area; this report did not attempt to account for AEWS D surface water deliveries to the overlap.

ET_c values are estimates based on *Report on Investigation of Optimization and Enhancement Water Supplies of Kern County*, Table 2, by Associated Engineering Consultants, dated 1983. This set of values, representing long-term average crop consumptive use, is also utilized in the Kern Fan Operations and Monitoring Report, which is prepared annually by the Kern Fan Monitoring Committee. Actual consumptive use of irrigation water will vary from year to year depending on rainfall and temperatures. Regarding the leaching requirement utilized for the crop water requirement calculation, it can vary by crop type, soil type, and other cultural farming practices. For the purpose of this report, the leaching requirement was based on a low, obtainable leaching requirement of five percent of the crop water requirement. The KCWA *Water Supply Report: 2011* stated a range of 5 to 10 percent and it is recognized this District can obtain a high level of district-wide efficiency since most applied water that percolates beneath the root zone is available for later reuse as a component of the groundwater supply. Furthermore, the District delivers water using pressurized delivery systems originating from the California Aqueduct to the farm delivery points; irrigated lands within the District do not require sub-surface drainage to remove salts and maintain salt balance; and applied irrigation water does not leave the SWSA as surface runoff. Although individual leaching requirements for each crop type can vary, given that water leached through the root zone is not lost

to the overall District supply in this District, it is appropriate to represent the total crop water requirement calculation for the District by use of a low leaching factor.

Table 21. A. Agricultural Crop Data for Representative Year 2011

Crop	Total Crop Acres¹	% of Total	Est ET_c (ft)²	Water Req. (AF)	Est. Leaching (AF)³	Total Req. (AF)
Alfalfa Hay and Clover	1,622	1.9%	3.50	5,678	284	5,962
Almonds ⁴	11,473	13.5%	2.50	28,683	1,434	30,117
Apple, Pear, Cherry,	1,433	1.7%	3.20	4,585	229	4,814
Carrots	3,755	4.4%	1.60	6,008	300	6,308
Citrus ⁴	20,043	23.5%	2.60	52,111	2,606	54,717
Corn and Grain Sorghum	305	0.4%	1.80	550	27	577
Cotton	4,843	5.7%	2.60	12,591	630	13,220
Flowers and Nursery	40	<0.1%	2.00	81	4	85
Grain and Grain Hay	1,988	2.3%	2.00	3,975	199	4,174
Grapes ⁴	23,759	27.9%	2.30	54,645	2,732	57,378
Melons, Squash, and	1,633	1.9%	1.60	2,612	131	2,743
Misc. Subtropical Trees ⁴	1,027	1.2%	3.20	3,287	164	3,451
Misc. Deciduous ⁴	281	0.3%	3.20	899	45	944
Misc. Field Crops	139	0.2%	2.00	277	14	291
Onions and Garlic	1,812	2.1%	1.70	3,081	154	3,235
Pasture and Misc.	198	0.2%	3.70	733	37	770
Peach, Nectarine, and	717	0.8%	3.20	2,294	115	2,408
Pistachio ⁴	1,753	2.1%	3.20	5,609	280	5,889
Potatoes	2,172	2.6%	2.00	4,345	217	4,562
Safflower and Sunflower	376	0.4%	1.80	676	34	710
Small Vegetables	3,816	4.5%	1.60	6,106	305	6,411
Tomatoes and Peppers	1,969	2.3%	1.60	3,150	157	3,307
Totals⁵	85,153	100.0%		201,975	10,099	212,074

¹ Total acres including double cropped acres, from Wheeler Ridge GIS and the District's 2011 Crop and Land Use Survey.

² From Report on Investigation of Optimization and Enhancement Water Supplies of Kern County, (1983), Table 2, by Associated Engineering Consultants.

³ Leaching requirements vary by crop type, soil type and other factors. For the purposes of this table, a leaching requirement of 5 percent of the crop water requirement was assigned, not been verified, however it is considered representative for District-wide efficiency.

⁴ Considered Permanent Crop, 71 percent of total acres in 2011.

⁵ Idle acres of 66,663 acres not included in the total for crop acres for 2011

Table 21. B. Agricultural Crop Data for Representative Year 2012

Crop	Total Crop Acres¹	% of Total	Est ET_c (ft)²	Water Req. (AF)	Est. Leaching (AF)³	Total Req. (AF)
Alfalfa Hay and Clover	2,462	2.7%	3.50	8,616	431	9,047
Almonds ⁴	11,976	13.3%	2.50	29,939	1,497	31,436
Apple, Pear, Cherry, Plum,	1,430	1.6%	3.20	4,577	229	4,805
Beans	104	0.1%	1.40	146	7	153
Carrots	2,974	3.3%	1.60	4,758	238	4,996
Citrus ⁴	21,171	23.5%	2.60	55,044	2,752	57,797
Corn and Grain Sorghum	607	0.7%	1.80	1,093	55	1,147
Cotton	3,419	3.8%	2.60	8,889	444	9,333
Flowers and Nursery	75	0.1%	2.00	151	8	158
Grain and Grain Hay	4,192	4.7%	2.00	8,384	419	8,804
Grapes ⁴	24,397	27.1%	2.30	56,112	2,806	58,918
Melons, Squash, and	1,702	1.9%	1.60	2,723	136	2,859
Misc. Subtropical Trees ⁴	1,118	1.2%	3.20	3,578	179	3,757
Misc. Deciduous ⁴	281	0.3%	3.20	899	45	944
Misc. Field Crops	2,518	2.8%	2.00	5,036	252	5,288
Onions and Garlic	1,740	1.9%	1.70	2,958	148	3,106
Pasture and Misc. Grasses	198	0.2%	3.70	733	37	770
Peach, Nectarine, and	601	0.7%	3.20	1,924	96	2,020
Pistachio ⁴	1,753	1.9%	3.20	5,609	280	5,889
Potatoes	2,001	2.2%	2.00	4,002	200	4,202
Safflower and Sunflower	180	0.2%	1.80	324	16	340
Small Vegetables	2,648	2.9%	1.60	4,237	212	4,449
Tomatoes and Peppers	2,498	2.8%	1.60	3,996	200	4,196
Turnips and Misc.	37	<0.1%	2.00	75	4	78
Totals⁵	90,082	100.0%		213,803	10,690	224,494

¹ Total acres including double cropped acres, from Wheeler Ridge GIS and the District's 2012 Crop and Land Use Survey.

² From Report on Investigation of Optimization and Enhancement Water Supplies of Kern County, (1983), Table 2, by Associated Engineering Consultants.

³ Leaching requirements vary by crop type, soil type and other factors. For the purposes of this table, a leaching requirement of 5 percent of the crop water requirement was as assigned, not been verified, however it is considered representative for District-wide efficiency.

⁴ Considered Permanent Crop, 69.6 percent of total acres in 2012,

⁵ Idle acres of 63,142 acres not included in the total for crop acres for 2012

Table 21. C. Agricultural Crop Data for Representative Year 2013

Crop	Total Crop Acres¹	% of Total	Est ET_c (ft)²	Water Req. (AF)	Est. Leaching (AF)³	Total Req. (AF)
Alfalfa Hay and Clover	1,821	2.1%	3.50	6,374	319	6,692
Almonds ⁴	12,686	14.5%	2.50	31,716	1,586	33,302
Apple, Pear, Cherry, Plum, and Prune ⁴	1,623	1.9%	3.20	5,192	260	5,452
Beans	154	0.2%	1.40	216	11	227
Carrots	2,828	3.2%	1.60	4,524	226	4,751
Citrus ⁴	21,285	24.3%	2.60	55,341	2,767	58,108
Corn and Grain Sorghum	987	1.1%	1.80	1,777	89	1,865
Cotton	1,974	2.3%	2.60	5,132	257	5,389
Grain and Grain Hay	4,036	4.6%	2.00	8,072	404	8,475
Grapes ⁴	25,123	28.7%	2.30	57,784	2,889	60,673
Melons, Squash, and Cucumbers	1,512	1.7%	1.60	2,419	121	2,540
Misc. Subtropical Trees ⁴	1,122	1.3%	3.20	3,592	180	3,771
Misc. Deciduous ⁴	468	0.5%	3.20	1,498	75	1,573
Misc. Field Crops	690	0.8%	2.00	1,379	69	1,448
Onions and Garlic	1,728	2.0%	1.70	2,937	147	3,084
Pasture and Misc. Grasses	160	0.2%	3.70	593	30	622
Peach, Nectarine, and Apricots ⁴	351	0.4%	3.20	1,123	56	1,179
Pistachio ⁴	2,583	3.0%	3.20	8,264	413	8,678
Potatoes	1,762	2.0%	2.00	3,524	176	3,700
Safflower and Sunflower	32	<0.1%	1.80	57	3	60
Small Vegetables	1,528	1.7%	1.60	2,445	122	2,567
Tomatoes and Peppers	2,931	3.4%	1.60	4,689	234	4,924
Turnips and Misc. Vegetables	38	<0.1%	2.00	75	4	79
Totals	87,422	100.0%		208,723	10,436	219,160

¹ Total acres including double cropped acres, from Wheeler Ridge GIS and the District's 2013 Crop and Land Use Survey.

² From Report on Investigation of Optimization and Enhancement Water Supplies of Kern County, (1983), Table 2, by Associated Engineering Consultants.

³ Leaching requirements vary by crop type, soil type and other factors. For the purposes of this table, a leaching requirement of 5 percent of the crop water requirement was assigned, not been verified, however it is considered representative for District-wide efficiency.

⁴ Considered Permanent Crop, 74.6 percent of total acres in 2013

⁵ Idle acres of 64,774 acres not included in the total for crop acres for 2013.

Table 22A shows the acres within the Total Area of the District categorized by the irrigated and non-irrigated land areas within or outside of the District's Surface Water Service Area. The method of irrigation is also categorized, indicating the majority of lands are irrigated with micro-drip systems. The contract service area acreage has changed little over time, while the irrigated acreage has varied due to many factors.

Table 22.A. District Irrigated Acreage for Representative Years

Acreage Basis	Total Acreage, per Year		
	2011	2012	2013
Surface Water Service Area			
Irrigated Lands¹			
Furrow	151	38	38
Center Pivot	59	59	59
Micro drip	54,267	54,396	54,345
Micro sprinkler	345	345	345
Sprinkler	4,972	5,846	4,628
Subtotal Spring Net Irrigated	59,794	60,684	59,415
Fall Net Irrigated	450	83	435
Double Cropped	1,213	1,131	662
Subtotal SWSA Irrigated/Cultivated²	61,458	61,898	60,512
Non-Irrigated Lands			
Miscellaneous Lands	3,649	3,757	4,972
Undeveloped/Native Vegetation/Grazing Land	403	397	397
Fallow/Other/Dry Farm Lands	8,235	7,243	7,297
Subtotal SWSA Non-irrigated	12,287	11,397	12,666
Subtotal Within Surface Water Service Area	72,081	72,081	72,081
Lands Outside Surface Water Service Area (GWA)			
Irrigated Lands¹			
Furrow	394	455	455
Center Pivot	1,073	1,073	1,073
Micro drip	10,560	11,402	11,091
Micro sprinkler	91	91	91
Sprinkler	8,772	10,499	10,449
Subtotal Spring Net Irrigated	20,891	23,521	23,160
Fall Net Irrigated	1,183	1,395	1,804
Double Cropped	1,622	3,268	1,947
Subtotal GWA Irrigated/Cultivated²	23,695	28,184	26,910
Non-Irrigated Lands			
Miscellaneous Lands	1,177	1,404	1,387
Undeveloped/Native Vegetation/Grazing Land	28,154	28,134	28,124
Fallow/Other/Dry Farm Lands	25,044	22,207	22,595
Subtotal GWA Non-Irrigated	54,375	51,745	52,106
Subtotal Outside Surface Water Service Area	75,266	75,266	75,266
Total District			
Irrigated Lands¹			
Furrow	545	493	493
Center Pivot	1,133	1,133	1,133
Micro drip	64,827	65,798	65,436
Micro sprinkler	436	436	436
Sprinkler	13,744	16,345	15,077
Subtotal Spring Net Irrigated	80,685	84,205	82,575
Fall Net Irrigated	1,633	1,478	2,239
Subtotal Net Spring Plus Net Fall Irrigated/Single Cropped⁴	82,318	85,683	84,814
Double Cropped ⁴	2,835	4,399	2,608
Total Irrigated/Cultivated³	85,153	90,082	87,422
Non-Irrigated Lands			
Miscellaneous Lands	4,826	5,161	6,359
Undeveloped/Native Vegetation/Grazing Land	28,557	28,531	28,521
Fallow/Other/Dry Farm Lands	33,279	29,450	29,892
Total Non-Irrigated/Idle⁴	66,662	63,142	64,772
Total Area Within District	147,347	147,347	147,347

¹ Net Acres² Matches Table 22B³ Matches Tables 21A, 21B, 21C, and 22B⁴ Matches Table 23

Table 22. B. District Irrigated Acreage for Representative Years

Acreage Basis	Total Acreage, per Year		
	2011	2012	2013
Surface Water Irrigated Area ¹	61,458	61,898	60,512
Groundwater Irrigated Area ¹	23,695	28,184	26,910
Total Irrigated Area²	85,153	90,082	87,422

¹ Total acres including double cropped and Fall Net Irrigated acreage, from Wheeler Ridge GIS and District 2011 through 2013 Crop and Land Use Surveys.

² Total acres of irrigated acreage in District (i.e. surface water service area plus groundwater irrigated area).

Cropped acres as shown in Tables 21A, 21B, and 21C contain all the District Service irrigated acres, including double cropped acres and the Fall Net Irrigated acres. The amount of irrigated land not cropped at any time during the year is indicated as Idle land in Tables 21A, 21B, and 21C footnotes. Inter-cropping is not a common practice within the District service area. District crop surveys were used to assess cropping acreage for the selected years and the surveys indicated some acres as being double cropped. Accordingly, the multiple crop information is reported in Table 23.

Table 23. Multiple Crop Information for Representative Years

Cropping Pattern	Total Acreage, per Year		
	2011	2012	2013
Single Cropped ¹	82,318	85,683	84,814
Inter-Cropping	Negligible	Negligible	Negligible
Double Cropped ²	2,835	4,399	2,608
Idle ³	66,662	63,142	64,772
Total⁴	151,815	153,224	152,194

¹ Acres NOT including double crop acres, from WRMWSD GIS and WRMWSD 2011-2013 Crop and Land Use Surveys

² Acres, from WRMWSD GIS and WRMWSD 2011-2013 Crop and Land Use Surveys

³ Gross acres, from WRMWSD GIS and WRMWSD 2011-2013 Crop and Land Use Surveys

⁴ Matches Table 21A, 21B, 21C

3.2 Environmental Water Use

While the District does not make direct delivery of water specifically for environmental purposes within the District Service Area, a portion of the District’s contract water is contributed to environmental needs outside of the District’s Contract Service Area. In particular, to the extent that the District’s SWP contract water supply is reduced in reliability to meet the environmental and water quality needs of the Delta, a portion of the contract water intended for delivery to the District Service

Area goes to meet environmental water uses outside of the District Service Area, supposedly benefiting fish and wildlife outside of the District.

To the extent water is in the District’s 850 Canal that is incidental to operations, a negligible benefit to local wildlife may occur. Since this is an incidental environmental use, it is not a consumptive environmental water use applicable to the AWMP water balance; Table 24 is completed accordingly. Additionally the District is a 24% participant in the Kern Water Bank Authority, which provides significant environmental benefits, including for uplands terrestrial species and water fowl.

Table 24. Environmental Water Uses for Representative Years

Environmental Water Use	Total Deliveries, per Year (AF)		
	2011	2012	2013
In-Stream Flow Releases	None ¹	None ¹	None ¹
Streams			
Lakes or Reservoirs			
Riparian Vegetation			
Other			
Total	0	0	0

¹ Any environmental uses of District water supplies are incidental to the District’s use and conveyance of water.

3.3 Recreational Water Use

The District does not supply water to recreational facilities within the service area.

Table 25. Recreational Water Uses for Representative Years

Recreational Facility Water Uses	Total Deliveries, per Year (AF)		
	2011	2012	2013
None			
Total	0	0	0

3.4 Municipal and Industrial Water Use

The District delivers only raw (non-potable) water to industrial water use within the District.

Table 26. Municipal and Industrial Water Uses for Representative Years

Municipal/Industrial Water Uses	Total Deliveries, per Year (AF)		
	2011	2012	2013
Municipal Entities	0	0	0
Industrial Entities ¹	2,157	3,127	3,577
Total	2,157	3,127	3,577

¹ Specific industrial entities receiving water supplies are generally listed in the District's monthly and annual water use reports.

Additionally it is noted that a portion of the District overlaps the Tejon-Castaic Water District (TCWDS) which provides primarily industrial water to the Tejon Industrial Complex along the I-5 corridor in the southern most portion of the District. The District does not provide water service to TCWD which has its own surface water supplies and groundwater banking assets for its area.

3.5 Groundwater Recharge Use

Some indirect recharge occurs within the District to the extent that the District delivers surface water in lieu of pumped groundwater to satisfy irrigation water requirements. In addition, surface water supplies which are surplus to immediate irrigation requirements within the District are available for direct groundwater recharge to locations outside of the District. In this regard, the District participates in the Kern Water Bank, the Pioneer Project, and the Berrenda Mesa banking projects; all of these banking projects rely on direct recharge, are located outside of the District on the Kern River alluvial fan, and provide a source of supply in “dry” periods. Table 27 shows the volume of water recharged for the three years selected, which indicates the District recharge occurs optimistically during particularly wet years when recharge through the use of spreading ponds outside of the District within banking facilities is significant.

Table 27. Groundwater Recharge Uses for Representative Years

Groundwater Recharge Water Uses (Locations)	Total Deliveries, per Year (AF)		
	2011	2012	2013
Kern Water Bank	60,768	0	0
Pioneer Project	18,415	0	0
Berrenda Mesa Project	3,435	0	0
In-District Recharge Ponds	273	0	0
Total	82,891	0	0

The District participates in three long-term “Water Banking” programs allowing the District to store then current “surplus” water and to recover their water when needed. Water banking involves the regulation of surplus surface water supplies, by placing the water into groundwater storage for subsequent recovery. The storage is achieved through either indirect or direct recharge. Indirect recharge is based on the delivery of surface water in-lieu of pumping groundwater. Direct recharge is based on the surface spreading and percolation of water supplies in basins or ponds, which is the method used in the Banking Projects.

The advantage of in-lieu recharge is that the recharge is essentially immediate, as the delivery of one acre-foot of water on the surface immediately displaces one acre-foot of groundwater pumping and does not depend upon percolation and the movement of water in the aquifer. One disadvantage is the fact that the surface water supply must be available on an irrigation demand schedule, with irrigation demands being relatively low during winter months. In contrast, direct recharge through use of the banking project facilities can be accomplished during any time of the year, which increases the likelihood of being able to capture unregulated supplies that become available from time to time.

3.6 Transfer and Exchange Use

Recall that District’s primary source of surface water is from the SWP and this water is delivered via the California Aqueduct into the District. When practicable, the District relies on transfers to supplement its annual water supply. Table 28 lists the amount of water transferred from various entities into the District in 2011, 2012, and 2013. Also shown in Table 28 is Article 21 water delivered from the KCWA that is not transfer or exchange water; it is wet period, surplus water delivered via the California Aqueduct.

Note that the District views these transfers and exchanges with non-district entities as separate from those made as wheeling of water within District for common landowners. The in-district wheeling of water actions do not alter the total agricultural water uses within the District and are not shown in Table 28.

Table 28. A. Transfer and Exchanges to District for Representative Years

From Agency	Type of Transfer ¹	Total Deliveries, per Year (AF)		
		2011	2012	2013
KCWA	Article 21	11,257	1,630	0
Kern Water Bank	Ag to M&I	448	2,311	2,642
Central Coast Water Agency	M&I to Ag	1,340	0	0
Butte Water District	M&I to Ag	0	2,599	1,367
Yuba County Water Agency	Ag to Ag	0	1,330	6,778
Friant-Kern Recirculation	Ag to Ag	4,752	3,086	0
Castaic Lake Water Agency	M&I to Ag	0	4,450	1,626
Fresno Irrigation District	Ag to Ag	0	1,349	889
Tehachapi-Cummings Community Water District	Ag to Ag	0	1,375	809
Western Hills Water District	M&I to Ag	0	999	443
Feather River Contractors	Ag to Ag	0	0	21,140
SWP Multi Year Market Pool	M&I to Ag	0	0	9,788
San Luis Reservoir ²	"Carry-over"	-8,512	-4,300	-889
Total (to District)³		9,285	14,829	44,593

¹ Typical transfer and exchange types include Ag (Agricultural) to M&I (Municipal/Industrial), M&I to Ag, or Ag to Ag.

² Water supplies from transfers and exchanges held-over in the California Aqueduct at the San Luis Reservoir or sent directly to banking entities (i.e. water supplies which were not physically sent to the District). Used as identified quantity to balance incoming water supplies to District.

³ Represents total water transferred or exchanged into District's conveyance system.

Table 28. B. Transfer and Exchanges from District for Representative Years

To Agency	Type of Transfer ¹	Total Deliveries, per Year (AF)		
		2011	2012	2013
Central Coast Water Agency	Ag to M&I	0	0	880
Total (from District)		0	0	880

¹ Typical transfer and exchange types include Ag (Agricultural) to M&I (Municipal/Industrial), M&I to Ag, or Ag to Ag.

3.7 Other Water Use

All water uses of any significance have been described previously in this section. Minor volumes of water are used within the District for dust abatement and mixing with agricultural chemicals before spraying. Table 29 notes that the cumulative miscellaneous water use reported by the District for other water use purposes is fairly insignificant.

Table 29. Other Water Uses for Representative Years

Other Water Uses	Total Deliveries, per Year (AF)		
	2011	2012	2013
Dust Abatement and Mixing	14	11	38
Total	14	11	38

3.8 Projected Water Use

The District receives surface water from the SWP, which is delivered to the District via the California Aqueduct. Historically, Article 21 and Turnback water available for purchase were used to supplement the District’s contract water supply. Recently, SWP supplies, including Article 21, have been significantly reduced and there is the potential for additional reductions in the future; however the amount and timing of the reduction is somewhat uncertain. In most years, the District purchases supplemental water supplies from KCWA and other sources.

The District’s contracted SWP water supply is constrained by the following management and regulatory factors:

- a. The conservation facilities to be constructed as part of the SWP have not been completed, which has the effect of reducing the yield of the District’s contract supply;
- b. Federal and State regulatory agencies have, particularly since the mid-1990s, placed additional constraints on pumping from the SWP’s Banks Pumping Plant, which were not contemplated, and have resulted in reductions in reliability and yield; and
- c. The annual allocation of water from the SWP during a given year is a moving target until as late as August in a given year; accordingly, District growers must make decisions regarding annual plantings before knowing their water allocation.

Permanent crops dominate the District’s irrigated lands, most of which rely on low-volume, drip irrigation methods. Without any foreseeable pressure to urbanize, the landscape is not expected to change in the near term. Permanent crops represent a “hard” demand for water that must be met each and every year. To the extent that surface water supplies are reduced, there is an offsetting increase in groundwater pumping to meet irrigation water requirements. In this regard, it is noted that groundwater levels were declining dramatically prior to importation of SWP supplies and were considered to be in a state of overdraft. The District’s Project corrected this overdraft and resulted in improvement in (shallower) groundwater levels. Accordingly, recent reductions in the availability of surface water supplies threaten to induce a long-term decline in groundwater levels.

4 Quantification and Quality Assessment of District Water Resources

4.1 Surface Water Supply

As previously discussed, surface water deliveries to the District began in 1971. All water delivered is in a raw untreated condition, suitable for irrigation, and is not suitable for human consumption without treatment. The primary source of surface water is SWP water delivered through the California Aqueduct. Besides SWP supplies, the District supplements deliveries with water originating from other sources, as noted in Table 28.

State Water Project

The District imports SWP water under a contract with the KCWA for 197,088 acre-feet per year. The contract with the KCWA was signed in 1967. Under its contract with the KCWA, the District receives an annual allocation of SWP water which is delivered from the California Aqueduct. The amount of water available from this source varies with the type of year (“dry” versus “wet”) and constraints on the amount of pumping allowed from the Sacramento-San Joaquin River Delta. Similarly, additional contract water supplies vary from year-to-year, as additional contract supplies are dependent on purchases made by the District.

Over the last 12 years, this source of supply has averaged about 117,432 acre-feet annually. Going forward, the average yield of District’s contract amount is expected to be around 61 percent of the 197,088 acre-feet or about 120,223 acre-feet annually (based on the *2011 SWP Water Supply Reliability Report*). Shortages in SWP supplies are occurring more frequently and are larger than originally envisioned, mainly due to the regulatory restrictions on exports from the Sacramento-San Joaquin River Delta.

From time to time, additional SWP supplies, referred to as “Article 21” water, are made available. Historically, the District has been able to receive Article 21 water; however, due to the aforementioned restrictions on pumping water from the Delta, Article 21 water is becoming less available to the District and other districts over time.

Tables 30A and 30B contain the surface water supplies delivered to the District that consist of various SWP sources plus water delivered that was recovered as previously banked supply from one of the water banks located outside of the District.

Table 30. A. Surface Water Supplies for Representative Years

Source of Water Supply	Type of Supply	Total Deliveries, per Year (AF)		
		2011	2012	2013
SWP Surface Water Supplies ¹	Surface	159,080	124,218	65,367
Kern Water Bank/Pastoria	Bank Return	588	3,044	3,477
Kern Water Bank	Bank Return	2,137	12,000	35,434
Pioneer Project	Bank Return	0	4,300	10,083
Berrenda Mesa Project	Bank Return	0	0	0
Common Landowner Transfers		0	500	0
Total		161,805	144,062	114,361

¹ Represents all water supplies from the SWP, including District Table A Allocation, Annual Carryover, DWR Pool A and B, Article 21 water supplies, and other water-purchase programs, see Table 30B.

Table 30. B. Surface Water Supplies from SWP Sources for Representative Years

SWP Program	Total Deliveries, per Year (AF)		
	2011	2012	2013
District Table A Allocation ¹	140,421	122,282	59,430
Article 21	16,239	0	0
Annual Carryover	2,420	1,493	5,700
DWR Turnback Pools	0	443	237
Total	159,080	124,218	65,367

¹ Water supply received as part of KCWA's allocation.

Table 31 lists restrictions or imposed limitations on sources of the District's surface water supply, including the largest component of the District's supply, SWP water via the California Aqueduct. Restrictions on this supply generally result from regulatory actions of wildlife agencies related to endangered species actions and actions of the SWRCB that restrict the pumping operations managed by the DWR, and related judicial proceedings. Pumping restrictions have adversely affected the reliability of SWP supply, caused groundwater levels to decline and generally result in application of lower quality groundwater to grow crops. The quantity of transfer water that can be delivered into the District or into banking programs outside of the District has also been restricted due to the imposed limitations shown in Table 31. Additionally these restrictions result in significant financial burdens to the District and its water users because (i) the fixed costs of DWR and the District have to be paid even with reduced quantities to be delivered, and (ii) banked supplies and programs to buy limited additional supplies can only be secured at much greater expense.

Table 31. Potential Restrictions on Water Sources

Impacted Source	Restrictions or Imposed Limitations	Name of Agency Imposing Restrictions	Operational Constraints
State Water Project (SWP)	Delivery Schedule and Volume	USFWS, NMFS, Federal Courts, and SWRCB	Reduced reliability of SWP deliveries south of the Sacramento-San Joaquin River Delta due to constraints on pumping.
Transfers	Conveyance through Sacramento-San Joaquin River Delta	USFWS, NMFS, Federal Courts, and SWRCB	Reduced amount of time during the year for which conveyance through the Delta is allowed.

4.2 Groundwater Supply

The District overlies the southern portion of the Kern County Subbasin within the larger San Joaquin Valley Groundwater Basin, which is a portion of the Central Valley aquifer system. *DWR Bulletin 118* (2003 Update) identifies the Kern County Subbasin as No. 5-22.14. The Kern County Subbasin is shown in relation to the District’s service area on Figure 5, and the size of the basin (as published by DWR) is indicated in Table 32.

Table 32. Local Groundwater Basins

Basin Name	Size (Sq. Mi.)	Est. Capacity (AF)	Safe Yield (AFY)
Kern County Groundwater Subbasin ¹	3,040	40,000,000	Unknown

¹ DWR San Joaquin District Kern County Groundwater Subbasin information available at following address: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/5-22.14.pdf

Information on groundwater management in the District, as well as the geology of the aquifer underlying the District’s service area, is presented in the WRMWSD’s 2007 Groundwater Management Plan. Table 33 indicates the date of the Plan and lists the firm responsible for its preparation.

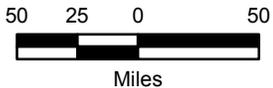
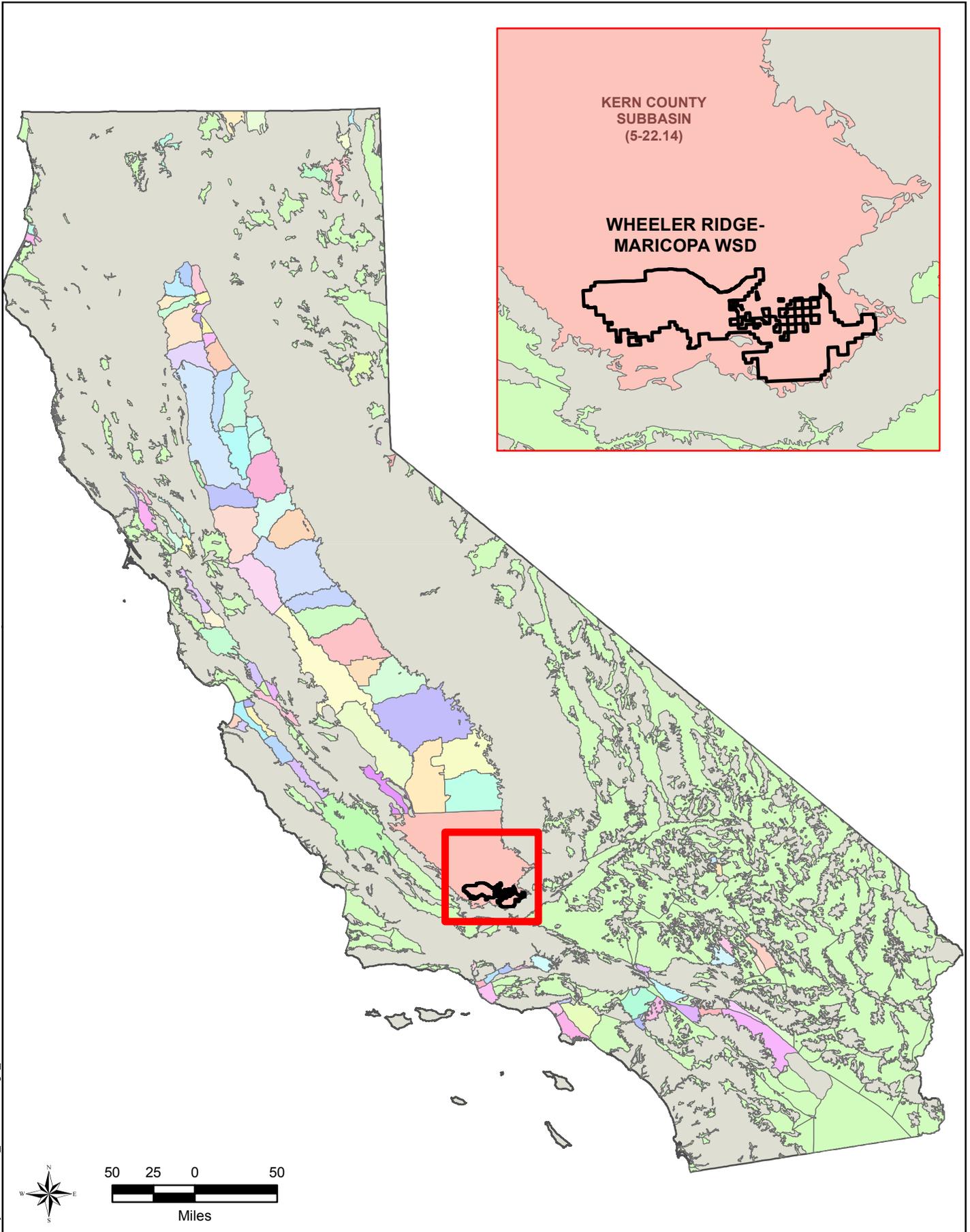
Table 33. Groundwater Management Plan Information

Prepared By	Todd Engineers w/Kennedy-Jenks Consultants
Year Completed/Approved	2007
Attached in Appendix¹ Yes/No	No

¹ Available upon request.

The District, DWR, KCWA, and Arvin-Edison WSD conduct groundwater monitoring within the District boundaries. Water level monitoring has been conducted in the District since the 1950’s.

As stated in the WRMWSD's Groundwater Management Plan, prior to 1967, the only source of water supply in the basin was groundwater. Since that time, the District has secured additional water sources including water from the SWP. Within the portions of the District collectively known as the Surface Water Service Area (SWSA), the District delivers water via a network of distribution lines and turnouts. This water supply consists of SWP water diverted from the California Aqueduct, water obtained from Kern County banking projects, local surface water, and groundwater pumped from the District's 16 groundwater wells. The District records the volume of water drawn from each source and delivered to customers.



SOURCE: DWR Bulletin 118, v.3, 2003.

Wheeler Ridge-Maricopa Water Storage District
Kern County, California

2014 Agricultural Water Management Plan



DISTRICT BOUNDARY IN RELATION
TO GROUNDWATER BASINS

DECEMBER 2014

FIGURE 5

Although the water supply provided by the District meets most of the water demand, there remains some water users within the SWSA who supplement surface deliveries with groundwater pumped from private wells. In addition, there are water users outside of the SWSA but within the District boundary whose entire water supply is drawn from private wells. The total volume of groundwater extraction within the District is the combination of water pumped from these private wells and pumping at the 17 District wells. While the District maintains records of the volume of water pumped from its own wells, data are not available on the number of private wells in operation nor the volume of groundwater pumped from these wells. The District's GWMP contains an estimated volume of annual groundwater pumping, on average, of approximately 61,461 AFY for the period 1971 to 2001. A typical well is shown in Figure 6.



Figure 6. Typical District-Owned Groundwater Well

Table 34 shows groundwater pumped into the District conveyance system by District and private wells for the years 2011, 2012, and 2013 in acre-feet per year.

Table 34. Groundwater Supplies for Representative Years

Groundwater Supply Source ¹	Total Deliveries, per Year (AF)		
	2011	2012	2013
District-owned Wells	1,037	14,579	16,474
Private Wells pumped into District	1,230	5,853	14,177
Total	2,267	20,432	30,651

¹Based on Wheeler Ridge *Summary of Deliveries*.

4.3 Other Water Supplies

The District actively imports surface water from the sources listed in Table 30. In general, there are little uncontrolled inflows to the District, with the exception of small creeks, which are frequently dry but which, at times, provide a source of unregulated inflow that does not, however, exit the District. Flows from the creeks are intermittent and not measured since the flows are very infrequent and do not produce large volumes.

4.4 Drainage from the Surface Area

Drainage wells and surface drainage systems are not employed by the District. In some areas, groundwater below the root zone from excessive deep percolation is recoverable and can be used to supplement surface water. In these areas, the recovered water is generally of poorer quality than surface water and is not suitable for irrigation unless blended with better quality surface water. As Table 35 summarizes, there are some minimal flows to saline sinks or perched water tables based on estimates provided by the District Engineer.

Table 35. Drainage Discharges

Surface/Subsurface Drainage Path	Water Uses, per Year (AF)		
	2011	2012	2013
Flows to Saline Sinks ¹	1,200	1,300	1,500
Flows to Perched Water Table	1,300	1,300	1,400

¹Based on deliveries to certain WRM2, WRM4, and WRM5 System turnouts outside usable GW basin, assuming 5% of deliveries go to return flows.

²Assuming 15% of these turnouts deliver to perched water lands and 5% of deliveries go to return flows

4.5 Water Supply Quality

4.5.1 Surface Water Quality

Recall that the District’s principal source of surface water is SWP water delivered by the California Aqueduct. Other sources are delivered using the same conveyance facility. Regarding the quality of the water delivered to the District from the California Aqueduct, few water quality problems have

been noted that limit the use of the water for irrigation in the District; the water is relatively good quality and suitable for irrigation. Water quality measurements are collected at Check 29 of the California Aqueduct which is located upstream of the turnouts used for deliveries to the District. Water quality data collected from Check 29 during winter and summer conditions are presented in Tables 36A, 36B, and 36C for 2011, 2012, and 2013.

Table 36. A. Surface Water Supply Quality Assessment for 2011

Parameter/ Constituent	Symbol	Concentration, per Season (mg/l) ¹	
		Winter ²	Summer ³
Boron	B	0.1	0.1
Calcium	Ca	14	13
Magnesium	Mg	8	6
Sodium	Na	24	22
Potassium	K	--	--
Chloride	Cl	27	24
Sulfate	SO ₄	25	26
Nitrate	NO ₃	3	1.5
Total Dissolved Solids	TDS	144	184

¹ Based on data taken from Check 29 of the California Aqueduct, available at following address: http://www.water.ca.gov/waterdatalibrary/waterquality/station_county/gst_report.cfm

² Corresponds with readings from December through February, specific date of 1/9/2011.

³ Corresponds with readings from June through August, specific date of 6/14/2011.

Table 36. B. Surface Water Supply Quality Assessment for 2012

Parameter/ Constituent	Symbol	Concentration, per Season (mg/l) ¹	
		Winter ²	Summer ³
Boron	B	0.2	0.2
Calcium	Ca	21	--
Magnesium	Mg	14	--
Sodium	Na	67	--
Potassium	K	--	--
Chloride	Cl	104	57
Sulfate	SO ₄	43	37
Nitrate	NO ₃	3.2	2.3
Total Dissolved Solids	TDS	322	229

¹ Based on data taken from Check 29 of the California Aqueduct, available at following address: http://www.water.ca.gov/waterdatalibrary/waterquality/station_county/gst_report.cfm

² Corresponds with readings from December through February, specific date of 1/8/2012.

³ Corresponds with readings from June through August, specific date of 6/18/2012.

Table 36. C. Surface Water Supply Quality Assessment for 2013

Parameter/ Constituent	Symbol	Concentration, per Season (mg/l) ¹	
		Winter ²	Summer ³
Boron	B	0.2	0.2
Calcium	Ca	24	23
Magnesium	Mg	14	13
Sodium	Na	65	56
Potassium	K	--	--
Chloride	Cl	94	77
Sulfate	SO ₄	45	40
Nitrate	NO ₃	4.8	1.8
Total Dissolved Solids	TDS	297	288

¹ Based on data taken from Check 29 of the California Aqueduct, available at following address: http://www.water.ca.gov/waterdata/library/waterquality/station_county/gst_report.cfm

² Corresponds with readings from December through February, specific date of 1/16/2013.

³ Corresponds with readings from June through August, specific date of 6/18/2013.

4.5.2 Groundwater Quality

Groundwater quality is generally not suitable for irrigation use in the western 6 miles of the District due to higher levels of salts and boron. However, east of this area, such quality is generally suitable for irrigation use, although significant water quality changes are noted from one subarea to another. Ambient groundwater quality and spatial variability across the study area were examined using water quality data provided by the District and geochemical plots constructed by Todd Engineers for the previously mentioned GWMP.

4.5.3 Other Water Supplies

Water transferred into the District or returned from banking projects is conveyed in the California Aqueduct; therefore, its water quality is represented by the sampling already occurring for the California Aqueduct.

4.5.4 Drainage from the Water Supplier's Service Area

The District is a member of the Kern River Watershed Coalition Authority (KRWCA), which is in turn a member of the Southern San Joaquin Valley Water Quality Coalition (SSJVWQC) and in that capacity, participates in, and contributes financially to, a Regional Water Quality Control Board program to monitor and improve surface water and groundwater quality associated with agricultural activities. The Regional Board has promulgated a broader Irrigated Lands Regulatory Program (ILRP) to address both surface water and groundwater quality. As a service to its landowners, the District does participate in and help facilitate the ILRP in cooperation with the KRWCA.

Since the District does not provide drainage facilities or assessment of on-farm subsurface drainage systems, the limitations associated with drainage reuse are not applicable to District operations, as noted in Table 37.

Table 37. Drainage Reuse Effects

Drainage Reuse Limitations	Parameter/Constituent
Increased Leaching	None
Blending Supplies	None
Restricted Area of Use	None
Restricted Crops	None
Other (e.g. Landowner)	Reuse system practiced by one landowner.

4.6 Water Quality Monitoring Practices

The District conducts some water quality monitoring in key wells across their service area. Much of the water quality information the District obtains is from private wells that is provided under condition of confidentiality and is not public information. Currently 14 active agriculture wells are included in the program with several alternate locations in the event that a program well cannot be sampled. Water samples are collected from these wells in June or July of each year and analyzed for general minerals, boron, SAR and Langlier indices, a program designed to evaluate the suitability of water quality for irrigation.

The District maintains these data in an Access database. In addition to data from their ongoing monitoring program, the District has also compiled and entered historical water quality data into their database. These data generally date back to the 1960s but contain data from one well sampled in 1910 and five wells sampled in the 1950s.

Included in the database are 133 different water quality parameters including metals, volatile organic compounds (VOC) and fuel oxygenates, major and minor anions and cations, total hardness, conductivity, total alkalinity, pH and TDS. The number of constituents analyzed varies from well to well. Many of the wells in the database contain at least one complete analysis for the major anions and cations, with the exception of potassium, which is absent from many of the cation analyses. Almost all of the wells have at least one value for TDS, total hardness, and pH. Table 38 provides general information on monitoring of source water quality in the District.

Table 38. Water Quality Monitoring Practices

Source	Monitoring Location	Monitoring Practice	Frequency of Analysis
SWP Surface Water	Check 29	Automated Station Data Grab Sample Data	Monthly ¹
Groundwater ²	Various Wells	Agricultural Suitability	Annually

¹ Monitored by other entities and the DWR, on behalf of the District.

² Primarily by District-owned wells, but periodically includes some privately-owned wells. Sample at start-up if discharge goes into district delivery system; if discharge in California Aqueduct, then Title 22 level of testing every three years.

As noted in Table 39, the District does not need to conduct monitoring of surface drainage.

Table 39. Water Quality Monitoring Programs for Surface/Subsurface Drainage

Monitoring Program	Analyses Performed	Frequency of Analysis
Surface Water and Groundwater	EC and NO ₃	Not needed.

5 Water Accounting and Water Supply Reliability

5.1 Quantification of Water Supplies

The District distribution system is composed mostly of pipeline laterals, some concrete-lined canals, and small pumps (5, 10, or 20 cfs) as described in Section 2.3. For the purposes of the AWMP, 2011, 2012, and 2013 were chosen to illustrate water delivery operations in the District. Table 40 includes a monthly accounting of the amounts of water arriving within District boundaries from the California Aqueduct, which is the delivery route for each source of supply.

Table 40. Surface and Other Water Supplies for Representative Years

Monthly Surface Water Deliveries ¹	Total Deliveries, per Year (AF)			
	2011	2012	2013	Avg.
January	1,613	6,100	2,066	3,260
February	5,333	8,012	5,485	6,277
March	7,660	9,557	9,141	8,786
April	13,618	8,171	13,144	11,644
May	20,717	19,923	21,060	20,567
June	27,055	25,903	25,540	26,166
July	29,353	25,719	24,287	26,453
August	24,461	22,416	21,162	22,680
September	17,923	14,671	14,916	15,837
October	12,343	11,278	11,790	11,804
November	4,699	3,843	4,740	4,427
December	6,314	3,298	4,743	4,785
Total	171,090	158,891	158,074	162,685
Transfer Deliveries ²	9,285	14,829	43,713 ³	22,902
Sub-Total⁴	161,805	144,062	114,361	139,783

¹ Monthly delivery includes total of surface water from the SWP and banking projects, as well as, transfer and exchange supplies entering the District.

² Transfer Deliveries reference total Transfer and Exchange supplies 'To District' from Table 28A.

³ Transfer Deliveries for 2013 references difference between total transfer supplies (i.e. 'To District' value from Table 28A. minus 'From District' value from Table 28B.). Only 2013 had supplies being transferred from the District to another agency.

⁴ Sub-Totals represent surface water supplies delivered to district, matching incoming surface water Totals From Table 30A.

The District, along with many other districts and local communities, pump groundwater from the Kern County Subbasin. The District measures and records groundwater pumping from district-owned wells; however, pumping from privately-owned wells is not reported to the District unless the water is pumped into the District’s system for conveyance and delivery. Table 41 presents a monthly summary of the quantity of groundwater, from both District-owned and privately-owned wells, that were pumped and delivered through the District conveyance system in 2011, 2012, and 2013.

Table 41. Groundwater Supplies for Representative Years (delivered within District conveyance system)

Monthly Groundwater Deliveries ¹	Total Deliveries, per Year (AF)			
	2011	2012	2013	Avg.
January	0	8	147	52
February	0	116	902	339
March	278	1,139	1,554	990
April	317	2,351	3,855	2,174
May	828	3,397	4,694	2,973
June	478	3,358	4,354	2,730
July	366	2,540	4,312	2,406
August	0	2,611	3,392	2,001
September	0	2,007	2,174	1,394
October	0	1,797	1,650	1,149
November	0	1,052	1,745	932
December	0	56	1,872	643
Total²	2,267	20,432	30,651	17,783

¹ Monthly delivery includes total of groundwater supplies from district and private wells entering the District's conveyance system. Private pumping that is not pumped into the District's delivery system is not included in the Table, as those volumes are not reported to the District.

² Total represents groundwater supplies into District's system, matching incoming groundwater Total from Table 34.

The imported surface water, previously banked water, and the pumped groundwater are the primary sources of water for the District. Effective precipitation, however, constitutes an uncontrolled source of supply which reduces the applied irrigation water requirement to some extent. As noted in Section 2.5, most of the precipitation occurs in the winter with little to none occurring during the summer months. Accordingly, most of the precipitation that falls within the District’s service area provides soil moisture at the beginning of the growing season.

Table 42 shows the estimated volume of effective precipitation for 2011, 2012, and 2013, based on the District Engineer’s calculation using the local precipitation, local assumptions, and the total irrigated area.

Table 42. Effective Precipitation Summary for Representative Years¹

Month	Precipitation, per Year (in)					
	2011		2012		2013	
	Total Precip. (in)	Effective Precip (AF)	Total Precip. (in)	Effective Precip (AF)	Total Precip. (in)	Effective Precip (AF)
January	0.47		0.58		1.26	
February	0.87		0.42		0.48	
March	2.23	12,015	1.24	3,570	0.72	0
April	0.03	0	1.79	10,710	0.01	0
May	0.50	0	0.00	0	0.26	0
June	0.06	0	0.00	0	0.00	0
July	0.00	0	0.00	0	0.00	0
August	0.00	0	0.00	0	0.00	0
September	0.15	0	0.00	0	0.00	0
October	0.44	0	0.30	0	0.02	0
November	1.00		0.13		0.34	
December	0.00		1.84		0.38	
Total	5.74	12,015	6.31	14,280	3.47	

¹Based on Thiessen average precipitation as computed from observations at six District-operated weather stations, all measurements by WRMWSD staff

² Assume effective precipitation occurs during the growing season (roughly March-Oct)

³ Assume that in any storm, the first 0.5 inches of precipitation evaporates before it makes it to the root zone.

⁴ 2011 effective precip = 1.7 in rainfall x 84,813 cropped acres (Table 23) x 1 ft/12 in = 12,015 AF

⁵ 2012 effective precip = 2.0 in rainfall x 85,684 cropped acres (Table 23) x 1 ft/12 in =17,850 AF

5.2 Quantification of Water Uses

Table 43 shows the volume of water delivered to District’s irrigation customers in 2011, 2012, and 2013. The volume of water delivered is based on flow measurements at the farm turnouts.

Table 43. Applied Water for Representative Years

Type	Water Deliveries, per Year (AF)		
	2011	2012	2013
Surface Water and Groundwater Sources ¹	164,072	164,494	145,012
Transfer Deliveries ²	9,285	14,829	43,713 ³
Total⁴	173,357	179,323	188,725

¹ All surface water and groundwater supplies delivered to the District as Total in Table 20.

² Transfer Deliveries reference total Transfer and Exchange supplies ‘To District’ from Table 28A.

³ Transfer Deliveries for 2013 references difference between total transfer supplies (i.e. ‘To District’ value from Table 28A. minus ‘From District’ value from Table 28B.). Only 2013 had supplies being transferred from the District to another agency.

⁴ Total deliveries to farm turnouts in District.

Table 44 summarizes water uses within the District service area for 2011, 2012, and 2013. The calculated crop ET_c was used in developing the District’s crop water requirement as seen in Tables 21A, 21B, and 21C and described in the text which accompanies the tables. The estimate of losses in the piped distribution system is minimal, which is based on District observation of measured

system inflows and outflows and is recorded as not applicable in Table 44 as “conveyance seepage and evaporation” (item 4). Refer to Section 3 for the description of other agricultural water uses included in Table 44.

Table 44. Quantification of Water Uses for Representative Years

Type	Category	Estimated Water Use, per Year (AF)		
		2011	2012	2013
Crop Water Requirement ¹	Crop Water Use (Tables 21A., 21B, and 21C.)	212,074	224,494	219,160
Leaching ²				
Cultural Practices ²				
Conveyance Seepage and Evaporation ³	Conveyance and Storage System			
Conveyance Operational Outflows ⁴				
Reservoir Evaporation ⁵		0	0	0
Reservoir Seepage ⁵		0	0	0
Environmental Wetlands	Environmental Uses (Table 24)	0	0	0
Environmental Other		0	0	0
Riparian Vegetation		0	0	0
Misc. Recreation	Recreation Uses (Table 25)	0	0	0
Municipal Entities	Municipal and Industrial Uses (Table 26)	0	0	0
Industrial Entities		2,157	3,127	3,577
Transfers and Exchanges Out of District	Uses Outside of District (Table 28B.)	0	0	880
Groundwater Recharge ⁶	Groundwater Uses (Table 27)	273	0	0
Other	Other Uses (Table 29)	14	11	38
Grand Total of All Uses		214,518	227,632	223,655

¹ Includes ETC and an estimated allowance for both leaching and cultural practices.

² Included in 'Crop Water Requirement' item.

³ District canal seepage assumed minimal due to large percentage of pipeline conveyance system without inherent losses, see Table 4 and preceding text.

⁴ Operational outflows are directed into the unlined channels for groundwater recharge.

⁵ Not applicable to the District, see Table 5 and preceding text.

⁶ Amount reflects only direct recharge inside the District, no canal seepage as included in 'Conveyance Seepage' item or deep percolation from applied irrigation water.

Table 45 intended to summarize the amount of monitored on-farm surface and subsurface drainage water leaving the service area; however, as discussed previously, drainage wells and surface drainage systems are not employed by the District.

Table 45. Quantify Water Leaving District for Representative Years

Drain Water Leaving District	Volume, per Year (AF)		
	2011	2012	2013
Surface Drain Water Leaving District	Negligible	Negligible	Negligible
Subsurface Drain Water Leaving District	Negligible	Negligible	Negligible
Sub-Total	0	0	0

Table 46 identifies the minimal irrecoverable losses within the District.

Table 46. Irrecoverable Water Losses for Representative Years

Drain Water Leaving District	Volume, per Year (AF)		
	2011	2012	2013
Flows to Saline Sinks ¹	1,200	1,300	1,500
Flows to Perched Water Tables ²	1,300	1,300	1,400
Sub-Total	2,500	2,600	2,900

¹ Based on deliveries to certain WRM2, WRM4, and WRM5 System turnouts outside usable GW basin, assuming 5% of deliveries go to return flows.

² Assuming 15% of turnouts deliver to perched water lands and 5% of deliveries go to return flows

5.3 Overall Water Budget

The total water supplies made available by the District to the lands within its service area in 2011, 2012, and 2013 are summarized in Table 47. The supply side of the water budget presented in this AWMP identifies the total deliveries by the District, which includes both surface water and groundwater pumped from District-owned and private wells. As described previously, on-farm pumping is not reported to the District except in instances where water from private wells is discharged into District facilities for conveyance. Refer to Section 5.1 for a description and quantities of these sources.

Table 47. Quantify Water Supplies for Representative Years

Water Supplies	Volume, per Year (AF)		
	2011	2012	2013
Surface Water Supplies (Table 40)	161,805	144,062	114,361
Groundwater Supplies (Table 41)	2,267	20,432	30,651
Annual Effective Precipitation (Table 42)	12,015	14,280	-
Water Purchases ¹			
Transfers or Exchanges into District (Table 28A)	9,285	14,829	44,593
Grand Total of All Supplies	185,372	193,603	189,605
Grand Total minus Effective Precip	173,357	179,323	
Grand Total minus Central Coast Water Agency (Table 28B) 880 AF			188,725
Accumulated Monthly Deliveries in AF (Annual Total)²	173,358	179,322	188,726

¹ Water purchases included as part of surface water supplies from Table 40.

² Accumulated Monthly Deliveries in Acre-Feet as reported in Engineer-Manager's Monthly Report for December 2014

Table 48 summarizes the water budget for the service area for 2011, 2012, and 2013. The budget summary identifies the estimated total water uses within the District service area, the water supplies delivered by the District, and any on-farm drainage leaving the service area. The difference of these values is called the Water Balance Closure Term. This computation is not the same as computing the closure term of a long-term water balance since this budget does not account for sub-surface

inflow to or outflow to or from the District, nor does it account for minor stream inflow, which would be included in a complete, long-term water balance.

Table 48. Budget Summary for Representative Years

Water Accounting	Volume, per Year (AF)		
	2011	2012	2013
Sub-Total of Water Supplies (Table 47)	185,372	193,603	189,605
Sub-Total of Water Uses (Table 44)	(214,518)	(227,632)	(223,655)
On-Farm Drainage Water Leaving Area (Table 45)	0	0	0
Water Balance Closure Term¹	(29,146)	(34,029)	(34,050)

¹ The closure term is the difference between estimated total water uses and the district-delivered water supplies.

The “water balance closure term” represents an estimate of the difference between the total water uses (water demand) and the District-delivered water supplies for each of the selected years. Regarding the Water Budget calculation, it is recognized as an estimated water balance closure term, calculated to meet the requirements of the DWR’s AWMP Guidelines, and does not represent all the components necessary for determining the long-term water balance for the District. For instance, the DWR’s water balance closure term does not capture the change in groundwater storage over time nor does it include all groundwater sustainability components, such as, annual allocations based on the safe yield of the basin.

5.4 Future Water Supply Reliability

Recall that the District contracted with the KCWA for the delivery of SWP water; however, shortages in this source of supply have been more frequent and larger than originally envisioned. This observation is largely due to the incomplete status of SWP facilities and increased regulatory restrictions on exports from the Sacramento-San Joaquin River Delta. In this regard, DWR Bulletin 160-09 (2009) articulated some of the water supply “challenges” facing the Tulare Lake Basin, of which the District is a part. These challenges include the following:

- a. Water quality and environmental needs for the Delta are reducing the export volume of water pumped and available for delivery. For example, new biological opinions for endangered species and statutory requirements in December 2008 reduced export pumping by around 20-30 percent.
- b. Changes in the OCAP (Operations Criteria and Plan, USBR) could worsen delivery reliability issues of imported water from the CVP and SWP.
- c. The San Joaquin River Settlement will reduce CVP water diverted into the Friant-Kern Canal, possibly by as much as 15 percent (on average) as interim flows began October 1, 2009, which also affects the availability of CVP 215 water.

According to the 2011 State Water Project Delivery Reliability Report (DWR 2012), the long-term reliability of surface water supplies to Southern California from the Delta is expected to average 61 percent of the contractual amounts.

Groundwater is pumped to the extent that irrigation water requirements exceed the other supplies available through the District. Accordingly, any reductions in the reliability of these other supplies will result in a commensurate increase in the use of groundwater. Increased use of pumped groundwater will contribute to lower groundwater levels (and higher costs of energy for pumping). While excessive groundwater pumping can result in land surface subsidence, the District does not contain the hydrogeological conditions necessary for such subsidence. The ability of the District to sustainably manage surface and groundwater resources in the long term within the District is dependent on the ability to import surface water supplies that the District has contracted for with DWR through the KCWA from the State Water Project.

Therefore, efficient water management practices and conjunctive management are critical for the well-being of the communities and districts that depend on these sources of water. The District has joined several neighboring water agencies in adopting an Integrated Regional Water Management Plan (Kern IRWMP) which identified “water supply reliability” as one of the Region’s principal water resources concerns going forward. The IRWMP identified and prioritized a number of projects to mitigate anticipated reductions in water supply reliability, several of which have been constructed, are under construction, or will be under construction in the near term. A discussion of future changes to the District’s water supplies, in particular, from climate change, is presented in Section 6 of the plan.

6 Analysis of the Effects of Climate Change

6.1 General Discussion Regarding Effects of Climate Change on Water Supply

Disclaimer: The District has prepared this Section, *Analysis of the Effects of Climate Change*, in accordance with the requirements of the DWR Guidebook for Preparing AWMPs. The District does not endorse the statements contained in the references regarding the validity or the extent of global warming and/or climate change.

The effects of climate change, particularly changes in the volume, nature, and timing of precipitation on the future of the District's surface water supply, will be driven by changes in hydrology in the Feather River System since the District's main source of surface water is the SWP. In addition, climate change effects may exacerbate pumping restrictions or constraints to convey water south of the Sacramento-San Joaquin River Delta, thus further reducing reliability. This section describes the potential effects of climate change and how it may affect the hydrology for the southern portion of the Central Valley and the statewide changes that could affect the District and its water supplies.

As stated in the DWR AWMP Guidebook, snowpack in the Sierra Nevada provides 65 percent of California's water supply. Estimates indicate that by 2050 the Sierra snowpack will be significantly reduced. Much of the precipitation is expected to fall as rain instead of snow during winter and may not be as easily stored in the current water system for later use. The climate is also expected to become more variable and extreme, bringing more droughts and floods. Agricultural water suppliers will need to be prepared to adapt to greater variability in weather patterns.

The DWR examined 12 future climate scenarios in a report titled *Using Future Climate Projections to Support Water Resources Decision Making in California* (Chung et al. 2009) to assess future reliability issues with the SWP and the CVP due to climate change. The 12 scenarios represent projections from six Global Climate Models for higher and lower greenhouse gas emissions while taking into account potential Delta salinity intrusion due to sea level rise. For all climate projections studied, the reliability, and thus volume of water delivered, by the SWP and CVP water supply systems is expected to be reduced. For instance, by mid-century, median Delta exports through the SWP's Banks Pumping Plant are expected to be reduced by 7 percent for the lower greenhouse gas emissions scenario and by 10 percent for the higher emissions scenario. Mid-century changes in Delta exports for the 12 future climate scenarios ranges from an increase of 2 percent to a decrease

of 19 percent. Current long-term reliability predictions of surface water deliveries via the California Aqueduct are expected to average 61 percent (DWR, 2011). Decreases in annual Delta exports due to climate change would reduce reliability even further, resulting in less water delivered south of the Delta, which directly affects the amount of water supplied to the District.

Several investigations were conducted by the USGS California Water Science Center (CAWSC) regarding hydrological effects of climate scenarios in the Sierra Nevada Mountain Range (USGS 2009; Water Resources Research, 2012). Each of these investigations predict that California's climate will become warmer (+2 to +4° C) and drier (10-15 percent) during the mid- to late-21st century, relative to historical conditions. These scenarios were based on a commonly accepted projection of 21st century climate from the GFDL CM2.1 (Geophysical Fluid Dynamics Lab Climate Model 2.1) global climate model, responding to assumptions of rapidly increasing greenhouse-gas emissions. If these predictions materialize, the level of runoff from the Sierra Nevada Mountains is expected to be much less reliable with quantities presumably declining over time. Reduced surface water deliveries for agriculture in the Central Valley, combined with increased demands for irrigation water due to the increasingly warmer, drier climate, will result in increased use of groundwater, the impacts of which could include the following:

- a. Reduced base flow in streams;
- b. Reduced groundwater outflows;
- c. Increased depths to groundwater, and
- d. Increased land subsidence.

Should climate change result in a reduction in water available from surface supplies, the increased frequency of groundwater pumping, from agricultural water districts and other users, will lead to a decrease in groundwater storage without the necessary means of replenishing the depleted storage. According to another CAWSC study (Proceedings of the Eighth International Symposium on Land Subsidence, 2010); Kern County may expect land subsidence due to the increased demand on groundwater that will result from climate change.

6.2 Effects of Climate Change on Agriculture's Water Demand

6.2.1 Irrigation Demand

The effects of climate change are expected to increase both daytime and nighttime temperatures in the Central Valley, resulting in lengthening of the growing season under much drier conditions. This general increase in temperatures, coupled with greater variability and unpredictability in

precipitation, is expected to lead to increases in evapotranspiration resulting from warmer seasons; thereby creating an increase in agricultural water demand for irrigation purposes and greater year-to-year variability of such demand.

6.2.2 Permanent Crops

As previously discussed in Section 3.1, permanent crops (e.g. temperate fruit and nut trees) account for around 70 percent of the total irrigated area in the District. Areas with predominately permanent crop acreage with significant water demand from these crops may have reduced flexibility for adapting to changing climatic conditions since they require water in all types of water years, “hardening” the demand. In addition, these types of crops generally require adequate winter chill to produce economically viable yield. Increased temperatures in the Central Valley are expected to reduce winter chill hours, thus causing adverse effects on crop yield. By the end of the century, the winter chill needed for these crops is predicted to disappear. Today, the number of hours of winter chill in the San Joaquin Valley has shrunk from about 1,500 a few decades ago, to approximately 1,000 to 1,200 hours (PLoS ONE, 2009). Some farmers are beginning to overcome this change by using new varieties.

Studies within the Central Valley are now underway to prepare farmers for the likely impacts of climate change. Such efforts include breeding varieties of fruit trees which can withstand the decreased winter chill hours, developing tools to aid the crops in coping with reduced chill, and researching the temperature responses of particular orchard crops to better understand potential long-term effects. However, some solutions, such as replanting orchards with altered crop varieties or the installation of tools, may not be feasible for many irrigators.

6.3 Response to Effects of Climate Change

The District is committed to monitoring key indicators of climate change that affect the hydrology of the key surface water sources and conveyance facilities (e.g. the SWP watershed and Sacramento-San Joaquin River Delta) and growing conditions in the District’s service area. The District will work with the Department of Water Resources in an effort to continue to provide adequate surface water supplies to meet the growing conditions in the District’s service area. The District has little to no control over the availability of its imported water supplies; rather, the District will remain focused on maximizing the use of imported water supplies (when they are available) through the banking and conjunctive management programs that support management of both surface water and groundwater resources.

7 Efficiency Improvements and Efficient Water Management Practices

CWC §10826(e) defines the water use efficiency information required of all agricultural water supplies to be included in an AWMP, per §10608.48. As such, this section addresses the water use efficiency improvements that have been implemented by the District and a listing of the Efficient Water Management Practices (EWMPs, CWC §10608.48(a) through §10608.48(f)) which have been implemented or plan to be implemented. Each of the EWMPs is also identified and referenced in the DWR Guidebook.

The District's annual budget contains funding for the personnel and materials necessary to operate, maintain, and improve the District's distribution system. This funding directly and indirectly supports the variety of EWMPs described below. The description of previous water management activities in this section is supplemented by key improvements made to Wheeler Ridge infrastructure and management previously described in this AWMP.

7.1 Water Management Activities and Efficiency Improvements

This AWMP identifies several previously implemented and ongoing water management activities, which include:

- a. Acquire surface water supplies from the State Water Project, and construct irrigation distribution system facilities to lands which previously relied exclusively on pumped groundwater for the purpose of District delivery of surface water.
- b. Secure additional dry year water supplies from groundwater banking and recovery projects (Kern Water Bank, Pioneer Project, and Berrenda Mesa Project) and local groundwater supplies (District wells and private wells).
- c. Secure additional water supplies to mitigate water shortages from the State Water Project.
- d. Manage imported water and groundwater conjunctively to increase water supply reliability.
- e. Promote water use efficiency through:
 1. Metered and tiered water pricing, and

2. Continued financial support of the North West Kern Resource Conservation District's (NWKRCDD) Mobile Laboratory and encouraging landowners to take advantage of this resource by requesting field irrigation evaluations.
- f. Actively participate in local water resource management forums, including the Water Association of Kern County, Kern County Integrated Regional Water Management Plan (Kern IRWM Plan), the Kern River Watershed Coalition Authority (KRWCA), and the Kern Groundwater Management Committee (now Kern Groundwater Authority).
- g. Require installation of flow meters on private landowner wells that pump into the District facilities.

7.2 EWMP Overview

The EWMPs identified in SBx7-7 are grouped in two categories as shown below, from the DWR Guidebook. The numbers supplied for each EWMP are used as reference later in this section.

Critical Efficient Water Management Practices (CR)¹

- a. Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2) of the legislation [CWC §10608.48(b.1), 1999 AWMC MOU C-1].
- b. Adopt a pricing structure for water customers based at least in part on the quantity delivered [CWC §10608.48(b.2)].

Conditional Efficient Water Management Practices (CO)²

- a. Facilitate alternate land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage [CWC §10608.48(c.1), 1999 AWMC MOU B-1].
- b. Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils [CWC §10608.48(c.2), 1999 AWMC MOU B-2].

¹ Implementation of Critical EWMPs (CWC Section 10608.48(b)) is required of all agricultural water suppliers.

² Other Conditional EWMPs (CWC Section 10608.48(c)) are required only if they are determined to be locally cost-effective or technically feasible by the agricultural water supplier.

- c. Facilitate financing of capital improvements for on-farm irrigation systems [CWC 10608.48(c.3), 1999 AWMC MOU B-3].
- d. Implement an incentive pricing structure that promotes one or more of the following goals: (A) more efficient water use at the farm level; (B) conjunctive use of groundwater; (C) appropriate increase of groundwater recharge, (D) reduction in problem drainage; (E) improve management of environmental resources; (F) effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions [CWC 10608.48(c.4), 1999 AWMC MOU C-2].
- e. Expand line or pipe distribution system, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage [CWC 10608.48(c.5), 1999 AWMC MOU B-5].
- f. Increase flexibility in water ordering by, and delivery to, water customers within operational limits [CWC 10608.48(c.6), 1999 AWMC MOU B-6].
- g. Construct and operate supplier operational outflows and tailwater recovery systems [CWC 10608.48(c.7), 1999 AWMC MOU B-7].
- h. Increase planned conjunctive use of surface water and groundwater within the supplier service area [CWC 10608.48(c.8), 1999 AWMC MOU B-8].
- i. Automate canal control structures [CWC 10608.48(c.9), 1999 AWMC MOU B-9].
- j. Facilitate or promote customer pump testing and evaluation [CWC 10608.48(c.10)].
- k. Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports [CWC 10608.48(c.11), 1999 AWMC MOU A-2].
- l. Provide for the availability of water management services to water users [CWC 10608.48(c.12), 1999 AWMC MOU A-3].
- m. Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage [CWC 10608.48(c.13), 1999 AWMC MOU A-5].
- n. Evaluate and improve the efficiencies of the supplier's pumps [CWC 10608.48(c.14), 1999 AWMC MOU A-6].
- o. Improve communication and cooperation among water suppliers, users, and other agencies [1999 AWMC MOU A-4].
- p. Facilitate voluntary water transfers [1999 AWMC MOU B-4].

Regarding the two Critical EWMPs and sixteen Conditional EWMPs listed above, the following information is addressed by the District in this AWMP per the DWR Guidebook (pages 70 through 75):

- a. A list of implemented and planned-to-be-implemented EWMPs.
- b. An estimate of the water use efficiency improvements estimated to occur in five and ten years.

7.3 Implemented and Planned-to-be-Implemented EWMPs

Table 49 summarizes the status of implementation of EWMPs at Wheeler Ridge.

Table 50 presents the District’s schedule for implementing EWMPs.

Table 49. Report of Efficient Water Management Practices

Num ¹	Description	Status	Implementation Notes
CR 1	Water Measurement	Currently Implemented	District water delivery points to Farm-gates or turnouts to customers are metered using McCrometer propeller meters ($\pm 2\%$ accuracy and $\pm 0.25\%$ repeatability) and are actively monitored by the District Staff. Delivery points into the District are metered by the DWR at turnouts from the California Aqueduct). Compliance with measurement standards (SBx7-7) is further discussed in Section 8.
CR 2	Volume-Based Pricing	Currently Implemented	Wheeler Ridge charges water users based on the volume of water delivered as described in Section 3.2.
CO 1	Alternate Land Uses	Not Applicable	The District does not actively facilitate alternate land uses within the District’s service area, which is beyond its current jurisdiction. Lands have been taken out of production; however, this was due to the economics of farming and available water supplies.
CO 2	Recycled Water Use	Currently Implemented	Since there are no municipalities in or near the District which could provide a source of recycled water, the opportunities and need for the District to facilitate the use of recycled and brackish water are limited. (However TCWD does have extensive recycling activities, overlapping a portion of the District.) Irrigation of crops in excess of evapotranspiration results in deep percolation to groundwater thereby recycling water for the added purpose to reduce depths to groundwater, enabling correction of groundwater overdraft and encouraging recovery of this water during dry periods.
CO 3	On-Farm Irrigation Capital Improvements	Not Applicable	Wheeler Ridge is a water purveyor, not a provider of on-farm capital. The District does, however, provide funds for irrigation efficiency evaluations (e.g. On-Farm Mobile Lab), which is a free service to landowners. The District will also provide information to landowners regarding grant programs, low interest loans, energy efficiency programs, etc. that may be available from time to time.
CO 4	Incentive Pricing Structure	Not Applicable	As described in Section 2.2, the District does not apply tiered pricing nor follow a seasonal pricing schedule when charging water users.
CO 5	Infrastructure Improvements	On-going Service	District conveyance system is predominantly piped network, as described in Section 2.1. Much of the infrastructure improvements facilitated by the District have involved the maintenance and continued operation of the piped network.

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2

Table 49. Report of Efficient Water Management Practices (continued)

Num¹	Description	Status	Implementation Notes
CO 6	Order/Delivery Flexibility	On-going Service	The District's ability to distribute water supplies and operate on an on-demand basis is covered in the <i>Rules and Regulations for Distribution of Water</i> document, and is discussed in Section 2.2. The California Aqueduct acts as a reservoir within the District and allows flexibility in timing and flows of water deliveries to growers.
CO 7	Supplier Operational Outflow and Tailwater Systems	Not Applicable	Irrigated lands are mostly planted with permanent crops using high-efficiency irrigation methods. Accordingly, there are very few drainage systems in the District and any farm tail water is handled by individual growers through their own on-farm tail water recovery systems (minimal use by growers). The California Aqueduct acts as a regulating reservoir to manage mismatches between supply and demand to avoid operational spills.
CO 8	Conjunctive Use	On-going Service/ Future Imp.	As described in Section 2, static groundwater levels in the District are deeper than most parts of Kern County meaning fewer District wells are operated (i.e. high pumping lifts and costs). As such, Wheeler Ridge has participated in the Kern Water Bank, Pioneer Project and Berrenda Mesa Project to store and recharge excess surface water supplies, as described in Section 4.3. In addition, WRM has acted as a conjunctive use district, primarily through incidental and in-lieu recharge, since 1971.
CO 9	Automated Canal Controls	Currently Implemented	Since the District's conveyance system is predominately a piped network (Table 4) opportunities for additional automation of canal controls is minimal; all structures are presently automated. The piped network infrastructure is already largely automated and heavily monitored by the District. Canal structures for conveying SWP supplies into the District, are already automated and remotely monitored in real time. Canal structures on the District's 850 Canal are remotely controlled in real time and around the clock with a SCADA system to minimize operational spills and ensure sufficient water surfaces for steady on-farm deliveries.
CO 10	Customer Pump Test/Evaluations	Not Applicable	Pump efficiency tests (measured kWh/AF) are performed by utilities and pump companies as requested by the landowners.

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2.

Table 49. Report of Efficient Water Management Practices (continued)

Num¹	Description	Status	Implementation Notes
CO 11	Water Conservation Coordinator	Currently Implemented	The District considers the 'Water Conservation Coordinator' title as synonymous with the Manager/Assistant Engineer-Manager position within the staff. As such, the District allows the person holding this position to implement water management plans and progress reports.
CO 12	Water Management Services to Water Users	On-going Service	The District provides funds for irrigation efficiency evaluations (e.g. On-Farm Mobile Lab) and maintains weather stations around the District's service area. Weather station climate data (evaporation and precipitation) are available on the District's website and are encouraged to be used for irrigation scheduling purposes.
CO 13	Identify Institutional Changes	On-going Service	Wheeler Ridge receives surface water from the SWP, contracted through the KCWA, and is party to turn-in agreements and point-of-delivery agreements with the DWR. Reduced reliability of SWP deliveries south of the Sacramento-San Joaquin River Delta due to administrative and judicial constraints on pumping have limited the District's ability to effectively manage and distribute surface water supplies to water users.
CO 14	Supplier Pump Improved Efficiency	On-going Service	District pump tests are conducted as needed, and pump efficiency is monitored on a continuous basis. The District's Pump/Electrical Department performs routine pump and electrical equipment repairs and maintenance. Non-routine work is contracted. The District provides some funding for District pump testing by services outside of the District staff.
CO 16	Facilitate Voluntary Water Transfers	On-going Service	The District has supported the transfer of a landowner's SWP water from another district into the Wheeler Ridge service area; given they are a landowner in both districts (i.e. the water would be moved from the landowner's land in another district to landowner's holdings in Wheeler Ridge). These transfers have been on a case-by-case and year-by-year basis and also require approval of KCWA. Wheeler Ridge has also allowed landowners to move their SWP water around within the District and within common farming units. Water Users with excess supplies can make those supplies available to others via the District Pool (Rule 9. of the Rules and Regulations). Wheeler Ridge also allows landowners to use the District's conveyance system to wheel water within the District in the same manner.

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2.

7.4 Efficiency Improvements and Non-Implemented EWMPs

Table 51 presents an estimated connection between water use efficiency improvements by the District and the implementation of EWMPs. Wheeler Ridge has chosen to implement those EWMPs which were considered ‘technically feasible’, when considering district water management operations, and/or ‘cost-effective’ based on the District’s typical costs of operations and maintenance. Non-implemented EWMPs are categorized as being “Not Applicable” and are shown in Table 52.

Table 50. Schedule to Implement Efficient Water Management Practices

Num¹	Description	Status	Staffing Req. and Budget Allotment²
CR 1	Water Measurement	Currently Implemented	Engineering, Operations & Maintenance
CR 2	Volume-Based Pricing	Currently Implemented	Administration, Accounting, Engineering
CO 1	Alternate Land Uses	Not Applicable	
CO 2	Recycled Water Use	Currently Implemented	Engineering
CO 3	On-Farm Irrigation Capital Improvements	Not Applicable	
CO 4	Incentive Pricing Structure	Not Applicable	
CO 5	Infrastructure Improvements	On-going Service	Administration, Engineering, Consultant Engineers
CO 6	Order/Delivery Flexibility	On-going Service	Administration, Accounting
CO 7	Supplier Operational Outflow and Tailwater Systems	Not Applicable	
CO 8	Conjunctive Use	On-going Service/ Future Imp.	Administration, Engineering, Consultant Engineers
CO 9	Automated Canal Controls	Currently Implemented	Engineering, Operations & Maintenance
CO 10	Customer Pump Test/Evaluations	Not Applicable	
CO 11	Water Conservation Coordinator	Currently Implemented	Administration
CO 12	Water Management Services to Water Users	On-going Service	Administration, Engineering, Operations & Maintenance
CO 13	Identify Institutional Changes	On-going Service	Administration
CO 14	Supplier Pump Improved Efficiency	On-going Service	Administration, Engineering, Operations & Maintenance
CO 15	Improve Communication Among Suppliers	On-going Service	Administration, Consultant Engineers
CO 16	Facilitate Voluntary Water Transfers	On-going Service	Administration, Engineering, Consultant Engineers

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2.

² Refers to staffing and budget classifications (i.e. Wheeler Ridge departments) as designated on the District's website (wrmwsd.com). External consulting engineering services are budgeted and used to support District staff as needed.

Table 51. Report of EWMP Efficiency Improvements

Num ¹	Description	Estimate of Water Use Efficiency That Occurred Since Last Report ²	Estimated Water Use Efficiency 5 and 10 years in Future
CO 2	Recycled Water Use		The District will continue to make use of water with higher concentrations of nitrate and brackish water where applicable.
CO 5	Infrastructure Improvements		The District will continue to invest in maintenance and operations improvements to the piped conveyance network.
CO 6	Order/Delivery Flexibility		District will continue exploring enhanced water ordering options (e.g. web-based) to improve operations and delivery flexibility.
CO 8	Conjunctive Use		The District will continue exploring groundwater recharge and recovery operations within the service area, and work with neighboring districts to expand banked water supplies.
CO 9	Automated Canal Controls		The District has an automated canal and pressurized pipe delivery system in place.
CO 11	Water Conservation Coordinator		The District will continue to fund water conservation manager.
CO 12	Water Management Services to Water Users		District will consider additional water purchases with neighboring districts to improve long-term water balance in-district.
CO 13	Identify Institutional Changes		The District will consider funding conveyance improvement to the SWP Delta facilities that increase the reliability of SWP contract supplies and support development of better science concerning Delta issues.
CO 14	Supplier Pump Improved Efficiency		Wheeler Ridge will continue to fund District pump efficiency improvements and to work with PG&E, the Resource Conservation District (RCD), and neighboring districts to minimize water costs, increase water use efficiency, and reduce power and energy costs.
CO 15	Improve Communication Among Suppliers		The District will maintain and promote communication with landowners and other entities through an active communications system.
CO 16	Facilitate Voluntary Water Transfers		District will continue to support landowner transfers of SWP supplies, on a case-by-case and year-by-year basis.

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2.

² There was no previous reporting of EWMP Water Use Efficiency improvements, thus the column is left blank.

Table 52. Non-Implemented EWMP Documentation

Num¹	Description	Reason for Non-Implementation	Justification/Documentation
CO 1	Alternate Land Uses	Not Cost-Effective	Land use already follows the economics of farming and available water supplies and beyond the District's jurisdiction. The District does not provide capital for alternate land uses.
CO 3	On-Farm Irrigation Capital Improvements	Not Cost-Effective	Wheeler Ridge is not a provider of on-farm capital. All water conveyance facilities, including farm turnouts, are owned and operated by the District.
CO 4	Incentive Pricing Structure	Not Cost-Effective	The District does not apply a tiered pricing structure for charging water users. Efficient water use is encouraged by the pricing contracted between the District and water users.
CO 7	Supplier Operational Outflow and Tailwater Systems	Not Technically Feasible	Irrigated lands are mostly planted with permanent crops using high-efficiency irrigation methods, meaning there are few drainage systems and tailwater issues.
CO 10	Customer Pump Test/Evaluations	Not Applicable	District policy is to not provide funding for on-farm pump testing for efficiency; testing is conducted by the landowner.

¹ Refer to Critical (CR) and Conditional (CO) numbers given in Section 7.2.

8 Supporting Agricultural Water Measurement Regulation Documentation

8.1 Description of Water Measurement Best Professional Practices

As stated in CWC Section 10608.48(b), all governed agricultural water suppliers are required to, “Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10” of the legislation. Furthermore, Section 531.10(a) requires that, “An agricultural water supplier shall submit an annual report to the department (DWR) that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices.”

The District receives SWP Water deliveries from 15 turnouts off the California Aqueduct (see Figure 2). Each turnout is equipped with a manufactured Venturi device operated and maintained by the DWR capable of directly measuring flow rate and accumulation of the total volume of water delivered. The accuracy of the Venturi-type measurement device is certified by the manufacturer to be accurate for volume measurements within ± 2 percent.

All District delivery points for water delivered from the District’s distribution system to each of the customers are called a “farm gate” or “turnout”. (Figure 4 in Section 2 is a photograph of a typical farm turnout). Each turnout is equipped with a manufactured propeller-based flowmeters capable of directly measuring flow rate and accumulating the volume of water delivered over time with use of a totalizer device. The flowmeters are certified by the manufacturer, McCometer Model 900, to have an accuracy of ± 2 percent. [District vertical flowmeters are MW800s and horizontal are MG900s]

District Operations and Maintenance Staff read the meters once a week (Tuesday) and observe each meter for any sign of abnormal reading based on prior experience with a particular meter. The field collected data are reviewed by a supervisor as a quality control procedure. Farm-level water delivery data are assembled by the District and are available to water users upon request throughout the season enabling irrigators to monitor water usage.

Since all measurement flowmeters used by the District are manufactured, certified devices and equipped with totalizers, the District can equate the calibrated accuracy of the flow meter to volumetric accuracy. According to the publication SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts by the Irrigation Training & Research Center (ITRC) of the California Polytechnic Institute, San Luis Obispo, flowmeters with totalizers provide measurements that are sufficiently precise in monitoring flow duration to assume that the flow rate accuracy is equivalent to the calibrated volumetric accuracy. As a result, the flowmeters used by the District to measure delivery of water at the farm gates provide data that enables reliable computation of volumes of water delivered at each turnout.

As stated previously, the DWR maintains devices that measure the quantity of water delivered through each of the turnouts from the California Aqueduct. The District makes a comparison between the total volumes delivered according to the DWR devices at the delivery points off of the California Aqueduct versus recordings of the total volume delivered to the landowners as determined by the District measurement devices at the farm gate delivery points, as shown in Tables 53A, 53B, and 53C. The differences are compared within the delivery system by laterals and indicate system accuracy within the limits expected by the water code. This difference is typically less than 2 percent and demonstrates the flowmeters at the turnouts are well within the accuracy range expected by the water code of ± 12 percent for existing measurement devices and ± 5 percent for new or replacement measurement devices.

Table 53. A. District Meter Measurement Data for 2011

Meter Name	DWR Meas. Inflow (AF)	WRM Meas. Inflow (AF)	Difference	% Difference
WRM2	3,785	3,798	13	0.34%
WRM3	5,898	6,133	235	3.83%
WRM4	14,448	14,447	-1	-0.01%
WRM5	33,414	34,109	695	2.04%
WRM6	6,515	6,670	155	2.32%
WRM7	21,930	22,927	997	4.35%
WRM8	16,051	16,823	772	4.59%
WRM9	8,779	9,152	373	4.08%
WRM9A	5,367	5,388	21	0.39%
WRM10	36,791	35,854	-937	-2.61%
WRM11	0	10	10	
WRM12	0	0	0	0.00%
WRM13A	855	868	13	1.50%
WRM13B	1,258	1,374	116	8.44%
WRM14	10,532	10,854	322	2.97%
WRM15	2,765	2,689	-76	-2.83%
Total	168,388	171,096	2,708	1.58%
Average	10,524	10,693	169	1.96%

Table 53. B. District Meter Measurement Data for 2012

Meter Name	DWR Meas. Inflow (AF)	WRM Meas. Inflow (AF)	Difference	% Difference
WRM2	3,324	3,396	72	2.12%
WRM3	5,892	6,179	287	4.64%
WRM4	16,681	16,839	158	0.94%
WRM5	35,108	35,643	535	1.50%
WRM6	6,679	6,596	-83	-1.26%
WRM7	22,702	23,318	616	2.64%
WRM8	16,008	17,222	1,214	7.05%
WRM9	7,438	7,669	231	3.01%
WRM9A	4,950	4,858	-92	-1.89%
WRM10	22,970	21,697	-1,273	-5.87%
WRM11	0	9	9	
WRM12	0	0	0	0.00%
WRM13A	873	818	-55	-6.72%
WRM13B	1,342	1,369	27	1.97%
WRM14	10,788	11,339	551	4.86%
WRM15	3,025	2,987	-38	-1.27%
Total	157,780	159,939	2,159	1.35%
Average	9,861	9,996	134	0.78%

Table 53. C. District Meter Measurement Data for 2013

Meter Name	DWR Meas. Inflow (AF)	WRM Meas. Inflow (AF)	Difference	% Difference
WRM2	3,844	4,059	215	5.30%
WRM3	6,120	6,415	295	4.60%
WRM4	19,450	19,778	328	1.66%
WRM5	34,637	36,634	1,997	5.45%
WRM6	6,892	6,962	70	1.01%
WRM7	20,608	21,600	992	4.59%
WRM8	17,313	18,713	1,400	7.48%
WRM9	7,691	8,112	421	5.19%
WRM9A	5,807	5,706	-101	-1.77%
WRM10	22,340	21,334	-1,006	-4.72%
WRM11	0	14	14	
WRM12	0	0	0	0.0%
WRM13A	882	873	-9	-1.03%
WRM13B	918	879	-39	-4.44%
WRM14	9,255	9,689	434	4.48%
WRM15	2,687	2,660	-27	-1.02%
Total	158,444	163,428	4,984	3.05%
Average	9,902	10,214	312	1.79%

The District uses a couple methods to check the field accuracy of the meters. One is they compare the total volume delivered from the whole population of flowmeters used to deliver water at the farm headgate to the total volume delivered by the DWR's devices that are used to meter water volume delivered into the District. This provides a method of comparing the volume of water delivered into the District and at the District's delivery points to the customer. District Staff also routinely monitor each delivery point meter for abnormalities and District policy is to replace a

meter if the abnormal reading cannot be rectified in the field.

As evidence of the District meter repair and replacement program, the following number of meters were either repaired or replaced by the field staff in 2011, 2012, and 2013.

Year, Number of Meter Repairs or Replacement

2011 Repairs-66, Replace-10

2012 Repairs-78, Replace-7

2013 Repairs-96, Replace-19

In addition to the District Staff monitoring for any abnormal performance, customers can also request the meter be tested. These accurate measurement devices and methods support the District's volumetric pricing structure and compliance with volumetric measurement requirements.

8.2 Legal Certification and Apportionment (Access to Farm-gates)

District staff has access to install, measure, maintain, operate, and monitor flow-measurement devices at all customer water delivery points (Farm-gates and turnouts) from the District's irrigation distribution system. As such, there are no institutional or legal impediments that restrict access to turnouts or measurement of water and, for the purposes of satisfying SBx7-7, there is no need to measure water upstream of points of delivery to individual customers.

8.3 Engineer Certification and Apportionment

An Engineer Certification is not applicable since the District is not relying on measurement options upstream of the delivery points to farm gates. The District measures deliveries at the farm gate using manufactured devices (flow meters) that are equipped with a "totalizer" with certified accuracy of +2 percent of the volume, replaces any malfunctioning measurement devices with manufactured devices with certified accuracy of +2 percent, and implements a methodology for comparison of total volume delivered at the farm gate to total volume delivered off of the California Aqueduct. The methodology used to determine the accuracy of District flow-measurement devices complies with the requirements of Section 597.3(a) and 597.4(a).

8.4 Description of Water Measurement Best Professional Practices

All water suppliers required to implement agricultural water measurement must include a description of Best Professional Practices regarding:

- a. The collection of water measurement data – District Staff are trained and supervised by the operations superintendent. District Staff provide field-inspections and analysis for every existing measurement device. A comparison of total water delivered into the District with the total water delivered to all water delivery points to the customer is documented in a report approved by the District Engineer.
- b. Frequency of measurements – District Staff collects the “totalizer” value from each meter once a week.
- c. Method for determining irrigated acres – District surveys the irrigated acres each year as part of the contract service area.
- d. Quality control and quality assurance procedures – Compare the total volume of water metered at all District delivery points with the total water delivered into the District by the DWR. Investigate differences and recommend corrective measures. Replace meters not functioning properly if determined not repairable.

The District maintains records of water delivered from the California Aqueduct into the District and all water delivered to customers at the Delivery Point (Farm-gate or turnout).

8.5 Documentation of Water Measurement Conversion to Volume

SBx7-7 requires an annual volumetric accuracy of within ± 12 percent on existing devices and ± 5 percent for new and replacement devices. As previously stated, the District’s flow measurement devices include totalizers (which directly record cumulative flow volume) with a manufacturer’s certified accuracy of ± 2 percent. Therefore, the District’s measurement devices directly record volumes within accuracy range required by SBx7-7.

8.6 Device Corrective Action Plan

As documented herein, the District’s existing water measurement devices perform substantially better than the ± 12 accuracy standard and new meters perform substantially better than the ± 5 percent accuracy standard. No correct action is identified or planned. As noted previously,

currently the District repairs or replaces flow meters when there is an obvious deficiency in their performance or when a water user questions the accuracy of a meter. The District will continue this practice on an ongoing basis since it also has the ability with the piped delivery system off of the California Aqueduct to compare the total water delivered into the District with the total volume of water delivered at the delivery points (Farm-gates and turnouts) to customers. New replacement meters will be manufactured devices, laboratory certified by their manufacturer prior to installation to have an accuracy of measurement within ± 5 percent by volume. The manufacturer presently used by the District has a certified accuracy of ± 2 percent by volume.

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Appendices

Appendix A

PROOF OF PUBLICATION

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STATE OF CALIFORNIA
COUNTY OF KERN

I AM A CITIZEN OF THE UNITED STATES AND A RESIDENT OF THE COUNTY AFORESAID; I AM OVER THE AGE OF EIGHTEEN YEARS, AND NOT A PARTY TO OR INTERESTED IN THE ABOVE ENTITLED MATTER. I AM THE ASSISTANT PRINCIPAL CLERK OF THE PRINTER OF THE BAKERSFIELD CALIFORNIAN, A NEWSPAPER OF GENERAL CIRCULATION PRINTED AND PUBLISHED DAILY IN THE CITY OF BAKERSFIELD COUNTY OF KERN,

AND WHICH NEWSPAPER HAS BEEN ADJUDGED A NEWSPAPER OF GENERAL CIRCULATION BY THE SUPERIOR COURT OF THE COUNTY OF KERN, STATE OF CALIFORNIA, UNDER DATE OF FEBRUARY 5, 1952, CASE NUMBER 57610; THAT THE NOTICE, OF WHICH THE ANNEXED IS A PRINTED COPY, HAS BEEN PUBLISHED IN EACH REGULAR AND ENTIRE ISSUE OF SAID NEWSPAPER AND NOT IN ANY SUPPLEMENT THEREOF ON THE FOLLOWING DATES, TO WIT:

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1/7/15

ALL IN YEARS 2014 - 2015

I CERTIFY (OR DECLARE) UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT.

K. Jones

DATED AT BAKERSFIELD CALIFORNIA

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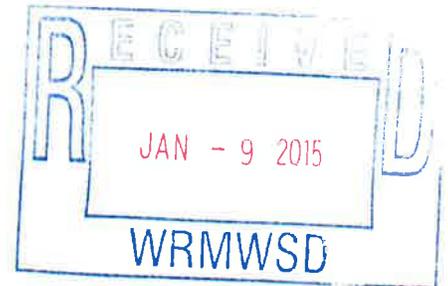
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First Text

PUBLIC HEARING NOTICE Notice is hereby gi

Ad Number 13742974

PUBLIC HEARING NOTICE
Notice is hereby given that the Wheeler Ridge-Maricopa Water Storage District (WRMWS D) will hold a public hearing on January 14, 2014 at 10:00 a.m. regarding:
2015 Agricultural Water Management Plan
The Water Conservation Act of 2009 (SBs 7-7) requires certain agricultural water suppliers in California to prepare Agricultural Water Management Plans (AWMP). To meet the requirements of this legislation, WRMWS D is preparing an AWMP to be reviewed and approved by the California Department of Water Resources (DWR). The AWMP includes a discussion of WRMWS D and its irrigation facilities, water supply and demand, and various programs, policies and efficient water management practices being implemented now or planned in the coming years. The WRMWS D Board of Directors will hold a hearing to consider public comments on the proposed AWMP. A copy of the AWMP may be reviewed at the WRMWS D office, at the address below. Written comments, submitted prior to the hearing, should be directed to:
Sheridan Nicholas - Assistant Engineer Manager
Wheeler Ridge-Maricopa Water Storage District
12109 Hwy 166
Bakersfield, CA 93313
Comments may also be provided at the hearing. If you have questions regarding the AWMP, please contact Sheridan Nicholas at 661-858-2281, extension 13.
December 31, 2014 January 7, 2015 (13742974)



Appendix B

**BEFORE THE BOARD OF DIRECTORS OF
WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT**

IN THE MATTER OF:

RESOLUTION NO. 2015-03

ADOPTION OF AGRICULTURAL WATER MANAGEMENT PLAN

WHEREAS, the Wheeler Ridge-Maricopa Water Storage District (District) has prepared a draft Agricultural Water Management Plan (AWMP) in accordance with the requirements of the Water Conservation Bill of 2009 (SBx7-7) and Water Code Section 10826, and as directed by the District's Board of Directors at its August 13, 2014 and January 14, 2015 meetings;

WHEREAS, this AWMP conforms to the reorganized framework presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan* issued by the California Department of Water Resources (DWR) on October 12, 2012 to aid water suppliers in preparing Agricultural Water Management Plans;

WHEREAS, the requirements in SBx7-7 are intended to encourage agricultural water suppliers to assess current efficient water management practices, to evaluate additional practices that may conserve water, and to require a certain level of accurate measurement of water; as such, the AWMP process presents an opportunity for water suppliers to demonstrate existing and planned activities and programs designed to improve the effective use of water and water use efficiency;

WHEREAS, included in Section 7 of this AWMP is a listing of the (a) efficient water management practices which have been implemented or are planned to be implemented and (b) water use efficiency improvements estimated to occur five and ten years in the future;

WHEREAS, the District held a noticed Public Hearing on January 14, 2015, to consider adoption of the draft AWMP; no written comments or formal protests were submitted on the draft AWMP; oral comments from the public and Directors were received;

WHEREAS, the District prepared a revised draft AWMP to reflect the oral comments made at the January 14, 2015 Public Hearing, and the revised draft AWMP was further considered at the February 11, 2015 regular Board of Directors meeting;

WHEREAS, the District is an authorized local agency and may therefore adopt and implement an AWMP; and

WHEREAS, the Board believes the adoption of the draft AWMP is in the best interests of the District and its landowners.

NOW, THEREFORE, BE IT RESOLVED that:

- (1) The foregoing findings, and each of them, are true and correct.
- (2) The District approves and adopts the Agricultural Water Management Plan in accordance with SBx7-7.

(3) The Board of Directors authorizes the officers and staff of the District to execute all documents and take any other action necessary or advisable to formalize said AWMP adoption including transmittal to the Department of Water Resources.

All the foregoing being on motion of Director Blaine, seconded by Director Mettler, and authorized by the following vote, to wit:

AYES: Atkinson, Blaine, Cappello, Fry, Greenlee, Mettler, Mullins.

NOES: None.

ABSTAIN: None.

ABSENT: Marin, Valpredo.

I HEREBY CERTIFY that the foregoing resolution is the resolution of said District as duly passed and adopted by said Board of Directors on the 11th day of February, 2015.

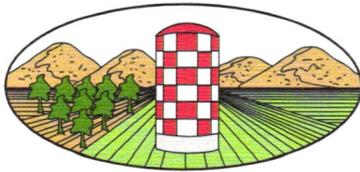
WITNESS my hand and seal of said Board of Directors this 11th day of February, 2015.



A handwritten signature in blue ink, appearing to be "J. Blaine", written over a horizontal line.

Secretary of the Board of Directors

Appendix C



WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT

12109 Highway 166, Bakersfield, CA 93313-9630

Telephone: 661.858.2281 ♦ Fax: 661.858.2643 ♦ Water Orders: 661.858.2296

www.wrmwsd.com

February 26, 2015

California State Library
Government Publications Section
Attn: Water Management Plan Coordinator
P.O. Box 942837
Sacramento, CA 94237-0001

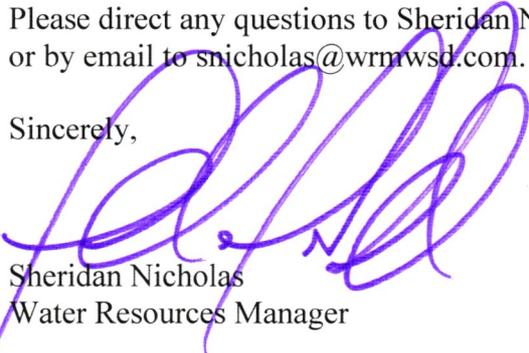
Subject: Agricultural Water Management Plan submission

To Whom It May Concern:

Please find enclosed one electronic copy of the Wheeler Ridge-Maricopa Water Storage District's 2014 Agricultural Water Management Plan.

Please direct any questions to Sheridan Nicholas, Water Resources Manager, at (661) 858-2281, or by email to snicholas@wrmwsd.com.

Sincerely,


Sheridan Nicholas
Water Resources Manager

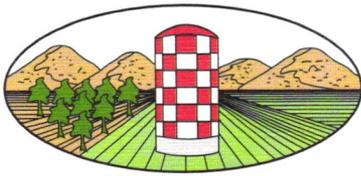
Enclosed: (1) Electronic copy of the AWMP and all applicable documentation

ROBERT J. KUNDE
ENGINEER-MANAGER

MARK E. GARDNER
CONTROLLER

THOMAS R. SUGGS
STAFF ENGINEER

STEPHEN L. DUNN
O&M SUPERINTENDENT



WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT

12109 Highway 166, Bakersfield, CA 93313-9630

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ROBERT J. KUNDE
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MARK E. GARDNER
CONTROLLER

THOMAS R. SUGGS
STAFF ENGINEER

STEPHEN L. DUNN
O&M SUPERINTENDENT

February 26, 2015

Agricultural Water Use Efficiency
Department of Water Resources
Statewide Integrated Water Management
Water Use and Efficiency Branch
Attn: Sabrina Cook
901 P Street, Room 214
Sacramento, CA 95814

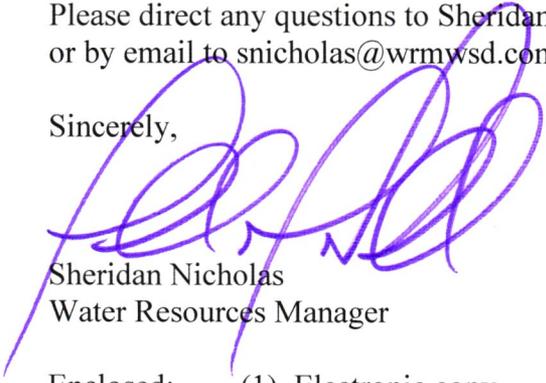
Subject: Agricultural Water Management Plan submission

To Sabrina Cook:

Please find enclosed one electronic copy and one hard copy of the Wheeler Ridge-Maricopa Water Storage District's 2014 Agricultural Water Management Plan.

Please direct any questions to Sheridan Nicholas, Water Resources Manager, at (661) 858-2281, or by email to snicholas@wrmwsd.com.

Sincerely,


Sheridan Nicholas
Water Resources Manager

Enclosed: (1) Electronic copy
(2) Hard copy of the AWMP and all applicable documentation

Appendix D

WHEELER RIDGE-MARICOPA WATER STORAGE DISTRICT

RULES AND REGULATIONS FOR DISTRIBUTION OF WATER

These Rules and Regulations are established pursuant to the requirements of the California Water Code by the Board of Directors of the Wheeler Ridge-Maricopa Water Storage District for the distribution and use of water within the District to enable the District to perform its functions most efficiently and to deliver water to Water Users at the least possible cost and are the Rules and Regulations mentioned in those certain water service contracts between the District and various landowners within the District. These Rules and Regulations were first adopted July 8, 1970, and have been amended from time to time. This edition of the Rules and Regulations supercedes all Rules and Regulations previously adopted by the Board of Directors, and is recorded with the Official Records of Kern County pursuant to water code §43003.5.

1. DEFINITIONS

Terms and expressions employed in these Rules and Regulations are as defined in the Water Service Contracts executed by the District and its landowners with the exception of certain terms or expressions used herein which do not appear in said contracts but which terms or expressions are defined or explained at the point where they are introduced in these Rules and Regulations. Where appropriate in these Rules and Regulations, words used in the singular shall include the plural and words used in the masculine shall include the feminine or an entity.

2. AUTHORITY OF THE ENGINEER-MANAGER AND EMPLOYEES

a. Engineer-Manager: The District's Distribution System is under the exclusive management and control of the Engineer-Manager, who is the person appointed by the Board of Directors of the District to manage the affairs of the District pursuant to its direction. No other person except the Engineer-Manager or his designee shall operate any of the facilities of the District's Distribution System.

b. District Employees: The Engineer-Manager shall supervise the activities of all District employees in connection with operation and maintenance of the District's Distribution System and all other activities of the District. The authority of the employees of the District shall be designated by the Engineer-Manager and any controversy between a Water User and a District employee that cannot be settled directly shall be appealed to the Engineer-Manager. In the event the Engineer-Manager is unable to reach a satisfactory decision, an appeal may be made to the Board of Directors. The decision of the Board of Directors shall be final and conclusive.

c. Right of Access: District employees authorized by the Engineer-Manager shall have reasonable access to lands and irrigation facilities within the District for the purpose of conducting District business which may include the following:

- (1) Inspection of the lands upon which water delivered from the Project is being applied for the purpose of determining Water User's compliance with the terms of the Water Service Contract.
- (2) Operation, maintenance inspection, repair or modification of facilities of the District's water supply, conveyance and Distribution System.
- (3) Determination of improper use or wasting of water.
- (4) Measurement of ground water levels and obtaining water quality samples from wells.
- (5) Determination of the type and area of specific crops grown.

Except in cases of emergency or where otherwise considered impracticable by the Engineer-Manager, the landowner, lessee or person in possession shall first be contacted before entering landowner's property other than upon District easements.

3. WATER SERVICE

a. Surface Water Service Area: Contract Water Service will be provided only to lands in the District's Surface Water Service, which service area has been amended by the Board of Directors from time to time. The lands included in said Surface Water Service Area at any given time are those certain parcels of real property described in the Exhibits A of those certain water service contracts which have been executed by the District and landowners and are on file in the District office. Lands within the Surface Water Service Area are shown on a map on file at the District office designated as "Surface Water Service Area," as amended from time to time. In case of a conflict between the lands described in Exhibit "A" to said certain water service contracts and said map, the description contained in said Exhibits shall govern. Pursuant to provisions of Division 14 of the California Water Code, an Original Project Assessment in the amount of the estimated costs of the District's project for providing water service to the affected lands was levied upon the lands in the Surface Water Service Area as contemplated by Resolution No. 349 and upon certain other benefited lands in the District and said assessment became final on October 18, 1968.

b. Additions of lands to Surface Water Service Area: Lands may be added to the Surface Water Service Area pursuant to an application filed with the Board therefor by the owner or owners of said lands, only if: (1) such addition is determined by the Board to be feasible and in the best interests of the District and in accordance with the criteria established in Board Resolution No. 349; (2) the owner or owners of said lands execute a contract with the District for water service for said lands in the form established by Board Resolution No. 69-60; (3) the owner or owners of said lands pay a charge equal to the sum of all charges which would have been paid to the District if said lands had been included within the originally adopted Surface

Water Service Area unless said charges have been paid by another parcel of land; and (4) the owner or owners of said lands agree in writing to pay any special charges at such time as calls might be made as hereinafter described, which special charges would be in lieu of calls on the Original Project Assessment on said lands, which charge will be the same as the amount which would be due if the lands subject hereto had received an Original Project Assessment by the same procedures whereby the Assessment was levied on all lands in the District's Adopted Surface Water Service Area and that, at such time as the project may be reassessed, the lands would receive the same treatment as all lands within the District's Adopted Surface Water Service Area.

Lands may also be added to the Surface Water Service Area by amendment of a Water Service Contract so as to increase the area described in Exhibit "A" therein provided the Contract Amount of Water is not increased and provided further that it is determined by the Board that such additions are: (1) in the best interest of the District, and (2) are not detrimental to other District Water Users. Any such additions shall be pursuant to an application filed with the Board of Directors by the owner or owners of said lands and each such application will be considered on a case-by-case basis. Such applications will not be approved unless it is determined that the proposed change does not unduly reduce the effective return flow to the ground water basin and unless it is demonstrated that the final amount of water will be sufficient for the type of crop involved. In the event the approval of such an application, the original acreage shall be the acreage used in determining the allocation of water pursuant to Section 9 of these Rules and Regulations.

c. Exclusion of Lands From the Surface Water Service Area: Lands may be excluded from the Surface Water Service Area pursuant to an application filed with the Board therefor only if: (1) the Board of Directors determines that such exclusion will not be detrimental to the best interests of the District, and (2) the obligations of the contract for water service, if any, binding said lands are assumed by other lands within the District which are added to the Surface Water Service Area as provided in Section 3(b) above. Assumption of said obligations must be under terms and conditions which will result in no financial loss to the District.

d. Unscheduled Water Service: Unscheduled water is water made available to a contract Water User in any year in excess of the Contract Amount, delivered through Water User's turnout, as provided in Section 2(f) of the Contract. Such water may be made available at the request of Water User and is delivered on an interruptible and non-dependable basis. Such service will be made available if the Board determines that it is in the best interest of the District and will only be made if it does not interfere with the obligations of the District under its Water Service Contracts.

e. Temporary or In-Lieu Water Service: Temporary or In-Lieu Water Service means the delivery of water on an interruptible and non-dependable basis for agricultural use to lands outside the Surface Water Service Area or to lands within that portion of the Surface Water Service Area where District facilities to serve said lands have not been constructed, under conditions established by the Board. Such temporary or In-Lieu service will be made available if the Board determines that it is in the best interest of the District, will be for a limited period of

time and will only be made if it does not interfere with the obligations of the District under its Water Service Contracts.

f. Industrial Water Service: Industrial Water Service means the delivery of water on an interruptible and non-dependable basis for industrial use, including construction work, and shall be made under conditions established by the Board. Industrial water service may be made pursuant to provisions for temporary water deliveries or pursuant to long-term contracts for Industrial Water Service. Such industrial water is not a potable water supply and shall not be used for domestic purposes or for human consumption unless specifically authorized by all agencies responsible for administering the Safe Drinking Water Act(s). It will be made available upon such terms as the Board determines is in the best interest of the District, will be for a limited period of time and will only be made if it does not interfere with the obligations of the District under its Water Service Contracts.

Subject to the foregoing, the District may also enter into long-term contracts to provide Industrial Water Service and/or to reserve system capacity which contracts shall be substantially uniform, which contractors are hereinafter referred to as "Industrial Water Users." Water Service pursuant to said contracts shall be subject to water being made available from the District pool established pursuant to Section 10 hereof. Upon finding that sufficient capacity exists within the District distribution system, the District may by contract reserve a portion of such capacity for the conveyance of water for industrial use, whether from supplies available to the District or supplies made available to the Industrial Water User.

g. Supplemental Water: Supplemental water means the water supplies acquired in addition to the water supply available under the Agency contract and includes district wells, Banking programs and water purchases. Supplemental water will be allocated pursuant to these Rules and Regulations up to the Contract Amount of Water in Water Users Water Service Contract. The quantities of Supplemental Water allocated to Water User shall only be available after Water User has submitted a signed order in a form provided by the District for such purposes in which the Water User agrees to the terms and conditions of delivery and payment for Supplemental Water.

4. DELIVERY, USE AND MEASUREMENT OF WATER

a. Annual Water Deliveries: Unless formally advised by Water User to the contrary, it will be assumed that Water User will desire delivery of his full contract amount of water each year. The District will make every effort to provide said contract amount of water on a demand basis as requested by Water User but does not assume any obligation if it is unable to do so. It should be recognized that the District's delivery capability is limited in the month or months of maximum demand by the capacity of the District's distribution facilities and such limitations must be considered in meeting Water User's request.

If Water User wishes to dispose of a portion of his contract amount of water, the District will attempt to do so in accordance with Article 5(k) of the Water Service Contract. If the allocation of the Contract Amount of Water in any year includes Supplemental Water and the District has not yet acquired or produced the Supplemental Water, it shall be the first water returned to the

District for disposal. To the extent Supplemental Water has not already been acquired or produced the Water User shall receive full credit for the cost of the Supplemental Water so returned. To the extent the Supplemental Water has already been acquired or produced said Supplemental Water shall be pooled in accordance with paragraph 9 hereof. If Water User wishes more than his contract amount of water, the District will attempt to meet Water User's request to the extent water can be made available.

The District will notify Water User as to the availability of water and the ability of the District to meet Water User's request from time to time as information is available to the District to do so.

b. Daily Water Orders: Orders to turn on or to turn off water, or orders to increase or decrease the rate of water delivery, shall be made at the District office through telephone communication, facsimile transmission, e-mail or personal communication from Water User or his designee as provided in these Rules and Regulations. Water orders shall be placed before 8:00 AM for water service for the following day, and water orders placed after 8:00 AM will be for water service the second succeeding day. In the event of an emergency, or when a change is in the delivery point within the service area of the same lateral, or when it may otherwise be practical to do so, changes in deliveries may be approved on lesser notice but the District assumes no obligation to do so. Although the District will make every reasonable effort to comply with the requested water orders, there may be times when, because of system capacity limitations, or limitations in the amount of water available from the Agency, such compliance may not be possible, and the District assumes no obligation therefor. Orders shall normally be made on the basis of continuous use of water during the 24-hour period commencing between 7:00 AM and 9:00 AM. **Provided however**, that the Board may establish special conditions for short-run deliveries and/or for deliveries at lower flow rates than for normal irrigation practices.

c. Authorization of Operating Agent: In the case of leased land, or for any other reason, Water User may execute and file with the District an "Authorization of Operating Agent" form. This form will authorize the operating agent or his designee to place water orders and shall constitute the consent of the Water User to all charges and the collection thereof, in any manner authorized under the Water Service Contract and by Sections 47181 to 47185 inclusive of the California Water Code. Said form may authorize operating agent to receive copies of District billings arising from the affected Water Service Contract. This authorization shall remain in effect until the date of termination stated thereon, or until superseded, or until revoked in writing by Water User or designee.

d. Appointment of Agent: Where the Water User consists of more than one individual, except husband and wife living at the same address, or when Water User is an entity, e.g., a corporation, state, county or other public agency, Water User shall appoint an agent for the purpose of performing any and all acts to be done by Water User as defined in the Water Service Contract, and for receiving all notices from the District and billings for charges incurred by reason thereof. The form of the appointment shall be prepared by the District. The appointment of such an agent will in no way release Water User or his lands from any obligation under the Water Service Contract.

e. Authority of Representative: Any person acting in any representative capacity as Water User shall furnish evidence of his authority to so act and bind Water User to the satisfaction of the District. Such representatives shall include a guardian, conservator, administrator, executor, trustee, partner including limited partnership, attorney-in-fact, operator of lands affected by a master operating agreement, and the like.

f. Interruptions in Service: Attention is directed to Section 3(h) of the Water Service Contracts which provides as follows: "District may temporarily discontinue or reduce the amount of water to be furnished to Water User as herein provided, for the purpose of investigation, inspection, maintenance, repair or replacement, as may be reasonably necessary, of any of the Project facilities for the furnishing of water to Water User, or of the facilities of the State Water Project, but so far as feasible, District will give Water User due notice in advance of such temporary discontinuance or reduction, except in case of emergency, in which case no notice need be given. In no event shall any liability accrue against District or any of its officers, agents or employees, for any damage, direct or indirect, arising from such temporary discontinuance or reduction of water deliveries." In case of emergency shut-off by the District an effort will be made to notify Water User as soon as possible.

g. Emergency Turnoffs by Water User: Water User may in an emergency, including but not limited to Acts of God, turn off the supply of water at Water User's turnout. If Water User effects such emergency turnoff he must notify the District office immediately by telephone or in person. Water User and anyone affecting such an emergency turnoff does thereby agree to assume the defense of and hold harmless the District and its officers, agents and employees from any and all loss, damage, liability, claims or causes of action of every nature whatsoever, for damage to or destruction of property including District's property, or for injury to or death of persons, in any manner, arising out of or incidental to such emergency turnoff.

h. Use of Other Water Supplies: Water User may use water furnished by District concurrently with water from other sources, provided that Water User can demonstrate to the satisfaction of the Engineer-Manager or his designee that project water is not being used on land other than that for which it is intended, as set forth in the Water Service Contracts and provided in these Rules and Regulations.

i. Waste of Water: Water delivery may be discontinued by the District for any Water User found to be wasting water either willfully, carelessly, or on account of defective or inadequate ditches or pipelines, or inadequate tailwater facilities, or inadequately prepared land, or improper management, and said water delivery will not be resumed until such conditions are corrected.

j. Farm Turnouts: Except as hereinafter provided for temporary deliveries of water and as provided in Sections 3(c) and 3(d) of the Water Service Contracts, all deliveries will be made only through District owned and operated turnouts.

k. Connections: All connections to District's system shall be made in a manner so as to prevent damage from occurring to District's system resulting from operation of Water User's system and so as to prevent water from Water User's system from entering District's system. Plans for the connection of Water User's system to District's system shall be submitted to the Engineer-

Manager or his designee for approval, and no such connection will be permitted until such approval has been given.

l. Combined Turnouts: In accordance with District's design criteria, water service will be provided to parcels less than twenty acres in size within the Surface Water Service Area only in conjunction with service to an adjacent larger parcel or several adjacent smaller parcels where the total combined area is twenty acres or more. Such service will be made through a single turnout designated a "Combined Turnout." Water will be furnished through such a Combined Turnout to a group of Water Users only upon condition that said group of Water Users first files with District an agreement in a form approved by the District, executed by each and every Water User in said group, and providing, among other things, the following:

(1) Acceptance of delivery of water through the combined turnout.

(2) Granting of an easement to the other Water Users as necessary to convey water from the combined turnout to their respective lands.

(3) Authorization for one individual to represent said group in all matters relating to delivery of water by District through said combined turnout.

In the event a parcel served by a single turnout is conveyed to two or more different parties, and each of the parcels is larger than 20 acres, the new owner(s) of the parcel(s) upon which the turnout is not located shall pay for the cost of constructing a new turnout, and any pipeline necessary to serve such turnout, and shall provide to the District a permanent easement in a form acceptable to the District to accommodate such new turnout and pipeline, unless the Board of Directors approves some other arrangement to serve said parcel.

m. Temporary Water Service Deliveries: As a condition of temporary water service, the owner of lands to be served shall have executed an agreement establishing a covenant running with the land, in a form provided by the District, wherein the landowner expressly acknowledges that the affected lands have no right to firm water service from the District. Delivery of temporary water service to lands for which such an agreement has been properly executed and recorded will be made in such a manner as may be approved by the Engineer-Manager or his designee.

n. Industrial Water Service Deliveries: For Industrial Water Users with long-term contracts, the District will attempt to provide the full contract amount of water each year from water supplies excess to the needs of the Surface Water Service Area from the District pool established pursuant to Section 10 hereof. To the extent such excess water supplies are not available the District shall be under no obligation to supply water for Industrial Water Service users. However, at such times water is not available from the pool, the District will make District system capacity reserved under the terms of the long-term Industrial Water Service Contract to wheel water supplied to Industrial Water Users from other sources and conveyed to District turnouts from the California Aqueduct. The District will also make its unused California Aqueduct capacity available for conveyance of water supplied by the District or by Industrial Water User under the terms of the long-term Industrial Water Service Contract to the extent such capacity is not being

used for other District water deliveries. However, at times when unused California Aqueduct capacity is not available from the District, the Industrial Water User shall be responsible for the delivery of water from the California Aqueduct into District facilities.

In the event an Industrial Water User wants to receive more or less than the quantity of water specified by the contract, it shall notify the District in writing of the difference by January 1, of the year of delivery.

If Industrial Water User orders less than the Contract Amount of Water the District will reserve a correspondingly lower quantity of excess pool water for Industrial Water User for that year. If Industrial Water User orders more than the Contract Amount of Water the District will attempt to meet Industrial Water User's additional request to the extent water can be made available.

The District will notify Industrial Water User as to the availability of water and the ability of the District to meet Industrial Water User's request from time to time as information is available to the District. From January 1 through May 31 of the year of delivery Water Users request for water will be provided from the monthly pools to the extent of availability. If the District is unable to provide for the balance of Industrial Water Users annual request on or before May 31 of the year of delivery Industrial Water Users may secure water from alternate sources for the balance of the year and will not be required to purchase water from subsequent pools.

Absent a long-term contract, delivery of Industrial water will be made in such a manner as may be approved by the Engineer-Manager or his designee.

o. Farming Unit Operation: Water User may assign all or part of his water entitlement through designated turnouts to a Farming Unit Operation. A Farming Unit Operation is a grouping of two or more parcels of land which is under the ownership or control (by lease or otherwise) of a single Water User which may include Contract and Non-Contract land. Such action authorizes the Farming Unit Operator or his designee to file water schedules, and order water and authorizes District to deliver said water through any of the several turnouts which have been designated by all Water Users similarly assigning water to said Farming Unit Operation. Such assignment shall be on appropriate forms provided by the District and shall remain in effect until the date of termination stated therein, or until superseded, or revoked in writing by Water User or Farming Unit Operator. The Farming Unit Operation may include contract and non-contract lands. However, if non-contract lands are included, the owner of the non-contract lands shall have executed an agreement establishing a covenant running with the land, in a form provided by the District, wherein the landowner expressly acknowledges that the non-contract lands have no right to firm water service from the District. In addition, the owner of the contract lands in the Farming Unit Operation shall execute annual agreements by May 1 or a subsequent date established by the Board establishing the Farming Unit Operation in a form provided by the District, agreeing to the lower priority for purchase of unscheduled water as set forth at 4.p.(2) of the Rules and Regulations, and acknowledging that allocation of water and/or system capacity will be based only on the area of contract land. Water delivered to non-contract land prior to the completion of Farming Unit Operation_Agreements shall be made pursuant to conditions for Temporary Water Service.

p. Priority of Requests: In the event the District is not able to meet all request for water, and without detracting from the provisions of Section 3(b) of the Water Service Contracts, priority of requests shall be considered on the following basis:

(1) Contract Water Service for the Contract Amount of Water in the Agricultural Water Service Contract of Water User, for use upon contract lands and lands within the Water Users Farming Unit Operation, shall receive the first priority.

(2) Unscheduled Water for the amount of unscheduled water requested by a Water User with the priority of such requests in the order as follows:

(a) Unscheduled Water for that portion of the requested Contract Amount of Water not allocated to Water User because of shortage of water supply provided the total water supply allocated under each of the Water Service Contracts will be in accordance with the provisions of Section 3.(1) of said Water Service Contracts.

(b) Additional Unscheduled Water for the amount of Unscheduled Water requested for use on contract lands.

(c) Unscheduled Water for use on non-contract lands in a Farming Unit Operation up to an aggregate quantity of water, including both the Contract Amount of Water and Unscheduled Water, equal to 4.0 acre-feet per acre on the contract lands within the Farming Unit Operation. Any additional water shall be purchased at the rates for temporary water.

(3) Industrial Water Service under long-term contracts for the Contract Amount of Water requested in the annual delivery schedule submitted by an Industrial Water User.

(4) Temporary water service for the amount of water requested by temporary Water Users, including temporary industrial water service.

(5) Temporary water service for areas annexed after October 9, 1975, other than where the annexation was coupled with a detachment of an equal number of acres for the amount of water requested by the landowner in said area.

The above priorities are applicable to the allocation of available water at any point in time when the demand exceeds the available water supply. The water supply once allocated in accordance with the above priorities shall remain so allocated notwithstanding any subsequent increase in demand of a higher priority.

q. Supplemental Water: Supplemental Water allocated to Water Users as part of the Contract Amount of Water may be delivered by Water User through Water Users' turnout(s) pursuant to water orders submitted by water user. Provided, however, that the Board may establish special conditions which limit the quantities of Supplemental Water available to Water User on a monthly or seasonal basis.

5. PAYMENTS FOR WATER

a. Contract Water Service: Under conditions of Contract Water Service, Water User shall pay the Water Availability Charge and Water Use Charge as provided in the Water Service Contract. On or before December 1 of each year, District will notify Water User in writing of the estimated total amount of these charges for the following year, and said total amount shall be paid by Water User in eight equal installments, said installments to become due and payable on the tenth day of the months of February through September. **Provided however**, the Board of Directors may elect to delay and or consolidate the payment schedule if information for computing rates is not timely available. On or before July 1 of each year following the first year of Contract Water Service, District will mail to Water User a final accounting of water charges for the previous year. District will include with said final accounting either (1) a statement of credit owing to Water User for overpayment, or (2) a statement of Water User's additional payment obligation which shall be due and payable on August 1. Any credit owing to the Water User for overpayment shall first be applied to cure any delinquency outstanding and then may be deducted from the Water User's next installment of Water User's payment obligation to the District. In the event such credit exceeds the amount of the next installment, then upon written request of Water User, the excess amount may be remitted to Water User. In the event of a change of ownership, the Board of Directors, upon written request by the current Water User, may authorize that the amount of such credit and any refund if applicable be remitted to the immediately previous Water User; otherwise, the credit/refund shall apply to the current Water User. If the final accounting adjustment reveals that an additional payment is due, that obligation shall be assessed against the then current Water User.

b. Unscheduled Water Service: Payments for unscheduled water service shall be made at the rate or rates established therefor by the Board. If the request for unscheduled water service has been made before the Statement of Estimated Annual charges has been completed, the charges for said service will be included in said Statement of Estimated Charges for the year. If the request is made subsequent thereto, payments shall be made monthly. Advance payment or establishment of credit may be required.

c. Temporary or In-Lieu Water Service: Under conditions of temporary or in-lieu water service, payment shall be made each month at the rate or rates and under conditions established by the Board of Directors for such temporary or in-lieu water service. Advance payment or the establishment of credit by the Water User may be required.

d. Industrial Water Service: (i) Payment for temporary Industrial Water Service shall be made at the rate or rates and under conditions established by the Board of Directors for such service. Advance payment or the establishment of credit may be required. (ii) In such cases where Industrial Water Service is provided under a water service contract entered pursuant to Section 3(f) hereof in which capacity is made available, then the contract for Industrial Water Service shall provide, in addition to other customary terms, that the water user annually pay a wheeling fee based on the Contract Amount of Water as provided in the Water Service Contract. In years and at times in which Industrial Water is furnished by the District, Industrial Water User shall also pay the Fixed Obligation (F.O.) component of the Water Availability Charge (WAC) and the Water Use Charge (WUC) for water ordered and delivered as provided in the Industrial Water Service contract. Payment for water furnished in excess of the Contract Amount of Water shall be at rates for Temporary Industrial Water Service. In those years and at times in which

Industrial Water is not furnished by District the Industrial Water User shall pay only the wheeling fee for water service. The contract may provide that should the F.O. and WUC exceed an indexed water cost that the Industrial Water User may secure its own water supply and the District deliver same upon paying the wheeling fee. Such wheeling fee shall, commencing in 2000, be the higher of \$100 per acre-foot of Contract Amount of Water each year of the long-term obligation to make capacity available, or \$50 per day of water delivery, adjusted annually by the Consumer Price Index, All Urban Consumers, All Items Index, Western Cities with populations of less than 1,500,000, for December of the calendar year immediately preceding utilizing the index for December 2000 as a base to determine adjustments.

On or before December 1 of each year, District will notify Industrial Water User under long-term water contract in writing of the estimated total amount of these charges for the following year and said total amount shall be paid by Industrial Water Users in four equal quarterly installments. Each installment is to become due and payable on the last day of the first month of each quarter. **Provided however** that in the event the District is unable to provide water for Industrial Water User or other credits are due to the Industrial Water User the second and subsequent quarterly installment payment for the Water Availability and Water Use Charges will be recomputed by the District and Industrial Water User will be notified of the change. On or before July 1 of each year following the first year of Industrial Water Service, District will mail to Water User a final accounting of water charges for the previous year. District will include with said final accounting either (1) a statement of credit owing to Industrial Water User for overpayment, or (2) a statement of Water User's additional payment obligation which shall be due and payable on August 1. Any credit owing to the Industrial Water User for overpayment may be deducted from the Industrial Water User's next installment of Water User's payment obligation to the District. In the event such credit exceeds the amount of the next installment, then, upon written request of Industrial Water User, it may authorize that the remaining amount of such credit be remitted to the Water User.

e. Supplemental Water: Payments for Supplemental Water shall be made at the rate or rates established therefore by the Board. Payment for Supplemental Water allocated as part of the Contract Amount of Water, for Water User and ordered by Water User shall be spread over the remaining regular monthly payments set forth in the Water Service Contract. Payment for Supplemental Water shall be subject to and a part of a final accounting of costs in the same manner as set forth in paragraph 5a of these Rules and Regulations. Water User shall be entitled to any credit due for overpayment and shall be responsible for any additional payment obligation as a result of underpayment identified in said final accounting adjustment.

f. Delinquency in Payments: Pursuant to Section 5(g) of the Water Service Contract the total amount of water charges of Water User is divided into eight equal installments which are due and payable on the tenth day of each of the months of February through September. If there is a delinquency in payments for water service for any turnout, the District shall impose penalties for such delinquency as follows:

(1) If the payment for any turnout which Water User is required to make to District is not received by the District by 5:00 PM on the 25th day of the month in which it is due and payable, said payment is delinquent within the meaning of Section 5(i) of the Water Service Contracts,

and delivery of water to said Water User will be discontinued. No further water deliveries will be made to said Water User until all delinquencies, plus penalties and interest if applicable, are paid, except as provided at subparagraph (3) hereof.

(2) Any payment remaining unpaid for a period of 30 days after the date it becomes due and payable (the 10th of the month) is delinquent as provided in Section 5(j) of said Contract, and a penalty of 10% of the payment will be charged plus interest at 12% per year until all payments are brought up-to-date. On the 10th of the month the District will deposit the remaining allocation of water from delinquent accounts in the current monthly pool and apply the credits therefrom to the Water Users account. Said credits will be applied before the assessment of penalty or interest on the delinquent account. In the event Water Users subsequently cures the delinquency, District will give Water User first priority upon any water in the pool remaining unsold, or water from other sources, which may be available to the District, up to that quantity of water originally placed in the pool from the delinquent account. Should a Water User be delinquent on October 10, the District will commence proceedings to collect the charges as provided in Sections 47181 to 47185, inclusive, of the Water Code. Provided, however, the District may commence such proceedings at an earlier date if the Board determines it is in the best interest of the District to do so. This may lead to a sale of the property affected by the Water Service Contract and to continued refusal of water service, all as provided in the Water User's Water Service Contract and these Rules and Regulations. Nothing herein contained shall be construed in any manner of enforcing any remedy, either at law or in equity, for any breach by Water User in failing to timely pay any assessments, tolls or charges.

(3) If the District is in possession of a Certificate of Sale (executed by the County Treasurer pursuant to Water Code §46761) for delinquent charges for Contract Water Service, and Water User demonstrates that he has no available means to satisfy the charges which are covered by the Certificate of Sale, water service may be provided to Water User so long as the Water User is otherwise entitled to Contract Water Service, and the Water User (and his tenant in the event Water User leases his land) enter into a form of agreement approved by the Board. Said agreement shall include the following provisions: (a) The Water User acknowledges the existence and priority of the Certificate of Sale; (b) The term of the agreement shall only be for one year and there shall be no automatic right of renewal; and (c) The Water User (and/or the tenant if the tenant as Operating Agent is paying water bills) must pay in advance contract water charges as determined by the District during the term of the agreement. Said agreement may also, at the discretion of the Board, provide for repayment of prior delinquent charges which are the subject of the Certificate of Sale. Service to such lands subject to a Certificate of Sale shall only be provided in accordance with terms and conditions of such agreement.

6. PAYMENT OF SPECIAL SERVICE CHARGES

Special Service Charges, as provided by law and as set forth in the Water Service Contracts will be collected periodically as provided by law. Such charges may include the Administrative and General Service Charges, Project Service Charge and Deferred Service Charge, all as set forth in the contracts, and such other tolls and charges as may be provided for under Water Storage District Law.

7. PROCEDURE FOR FIXING TOLLS AND CHARGES NOT ESTABLISHED BY CONTRACT

In accordance with Section 43003 of the Water Code, the following procedures are established for fixing Tolls and Charges authorized by Sections 43006 and 47180 other than those established by the Water Service Contract. Before fixing any such Toll and Charges, the Board shall pass a resolution declaring its intent to do so and in the resolution fix a time not less than two weeks from the date of the resolution as the time when the Board will meet to consider the matter of fixing such Tolls and Charges. A copy of the Resolution of Intention shall be published in a newspaper of general circulation in Kern County once a week for at least two weeks before the time appointed by the Board for the open meeting. At the time appointed for the open meeting, the Board shall consider the matter of fixing the Tolls and Charges, hear any objections thereto and may adjourn the matter from time to time.

8. WATER SHORTAGES

Pursuant to powers granted by Section 43003 et seq., of the California Water Code, the Board has established the following policy to provide for the sharing of the burden of any shortages in the quantity of water available for distribution to Water Users and the cost thereof during any year.

a. Allocation of Water: The water supplies available to the District will be allocated to the District's Agricultural Contract Water Users as follows:

i. If the District's available water supply in any year is less than the total of Contract Amount of Water for all Water Users, but more than two acre-feet per acre when averaged for all lands in the Surface Water Service Area, the available supply will be apportioned to all Water Users in the proportion that each Water User's Contract Amount of Water for that year bears to the total of Contract Amount of Water for all Water Users.

ii. If the District's available supply in any year, averaged for all lands in the Surface Water Service Area, is less than two acre-feet per acre, the available supply will be apportioned among all Surface Water Service Area lands on an equal acre-feet per acre basis provided that Water User shall not be apportioned more water under this paragraph (ii) than Water User would receive under paragraph (i) above. Notwithstanding the above, in the event of a severe long-term water shortage, the Board reserves the right to make such other allocations as it deems appropriate, taking into consideration the type of crop, critical water needs, and the economic effect of losses which may occur as a result of such allocations and may provide for adjustments of charges as a result of such allocations.

b. Supplemental Water: The District during years of short supply may obtain water supplies in addition to that available under the Agency Contract, including District wells and Banking Programs. Such water supplies shall be allocated first to provide the full Contract Amount of Water provided for in the contracts for Agricultural Water Service under terms as the Board then determines appropriate and the costs thereof borne by the beneficiaries of such supplies. The

method of allocation of Supplemental Water shall be as set forth in the contracts for Agricultural Water Service and recited in paragraph 8(a) above.

c. Industrial Water: Apportionment of water under an Industrial Water Service Contract shall be governed by the terms of that Contract.

d. Conveyance of Ground Water: In any year the District declares a water shortage exists, District facilities may be used to convey ground water for use upon land within the District for agricultural purposes [whether or not the lands to be served are within the common ownership or Farming Operation of the land from which the water is pumped], provided the affected parties enter into an Agreement in a form provided by the District which shall include but not be limited to the following provisions:

- i. Nothing therein contained shall be interpreted as a waiver, relinquishment, and/or abandonment of the District's title to water stored in the underground as a result of the District's project.
- ii. The District shall not involve itself with any disputes regarding the right of a landowner/Water User or others, nor any disputes regarding continuation of such service, nor any dispute regarding payment for such a ground water conveyed, and any landowner/Water User desiring to utilize the District's facilities for such purposes shall hold the District harmless from any such claims.
- iii. Wheeling from one system to another generally is only possible if the water being delivered to the District system is of sufficient quality to discharge into the California Aqueduct as determined by the State. Only to the extent the District is taking delivery of surface water may ground water be delivered to the District and "banked" for later uses with the District at times when the District would be taking delivery of surface water. Such restriction must be applied on a system by system basis unless water quality of the ground water is sufficient to discharge it into the California Aqueduct.
- iv. The wheeling charge shall be sufficient to recover all costs to the District associated with the Storage, conveyance and delivery of ground water. The wheeling charge shall be estimated based on available information on costs and estimated quantities of ground water production. The estimated wheeling charge shall be paid by Water User within 30 days of notice. When the final costs are determined by the District, any overpayment will be credited to the Water User, and any additional charge will be paid by Water User within 30 days of notice. The cost of power and energy for pumping shall not be included in the wheeling charge and shall be charged separately based on the unit rate for transferring water between pump zones.
- v. Water User shall indemnify and hold the District harmless from any damages resulting from loss of pumped ground water due to causes beyond the control of the District.
- vi. The cost of providing connections to District systems, including any protective devices required by District as a condition of such connection, shall be paid from funds deposited by Water User for this purpose in advance of construction.

9. DISPOSAL OF WATER

As provided in Section 5(k) of the Contract, the District will make reasonable efforts to dispose of any water made available to but not required by Water User, and to the extent of Water User's obligation, any net revenue from such disposal shall be credited to Water User. In disposing of any such water, District will make reasonable effort to obtain the maximum amount of credit for Water User. If in the event such water is made available to the District by Water Users in accordance with Section 5(k) of the contract, over a period of time covering two or more calendar months, then such water will be accumulated into monthly pools which may be established by the District, and all the water from the first such pool will be sold and credits applied to its contributors before any sales are made from the second pool, and all water from the second pool will be sold before any sales are made from the third pool, etc., thus following a "first-in-first-out" policy in increments of monthly pools. **Provided however**, if any water in the second or subsequent monthly pools is sold at rates higher than any individual rate for water sold from the first pool, then the pool sales shall be adjusted so that the highest rates for water sold are credited to the first pool and successively lower rates are applied to the second and subsequent pools.

10. CONTROL, USE AND RECAPTURE OF WATER

a. District will not be responsible for the control, carriage, handling, use, disposal or distribution of water delivered to Water User hereunder outside the facilities then being operated and maintained by District. Water User shall indemnify and shall assume the defense of and hold harmless the District and its officers, agents and employees for any and all loss, damage, liability, claims or causes of action of every nature whatsoever for damage to or destruction of property, including the District's property, for injury to or death of persons, in any manner arising out of or incidental to the control, carriage, handling, use, disposal or distribution of water outside such facilities.

b. Pursuant to the provisions of Section 3 of the Contract dealing with conditions of delivery, place of use of project water, and Water User's liability and indemnification, water delivery may be discontinued by the District for any Water User who permits water delivered by District to escape beyond the boundary of the lands described in said contract whether willfully, carelessly, or on account of defective or inadequate ditches or pipelines, or inadequate tailwater facilities, or inadequately prepared land or improper management, and said water delivery will not be resumed until such conditions are corrected. For the purposes of administration of this section, for lands included in a Farming Unit Operation as described in Section 4(o) of these Rules and Regulations, the contract lands shall be deemed to include all lands within said Farming Unit Operation; provided, however, that nothing herein contained shall limit or detract from the obligations assumed by Water User.

c. Without obligating District to assume any responsibility therefor, District shall have the right to the use of all waste, seepage, and return flow resulting from water supplied by the District, including but not limited to Project Water, which escapes or is discharged beyond Water User's recovery facilities, if any, and nothing herein contained shall be construed as an abandonment or relinquishment of District of the right to recapture and the use of any such water; **Provided**

however, that nothing herein contained shall limit or detract from the obligations assumed by Water User.

11. CARRYOVER

Carryover is the ability to use undelivered State Water Project entitlement in the year following its allocation as part of the Contract Amount of Water. Water Users are permitted to carry over undelivered State Water Project Entitlement allocated to them as part of their Contract Amount of Water and not pooled as of December 31 of the year of allocation. Water from the District's supplemental water programs, or purchased from District pools, may not be carried over by Water Users. In administering this rule, the first water delivered during the year will be counted as SWP entitlement up to the quantity of entitlement allocated to Water User. Other water supplies including supplemental water and pool purchases will be the last water supplies delivered to Water Users. Payment for Carryover shall be at rates or rates established by the Board, to recover the costs associated with delivery of carryover water. Carryover water is subject to loss without notice, and the District shall not be responsible for losses damages from the loss of Carryover water.

12. PRESERVATION OF PUMPING RIGHTS

In order that no Water User be prejudiced by utilizing Project Water in lieu of exercising whatever rights he may have to pump ground water and in recognition of the anticipated benefit to the District's underground water supply arising from the implementation of the District's project, the Board of Directors has adopted the following policies:

a. All Water User's contracts with the District for water service shall include a Section 3(m) which is quoted following:

"In the interest of preserving to Water User his rights to pump ground water for use on his lands which will be served with water under this contract, it is agreed that, during all the years that District delivers water to Water User, to the extent that Water User shall reduce his pumping of ground water and shall make use of water so delivered to him by District, Water User's said use of water so delivered to him by the District shall be deemed the same as if he had pumped from the underground a quantity of water equal to the quantity of water so delivered to him by District. Water User also agrees to recognize and be bound by the pumping rights similarly preserved to other Water Users in the District pursuant to water service contracts heretofore and hereafter executed. It is further agreed that, in the event District were to carry out a program for spreading of water and percolation thereof to underground storage, District shall have the right to use of the underground storage for spreading and recovery of water in connection with supplying water service to Water User and to all other Water Users, and it is further agreed that, to the extent that District may pump water from underground supplies for furnishing to Water Users, District shall be deemed to be exercising said Water User's rights to pump water from underground water supplies; **Provided however**, that nothing herein contained shall prevent or hinder Water User from exercising his rights to pump ground water."

b. During the lifetime of District's adopted project, District will maintain records of ground water level and quality, and, in accordance with Water Storage District Law, if future conditions should indicate the need therefor, will levy a service charge on lands irrigated from ground water and/or seek to have an Assessment Commission appointed to readjust the Original Project Assessment to reflect project benefits to lands within District irrigated from ground water; and such action will be taken in a timely manner in order to maintain financial equity between the Water Users and ground water users in District.

In effecting this policy it is declared that without obligating District to assume any responsibility therefor and without limiting or detracting from the obligations assumed by Water Users in this regard, District shall have the right to the use of all waste, seepage and return flow resulting from Project Water which escapes, percolates or is discharged beyond Water User's recovery facilities, if any, and nothing herein contained shall be construed as an abandonment or relinquishment by District of the right to the recapture, use and benefit of all such water, and any use made of any resultant benefit to ground water conditions arising from project water is made with the consent of the District, which consent is revocable at any time, and such use is not to be considered a use adverse to District's rights nor shall any such use under any circumstances create an estoppel in asserting such rights at any time.

Further in effecting this policy, it is declared that, during all the years that District delivers water to a Water User, to the extent that such Water User shall have reduced his pumping of ground water and shall make use of water so delivered to him by District, any use made of the resultant benefit to ground water conditions is made with the consent of said Water User, which consent is revocable at any time, and such use is not to be considered a use adverse to his right to the continued exercise of his rights to pump and utilize ground water nor shall any use under any circumstances create an estoppel in asserting any such right at any time.

13. PROTECTION OF DISTRICT FACILITIES

Without limiting rights otherwise reserved and except for drains and waterways built by the District expressly for the conveyance of drainage water, no persons will be allowed to drain irrigation water upon District-owned property, and any person doing so will be subject to fine and damages, will be in violation of these Rules and Regulations and water service may be terminated.

It is the duty of Water User to furnish reasonable protection for the individual Farm Turnout to prevent damage to said turnout. In the event that damage occurs to Farm Turnout as a result of failure by Water User to provide such protection, the repair of such damage will be made by the District, the expense of such repair will be charged to Water User and no water will be furnished through the affected turnout until such repairs are made and the charges therefor paid to the District.

14. SUBSIDENCE

It is known that portions of the District to be served with project water consist of soil which, with continued application of water, may consolidate to a considerable degree. It is also reasonable to

assume that this phenomenon may result in damage to District's facilities. This factor is recognized in the District's Project Report, which contains estimates of an amount of money necessary to pay the added cost of construction required to minimize danger and an estimate of the cost of increased maintenance on facilities in said subsidence areas. Such factors were again considered during final design of project facilities and in connection with the District's right of way program. It is also recognized that the use of water in such areas for normal agricultural purposes may nevertheless result in unforeseen damage to District's facilities arising from this natural phenomenon.

It has been suggested that paragraph 3(e) of the Water Service Contract and various portions of these Rules, particularly Rule 13, can be interpreted as rendering a Water User liable for any and all damage occurring to District's facilities by reason of the ordinary use of his lands for agricultural purposes. It is to be noted that nothing contemplated in the Water Service Contracts or these Rules and Regulations is intended to make any Water User strictly liable for damage to District's facilities attributable to subsidence; that the philosophy of the Project Report is such that the Water Users will pay the estimated cost of minimizing such damage and the increased maintenance attributable thereto as a District expense, and that the consideration paid, or to be paid, to Water Users for the acquisition of District's rights-of-way has not included an element of damage for assumption of any liability arising from such risk.

In this regard, and notwithstanding anything contained in the Water Service contract and/or these Rules and Regulations, District will repair, at District's own expense, damage to District facilities due to subsidence occasioned by the normal, ordinary and reasonable use of land of Water User, provided that Water User's use incorporated every reasonable precaution to prevent, eliminate or minimize such damage; **Provided however**, nothing herein contained shall modify in any manner the provisions of Paragraph 3(h) of the Water Service Contract or in any manner render District liable for any damage to a Water User occasioned by disruption of Water Service.

15. ENCROACHMENT ON DISTRICT PROPERTY

Without limiting rights otherwise reserved, consent for encroachment will be required from the District before any drains, fences, pipelines or other encroachments from private sources will be permitted to be used upon the District's property. Consent forms will be furnished by the District to the applicant and must first be approved by the Engineer-Manager or his designee before any construction begins. Where District rights in any property are an easement, no encroachments will be permitted which will in any manner interfere with the rights under said easement, and the District's consent must first be obtained before any pipelines or other encroachments are constructed in any easement area. The work shall be constructed to specifications approved by the District at the sole expense of the permittee and maintained to the satisfaction of the District. If such consent is granted, then the permittee shall be solely responsible for and shall indemnify and shall assume the defense of and hold harmless the District and its officers, agents and employees from any and all loss, damage, liability, claims or cause of action of every nature whatsoever, for damage to or destruction of property, including the District's property, or for injury to or death of persons, in any manner, arising out of permittee's exercise of the rights and privileges given in the granting of such consent. Issuance of consent does in no way grant a permanent right, and if the District determines at a future date that said works do in fact interfere

with its operations, said works shall be removed and the District's property restored to its original state at the sole expense of the permittee. Granting of such consent does in no way and in no extent surrender or subordinate the District's control or supervision over the encroachment. Any person or his authorized agent who uses the property of District for the movement of equipment shall be responsible to District for any damage to District property. No livestock will be allowed to enter upon or graze on District's fee property without the specific written approval of the District. Any persons using a District rights-of-way for any purpose assumes all risks associated therewith and assumes the responsibility for any damage to District property resulting therefrom and also for any damage to private property caused by such damage to District property.

16. MODIFICATION OF THE PROJECT FACILITIES

No changes shall be made in the constructed project facilities except by District personnel or its contractors and in accordance with the District's specifications. If a modification is made at the request of a Water User, and for his benefit, the cost thereof shall be paid in advance by the Water User requesting said modification. The advance payment shall be determined by the Engineer-Manager based upon an estimate of the costs including but not limited to reasonable charges for engineering performed by the District and overhead, and after completion of the work a final accounting shall be submitted to the Water User. Within thirty (30) days after submission of said final accounting, the Water User will pay the difference between the actual cost and the estimate thereof, or the District will make a refund if the actual cost is less than the advance payment. Any additions to project facilities so constructed shall become the property of the District.

17. SALE OR TRANSFER OF TITLE TO LANDS

a. Without limiting the provisions of Paragraph 10 of the Water Service Contracts, when land affected by a Water Service Contract is sold or title otherwise transferred to another party, District will be under no obligation to deliver water to such lands until the Water Service Contract is assumed by the new landowner. Such assumption shall be on forms provided by the District, executed and completed in a manner satisfactory to the District. In the event of a transfer of ownership as to a portion of the lands described in an Exhibit "A" to a Water Service Contract and in the absence of written instructions from the affected landowner, the Assumption Agreement will be prepared so as to allocate the rights and obligations under said Water Service Contract on an acreage basis.

b. Notwithstanding any transfer or change of ownership, the District shall be entitled to administer a Water Service Contract in reliance upon and in accordance with matters in the files at the District office including but not limited to matters regarding title to land, address of Water User, authorizations, appointments, designations, credits and refunds and the like, until or unless District has received actual notice in writing that any or all of such matters are changed, modified or revoked.

18. MISCELLANEOUS PROVISIONS REGARDING ASSIGNMENTS AND TRANSFERS

a. The execution by the District of any assignment and/or the giving of its consent to transfer of the rights of a Water User under a Water Service Contract or to a disposal of water by the District pursuant to Rule 10 hereof, shall be without any warranty of title on the part of the District and shall not be interpreted as any representation, express or implied, by or on behalf of District, that such assignment, transfer or disposal is free and clear of outstanding encumbrances.

b. Without attempting to establish or in any manner affect the rights of any person arising from a deed of trust, any person or entity having any interest in a deed of trust on property subject to a Water Service Contract, may file with the District a written request for notice of failure to make the payments required by such Water Service Contract or a request for notice of any specific act that the District may be requested to undertake or to consent to under the Water Service Contract or these Rules and Regulations that such person alleges will detrimentally affect its interest, including but not limited to (1) a request for exclusion from the Surface Water Service Area; (2) a request for written permission to utilize water on lands other than those described in Exhibit "A" to a Water Service Contract for a period in excess of a year; or (3) a request for assignment of rights under Water Service Contract for a period in excess of a year. Upon receipt of such notice, District shall give such person written notice of default or of any request that it take such action as is set forth in the request for notice, at least fifteen (15) days prior to foreclosure proceedings or prior to such other specified act by the District, unless such person has given written consent to the requested action. In addition to setting forth the matters as to which notice by the District is requested, the request for such notice shall set forth a legal description of the land affected; the name of the current owner of the fee; the name and address where the requested notice is to be sent and a copy of the deed of trust showing the recording information. Any notice from the District shall be effective when deposited in the mail, postage prepaid, directed to the address shown in the notice. **Provided however**, District may disregard any request for notice which has not been refiled within fifteen (15) days of a written demand therefor by the District mailed in the same manner and with the same effect as hereinabove provided for the notice by the District; **Provided further, however**, nothing herein provided shall render District liable to any person under any circumstances.

19. REAPPORTIONMENT OF ASSESSMENTS

The provisions hereof are supplementary to the provisions of Article 8 (commencing with Section 46325) of Chapter 2 or Part 9 of the Water Code.

When any tract of land upon which an assessment has been levied, has been subdivided into smaller parcels of land, the Board may, in the absence of any application being filed therefor, prior to a call on said assessment or prior to closing of the County Assessment Rolls if the alternative procedure for collecting District assessments is utilized, order that such assessments be reapportioned in the same manner as utilized in establishing the assessments on the entire tract being reapportioned without notice and hearing unless a person interested shall have filed with the Board a request for notice of hearing of reapportionment of assessments to be made pursuant to Section 46325.

Applications for reapportionment of assessments on tracts of land in the District shall be in such form as is approved by the Board; landowners' signatures shall be acknowledged in the same

form as a conveyance of real property and the application shall be accompanied by certified copies of recorded deeds showing the current ownership of the entire tract to be reapportioned. If the application be signed by less than all the landowners within the subdivided tract, a hearing will be held and notice of hearing shall be by mail directed to landowners affected at the address shown on District records and only to such other persons as are interested who have filed with the Board a request for notice of reapportionment, mailed at least ten (10) days prior to the day of hearing. District may require a report as to status of title of said reapportionment tract and may require a payment of such fees and costs by the applicant as the Board may establish.

20. MUNICIPAL AND INDUSTRIAL WATER

These Rules and Regulations are applicable to water served for agricultural use and industrial use. Water will be furnished for industrial use only with the written permission of the District and subject to specific terms and conditions to be imposed for the particular service involved or pursuant to contracts for Industrial Water Service. Water is in a raw, untreated condition and is considered to be unfit for human consumption without treatment. Insofar as is practicable the basic rules and regulations governing the delivery of irrigation water shall apply to delivery of water for industrial use.

21. SECTION 592 OF THE PENAL CODE OF THE STATE OF CALIFORNIA

Attention is directed to the provisions of Section 592 of California Penal Code as follows: "Every person who shall, without authority of the owner or managing agent, and with intent to defraud, take water from any canal, ditch, flume or reservoir used for the purpose of holding or conveying water for manufacturing, agricultural, mining, irrigating or generation of power, or domestic uses, or who shall without like authority raise, lower or otherwise disturb any gate or other apparatus thereof, used for the control of measurement of water, or who shall empty or place or cause to be emptied or placed, into any such canal, ditch, flume or reservoir, any rubbish, filth or obstruction to the free flow of the water, is guilty of a misdemeanor."

22. AUTHORITY OF CONTRACTS

This District entered into a contract with the Kern County Water Agency and contracts between the District and Water Users for water service. In case of an inconsistency between these Rules and Regulations and the Water Users Contract, the Agency Contract, the Master Contract, Industrial Water Service Contract and any amendments thereto, the Contracts shall govern.

23. ENFORCEMENT OF RULES AND REGULATIONS

The Engineer-Manager of the District is authorized to do all acts necessary and proper to enforce these Rules and Regulations. Failure of a Water User to comply with any of the Rules and Regulations shall be sufficient cause for the termination of water service, and water service will not again be furnished to such Water User until full compliance has been made with all the requirements as herein set forth; **Provided however**, that Water User shall in no way be relieved of any responsibility for payment of any charges or obligations by reason of such termination of

water service. When it is practicable to do so, advance notice of any such termination of water service will be furnished to Water User. In no event shall any liability accrue against District or any of its officers, agents or employees, for damage, direct or indirect, arising from such terminations of water service. Non-enforcement of any provision of these Rules and Regulations does not constitute a waiver of the District's right of enforcement at any time.

24. APPEAL OF DECISION OF ENGINEER-MANAGER

In the event a Water User disagrees with a decision made by the Engineer-Manager in carrying out the enforcement of these Rules and Regulations, he shall have the right of appeal to the Board of Directors. Appeals shall be submitted in writing no less than five (5) days prior to a regular meeting of the Board in order to be considered at that meeting, shall specifically set forth the decision being appealed and shall give the reasons for said appeal. Decisions of the Board of Directors shall be final and conclusive.

25. CHANGES IN RULES AND REGULATIONS

The Rules and Regulations shall become effective immediately and may be added to, amended or repealed at any time by resolution of the Board of Directors of the District.

26. SEVERABILITY OF PROVISIONS

If any provision of these Rules, or the application thereof to any person or circumstance, is held invalid, the remainder of these Rules, and the application of its provisions to other persons or circumstances, shall not be affected thereby.

27. BLANCA ROSA IMPROVEMENT DISTRICT

On May 12, 1993, the Board of Directors formed the Blanca Rosa Improvement District, consisting of certain lands within the White Wolf ground water basin within the District. On August 17, 1993, the Improvement District's voters approved a project to provide supplemental water service for lands within the Improvement District. Such supplemental service is provided pursuant to separate water service contracts and Rules and Regulations of said Improvement District.

Appendix E

DWR Agricultural Water Management Plan Checklist

The DWR's Agricultural Water Management Plan Checklist is set forth in Section 2.1 the *DWR Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan*.

AWMP WATER CODE REQUIREMENT CHECKLIST

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.1.1	1.4	AWMP Required?	10820, 10608.12
S.2.1	1.4	At least 25,000 irrigated acres or	10853
N/A	1.4	Less than 25,000 irrigated acres and funding provided.	10853
S.1	1.4	Initial AWMP prepared and adopted by December 31, 2012?	10820(a)
	1.4	December 31, 2015 update.	10820(a)
S.1	1.4	5-year cycle update.	10820(a)
S.1	1.4	New agricultural water supplier after December 31, 2012 – AWMP prepared and adopted within 1 year.	10820(b)
S.7.1	1.5, 4.2	1999 AWMC MOU: Report on EWMP implemented or scheduled for implementation included.	10827
S.1.1	1.5, 5	USBR water management/conservation plan:	10828(a)
S.1.1	1.5, 5.1	Adopted and submitted to USBR within the previous four years, AND	10828(a)(1)
S.1.1	1.5, 5.1	The USBR has accepted the water management/conservation plan as adequate.	10828(a)(2)
N/A	1.4	UWMP or participation in area wide, regional, watershed, or basin wide water management planning: does the plan meet requirements of SBx7-7 2.8 (use checklist)	10829
S.1.3	3.1 A	Description of previous water management activities.	10826(d)

AWMP WATER CODE REQUIREMENT CHECKLIST (CONTINUED)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.1.4	3.1 B.1	Was each city or county within which supplier provides water supplies notified that the agricultural water supplier will be preparing or amending a plan?	10821(a)
S.1.4	3.2 B.2	Was the proposed plan available for public inspection prior to plan adoption?	10841
APP. A	3.1 B.2	Publically-owned supplier: Prior to the hearing, was the notice of the time and place of hearing published within the jurisdiction of the publicly owned agricultural water supplier in accordance with Government Code 6066?	10841
APP. A	3.1 B.2	14 days notification for public hearing?	GC 6066
APP. A	3.1 B.2	Two publications in newspaper within those 14 days?	GC 6066
APP. A	3.1 B.2	At least 5 days between publications? (not including publication date)	GC 6066
APP. A	3.1 B.2	Privately-owned supplier: was equivalent notice within its service area and reasonably equivalent opportunity that would otherwise be afforded through a public hearing process provided?	10841
S.1.5	3.1 C.1	After hearing/equivalent notice, was the plan adopted as prepared or as modified during or after the hearing?	10841
S.1.4	3.1 C.2	Was a copy of the AWMP, amendments, or changes, submitted to the entities below, no later than 30 days after the adoption?	10843(a)
S.1.4	3.1 C.2	The department.	10843(b)(1)
S.1.4	3.1 C.2	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	10843(b)(2)

AWMP WATER CODE REQUIREMENT CHECKLIST (CONTINUED)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.1.4	3.1 C.2	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	10843(b)(3)
S.1.4	3.1 C.2	Any urban water supplier within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(4)
S.1.4	3.1 C.2	Any city or county library within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(5)
S.1.4	3.1 C.2	The California State Library.	10843(b)(6)
S.1.4	3.1 C.2	Any local agency formation commission serving a county within which the agricultural water supplier provides water supplies.	10843(b)(7)
S 1.5	3.1 C.3	Adopted AWMP availability.	10844
N/A	3.1 C.3	Was the AWMP available for public review on the agricultural water supplier's Internet Web site within 30 days of adoption?	10844(a)
S.1.5	3.1 C.3	If no Internet Web site, was an electronic copy of the AWMP submitted to DWR within 30 days of adoption?	10844(b)
	3.1 D.1	Implement the AWMP in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.	10842
S.2	3.2	Description of the agricultural water supplier and service area including:	10826(a)
S.2.1	3.2 A.1	Size of the service area.	10826(a)(1)
S.2.2, S.2.3	3.2 A.2	Location of the service area and its water management facilities.	10826(a)(2)
S 2.4	3.2 A.3	Terrain and soils.	10826(a)(3)
S 2.5	3.2 A.4	Climate.	10826(a)(4)
S 2.6	3.2 B.1	Operating rules and regulations.	10826(a)(5)

AWMP WATER CODE REQUIREMENT CHECKLIST (CONTINUED)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.2.7	3.2 B.2	Water delivery measurements or calculations.	10826(a)(6)
S.2.8	3.2 B.3	Water rate schedules and billing.	10826(a)(7)
S.2.9	3.2 B.4	Water shortage allocation policies.	10826(a)(8)
S.3	3.3	Water uses within the service area, including all of the following:	10826(b)(5)
S.3.1	3.3 A	Agricultural.	10826(b)(5)(A)
S.3.2	3.3 B	Environmental.	10826(b)(5)(B)
S.3.3	3.3 C	Recreational.	10826(b)(5)(C)
S.3.4	3.3 D	Municipal and industrial.	10826(b)(5)(D)
S.3.5	3.3 E	Groundwater recharge.	10826(b)(5)(E)
S.3.6	3.3 F	Transfers and exchanges.	10826(b)(5)(F)
S.3.7	3.3 G	Other water uses.	10826(b)(5)(G)
S.4	3.4 A	Description of the quantity of agricultural water supplier's supplies as:	10826(b)
S.4.1	3.4 A.1	Surface water supply.	10826(b)(1)
S.4.2	3.4 A.2	Groundwater supply.	10826(b)(2)
S.4.3	3.4 A.3	Other water supplies.	10826(b)(3)
S.4.4	3.4 A.4	Drainage from the water supplier's service area.	10826(b)(6)
S.4	3.4 B	Description of the quality of agricultural waters suppliers supplies as:	10826(b)
S.4.5	3.4 B.1	Surface water supply.	10826(b)(1)
S.4.5	3.4 B.2	Groundwater supply.	10826(b)(2)
S.4.5	3.4 B.3	Other water supplies.	10826(b)(3)
S.4.6	3.4 C	Source water quality monitoring practices.	10826(b)(4)
S.4.6	3.4 B.4	Drainage from the water supplier's service area.	10826(b)(6)
S.5	3.5	Description of water accounting, including all of the following:	10826(b)(7)
S.5.1	3.5 A	Quantifying the water supplier's water supplies.	10826(b)(7)(A)
S.5.2	3.5 B	Tabulating water uses.	10826(b)(7)(B)

AWMP WATER CODE REQUIREMENT CHECKLIST (CONTINUED)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.5.3	3.5 C	Overall water budget.	10826(b)(7)(C)
S.5.4	3.5 D	Description of water supply reliability.	10826(b)(8)
S.6.1	3.6	Analysis of climate change effect on future water supplies analysis.	10826(c)
S.1	3.7	Water use efficiency information required pursuant to Section 10608.48.	10826(e)
S.7.1	3.7A	Implement efficient water management practices (EWMPs).	10608.48(a)
S.7.1	3.7 A.1	Implement Critical EWMP: Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).	10608.48(b)
S.7.1	3.7 A.1	Implement Critical EWMP: Adopt a pricing structure for water customers based at least in part on quantity delivered.	10608.48(c)
S.7.1	3.7 A.2	Implement additional locally cost-effective and technically feasible EWMPs.	10608.48(c)
S.7.2	3.7 B	If applicable, document (in the report) the determination that EWMPs are not locally cost-effective or technically feasible.	10608.48(d)
S.7.1	3.7 A	Include a report on which EWMPs have been implemented and planned to be implemented.	10608.48(d)
S.7.1	3.7 A	Include (in the report) an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future.	10608.48(d)
	5	USBR water management/conservation plan may meet requirements for EWMPs.	10608.48(f)

AWMP WATER CODE REQUIREMENT CHECKLIST (CONTINUED)

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
S.8.4	6 A	Lack of legal access certification (if water measuring not at farm gate or delivery point).	CCR §597.3(b)(2)(A)
N/A	6 B	Lack of technical feasibility (if water measuring not at farm gate or delivery point).	CCR §597.3(b)(1)(B), §597.3(b)(2)(B)
N/A	6 A, 6 B	Delivery apportioning methodology (if water measuring not at farm gate or delivery point).	CCR §597.3.b(2)(C)
S.8.1	6 C	Description of water measurement BPP.	CCR §597.4(e)(2)
S.2.7, S.8.6D	6 D	Conversion of measurement to volume.	CCR §597.4(e)(3)
S.8	6 E	Existing water measurement device corrective action plan? (if applicable, including schedule, budget and finance plan)	CCR §597.4(e)(4)

Appendix F

MODEL MW/MG/MT900

DESCRIPTION

The Models MW900, MG900 and MT900 are manufactured to comply with the applicable provisions of the American Water Works Association Standard No. C704-02 for propeller type flowmeters. The 900 series is manufactured in three different end connections. The MW900 with beveled ends; the MG900 with grooved ends; and the MT900 in line sizes 2 through 6-inch NPT threaded ends. The meter flow tubes are coated with fusion-bonded epoxy for maximum corrosion protection and integral flow straightening vanes reduce upstream flow turbulence. As with all McCrometer propeller flowmeters, standard features include a magnetically coupled drive, instantaneous flowrate indicator and straight-reading, six-digit totalizer.

Impellers are manufactured of high-impact plastic, capable of retaining their shape and accuracy over the life of the meter. Each impeller is individually calibrated at the factory to accommodate the use of any standard McCrometer register. The 900 series can be field-serviced without the

need for factory recalibration. Factory lubricated stainless steel bearings are used to support the impeller shaft. The sealed bearing design limits the entry of materials and fluids into the bearing chamber providing maximum bearing protection.

The instantaneous flowrate indicator is standard and available in gallons per minute, cubic feet per second, liters per second and other units. The register is driven by a flexible steel cable encased within a protective vinyl liner. The register housing protects both the register and cable drive system from moisture while allowing clear reading of the flowrate indicator and totalizer.

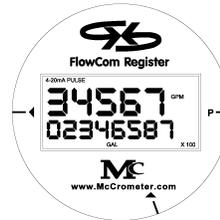
INSTALLATION

Standard installation is horizontal mount. If the meter is to be mounted in the vertical position, please advise the factory. A straight run of full pipe the length of five diameters ahead and one diameter behind the meter is the minimum normally recommended.



The McCrometer Propeller flowmeter comes with a standard instantaneous flowrate indicator and straight-reading totalizer.

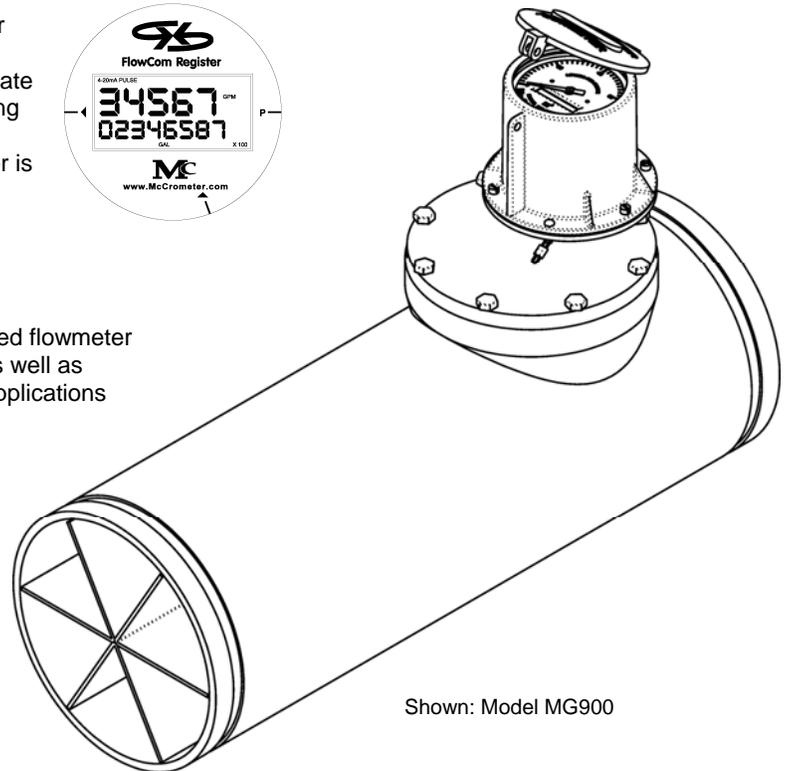
An optional FlowCom register is also available.
Typical face plates.



APPLICATIONS

The McCrometer propeller meter is the most widely used flowmeter for municipal and wastewater treatment applications as well as agricultural and turf irrigation measurement. Typical applications include:

- Water and wastewater management
- Center pivot systems
- Sprinkler irrigation systems
- Drip irrigation systems
- Golf course and park water management
- Gravity turnouts from underground pipelines
- Commercial nurseries



Shown: Model MG900

MAIN LINE FLOWMETER MODELS MW/MG/MT900

SPECIFICATIONS

PERFORMANCE

ACCURACY/REPEATABILITY: ±2% of reading guaranteed throughout range. ±1% over reduced range. Repeatability 0.25% or better.

RANGE: See dimensions chart below.

HEAD LOSS: See dimensions chart below.

MAXIMUM TEMPERATURE: (Standard Construction) 160°F constant

PRESSURE RATING: 150 psi

MATERIALS

BEARING ASSEMBLY: Impeller shaft is 316 stainless steel. Ball bearings are 440C stainless steel.

MAGNETS: (Permanent type) Alnico

BEARING HOUSING: Brass; Stainless Steel optional

REGISTER: An instantaneous flowrate indicator and six-digit straight-reading totalizer are standard. The register is hermetically sealed within a die cast aluminum case. This protective housing includes a domed acrylic lens and hinged lens cover with locking hasp.

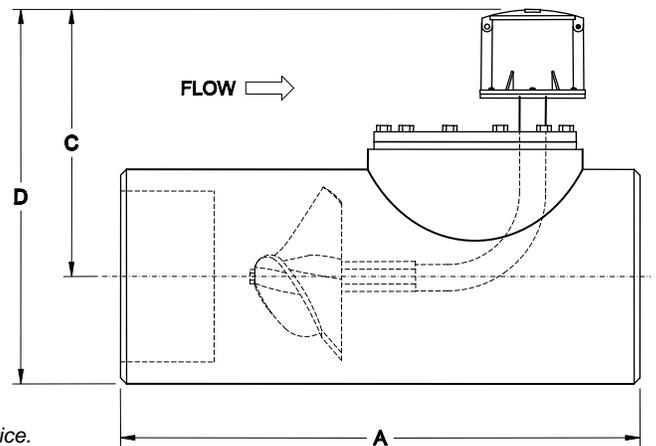
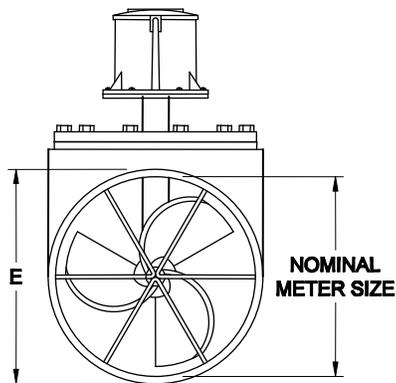
IMPELLER: Impellers are manufactured of high-impact plastic, retaining their shape and accuracy over the life of the meter. High temperature impeller is optional.

COATING: Fusion-bonded epoxy

BODY: Epoxy-coated carbon steel pipe conforming to A.S.A. pipe schedules.

OPTIONS

- Register extensions available
- All stainless steel construction
- High temperature construction
- "Over Run" bearing assembly for higher-than-normal flowrates (available only on 4" and larger)
- Electronic propeller meter available in all sizes of this model
- A complete line of flow recording/control instrumentation
- Certified calibration test results
- Stainless steel bearing housing
- Canopy boot



McCrometer reserves the right to change design or specifications without notice.

	DIMENSIONS												
Meter and Nominal Pipe Size	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24
Maximum Flow U.S. GPM	250	250	250	600	1200	1500	1800	2500	3000	4000	5000	6000	8500
Minimum Flow U.S. GPM	40	40	40	50	90	100	125	150	250	275	400	475	700
Approx. Head Loss in Inches at Max. Flow	29.50	29.50	29.50	23.00	17.00	6.75	3.75	2.75	2.00	1.75	1.50	1.25	1.00
Approx. Shipping Weight-lbs.			25	45	80	110	190	232	259	300	596	680	885
A (inches)	* SEE SPECIAL NOTE BELOW		16.00	20.00	22.00	24.00	26.00	28.00	42.00	48.00	54.00	60.00	60.00
B (inches)			5.25	5.25	6.25	6.25	8.25	10.00	13.00	13.00	14.00	16.00	18.00
C (inches)			8.75	10.75	10.75	11.75	13.75	14.75	14.75	16.75	16.75	18.75	20.75
D (inches)			10.50	13.00	14.06	16.06	19.12	21.12	21.75	24.75	25.75	28.75	32.75
E (inches)			3.50	4.50	6.62	8.62	10.75	12.75	14.00	16.00	18.00	20.00	24.00
No. of Topplate Bolts	6	6	6	8	8	12	12	12	12	16	16	16	

*SPECIAL NOTE: Reducing fittings (female threaded), are included to adapt the 3-inch model to 2" and 2 1/2" line sizes.

Larger flowmeters on special order.

MT900 available in sizes 2" through 6" only.

FOR MORE INFORMATION CONTACT: