Semitropic Water Storage District

Agricultural Water Management Plan

December 2015

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List of Acronyms

AF	acre-feet
AWMC	Agricultural Water Management Council
AWMP	Agricultural Water Management Plan
CASGEM	California Statewide Groundwater Elevation Monitoring
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CVC	Cross Valley Canal
CVP	Central Valley Project
DWR	Department of Water Resources
ET	Evapotranspiration
ET_c	Crop Evapotranspiration
ET_O	Reference Evapotranspiration
EWMP	Efficient Water Management Practice
ID	Irrigation District
ITRC	Irrigation Training & Research Center (Cal Poly)
GWMP	Groundwater Management Plan
KCWA	Kern County Water Agency
KRWCA	Kern River Watershed Coalition Authority
M&I	Municipal and Industrial
MOU	Memorandum of Understanding
OCAP	Operations Criteria and Plan (USBR)
ppm	parts per million
USACE	U.S. Army Corps of Engineers
SBx7-7	Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SWP	State Water Project
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
WSD	Water Storage District

Section I. Plan Preparation and Adoption

The Semitropic Water Storage District (Semitropic WSD, Semitropic or District) is located in the Southern San Joaquin Valley, California, in the northwestern portion of Kern County. *Figure 1* shows the location of the District.

Semitropic completed an Agricultural Water Management Plan (AWMP) in 2006 pursuant to the Agricultural Water Suppliers Efficient Water Management Practices Act of 1990 (AB 3616). In 2013 the District prepared an updated AWMP in accordance with the requirements of the Water Conservation Act of 2009 (SBx7-7, Steinberg Statute of 2009, Section 1, Part 2.55, Division 6 of the California Water Code); the Agricultural Water Management Planning Act (Section 1, Part 2.8, Division 6 of the Water Code); and the Agricultural Water Measurement Regulation requirements (described in Title 23 of the California Code of Regulations). This current update to the AWMP complies with Executive Order B-29-15 which was issued on April 1, 2015 in response to the 2013-15 drought conditions. Executive Order B-29-15 requires detailed drought management plans, as well as the quantification of water supplies and demands for 2013, 2014, and 2015. This AWMP update conforms to the template presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan* (Guidebook) issued by the California Department of Water Resources (DWR) in June 2015, although the Guidebook appears to make recommendations beyond that provided by SBx7-7. While the tables in this AWMP have been prepared using the format prescribed in the Guidebook, some are not entirely applicable to this District and are so noted.

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 measure water with a certain level of accuracy. 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.

Included in *Section VII* of this plan is a description of the efficient water management practices implemented or planned to be implemented, estimates of water use efficiency improvements that have been implemented since the District completed their last AWMP, and estimates of water use efficiency improvements expected to occur five and ten years in the future.

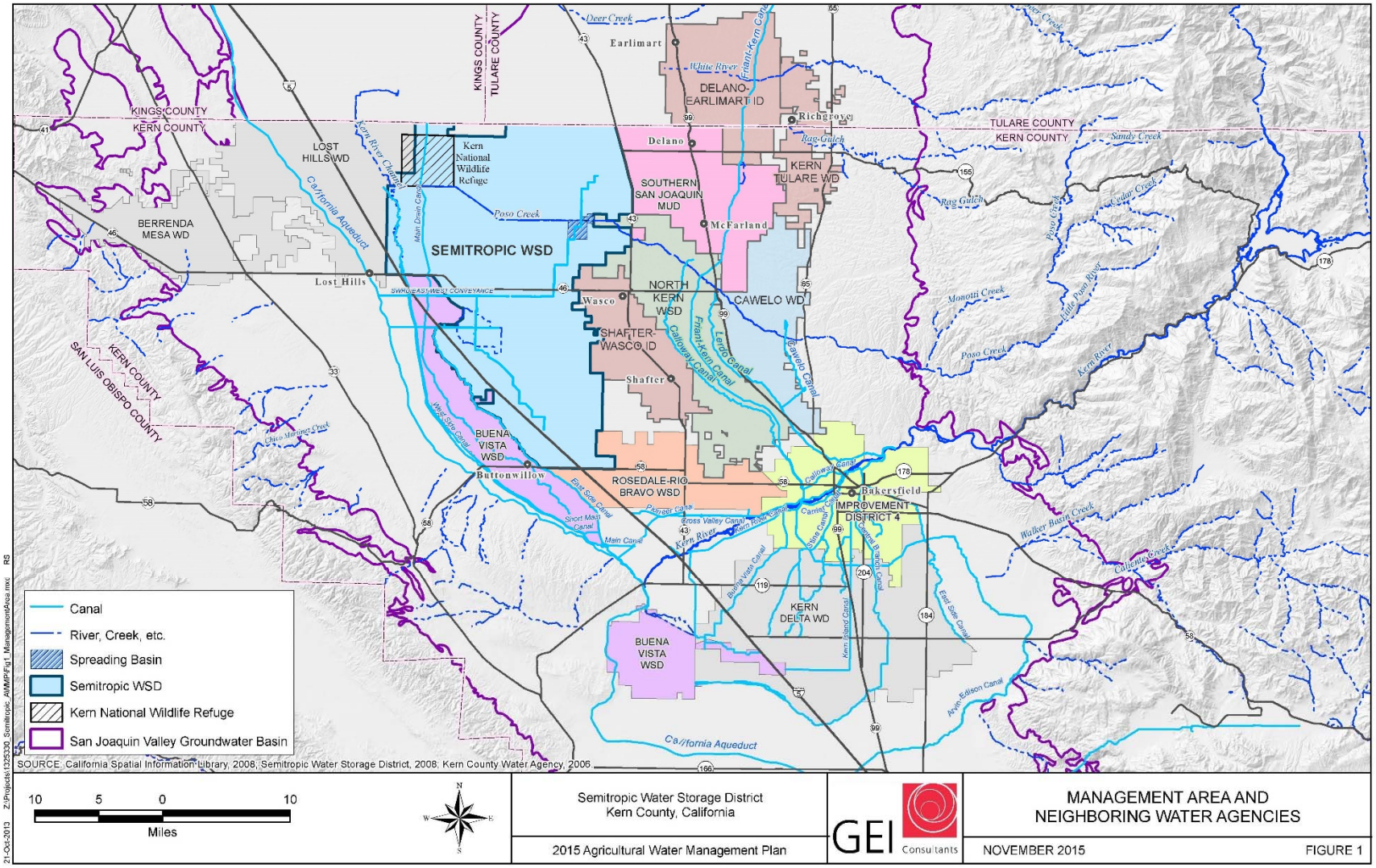

Figure 1 – Management Area and Neighboring Water Agencies

The Efficient Water Management Practices (EWMPs) identified in SBx7-7 are grouped in two categories and are reproduced following (from the Guidebook).

Critical Efficient Water Management Practices

1. 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.

2. Adopt a pricing structure for water customers based at least in part on quantity delivered.

Conditional Efficient Water Management Practices

1. Facilitation of alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including problem drainage.
2. Facilitation of use of available recycled water that otherwise would not be used beneficially, meets health and safety criteria, and does not harm crops or soils. The use of recycled urban wastewater can be an important element in overall water management.
3. Facilitate the financing of capital improvements for on-farm irrigation systems.
4. Implement an incentive pricing structure that promotes one or more of the following goals:
    a. More efficient water use at the farm level such that it reduces waste;
    b. Conjunctive use of groundwater;
    c. Appropriate increase of groundwater recharge;
    d. Reduction in problem drainage;
    e. Improved management of environmental resources, and
    f. Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.
5. Expand lined or piped distribution systems, construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.
6. Increase flexibility in water ordering by, and delivered to, water customers within operational limits.
7. Construct and operate supplier operational outflow and tailwater systems.
8. Increase planned conjunctive use of surface water and groundwater within the supplier service area.
9. Automate canal control devices.
10. Facilitate or promote customer pump testing and evaluation.
11. Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.

12. Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
    a. On-farm irrigation and drainage system evaluations;
    b. Normal year and real-time irrigation scheduling and crop evapotranspiration information;
    c. Surface water, groundwater, and drainage water quantity and quality data, and
    d. Agricultural water management educational programs and materials for irrigators.
13. Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional change to allow more flexible water deliveries and storage.
14. Evaluate and improve the efficiencies of the suppliers' pumps.

A. Description of Previous Water Management Activities

Water management activities previously implemented or now being implemented by the District are listed in this section. Information regarding the implementation of each EWMP is also presented in Section VII of this AWMP.

a. Continue to support voluntary land retirement as a means of reducing local demands upon the groundwater basin.
b. Encourage and facilitate the construction of irrigation distribution system facilities to lands which rely exclusively on pumped groundwater for the purpose of expanding the District's capability to deliver surface water in lieu of groundwater pumping.
c. Deliver surface water in lieu of groundwater pumping when practicable; use water pricing, as appropriate, to encourage such deliveries.
d. Maximize use of available surface water supplies for irrigation; use water pricing, water exchanges and water banking as appropriate.
e. Develop water exchanges and/or water banking arrangements that result in a net increase in District water supplies, when practicable.
f. Encourage and support neighboring water agencies with the importation of available surface water supplies.
g. Recharge the aquifer with surface water suitable for irrigation.
h. Promote water use efficiency through financial support of the North West Kern RCD-DWR Mobile Laboratory, encouraging landowners to take advantage of this resource by requesting field irrigation evaluations, and encouraging landowners to apply for financial assistance for on-farm irrigation application efficiency improvements through existing federal and state programs.

i. Actively participate in local water resource management forums, including the Semitropic Water Storage District's Groundwater Monitoring Committee, the Poso Creek Regional Water Management Group, the Kern River Watershed Coalition Authority, and the Kern Groundwater Management Committee.
j. Encourage the installation of flow meters on private wells.
k. Identify wells monitored by DWR and consolidate water level readings from these wells with readings from wells measured by Semitropic.
l. Participate in California Statewide Groundwater Elevation Monitoring (CASGEM) Program using groundwater level readings.
m. Identify wells which are sampled for water quality by DWR.

B. Coordination Activities

B1. Notification of AWMP Preparation

SBx7-7 does not specify how much advance time is required for notification of cities and counties of 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. In complying with these provisions, Semitropic WSD notified the entities shown in *Table 1*. *Appendix A* includes the public notice of plan preparation.

B2. Public Participation

Public participation activities associated with preparation of the AWMP are presented in *Table 1*.

Table 1. Summary of Coordination, Adoption and Submittal Activities

Potential Interested Parties	Notified of Plan Preparation	Assisted in Preparation	Received Draft Plan	Notified of Public Meetings	Notified of Intention to Adopt	Sent Copy of Adopted Plan
Kern County Water Agency	X			X		
CA Dept. of Water Resources	X		X	X		X
County of Kern	X			X		
City of Wasco	X			X		
City of Lost Hills	X			X		
Shafter-Wasco ID	X			X		
North Kern WSD	X			X		
Buena Vista WSD	X			X		
Kern-Tulare WD	X			X		
Cawelo WD	X			X		
Rosedale-Rio Bravo WSD	X			X		
Delano-Earlimart ID	X			X		
Southern San Joaquin MUD	X			X		
California State Library						X

C. Plan Adoption and Submittal

This AWMP serves to assess Semitropic WSD's current and planned water management operations and addresses the provisions of SBx7-7. The plan describes the implementation of two mandatory EWMPs and the implementation or planned implementation of conditional EWMPs in tables in Section VII. A schedule and budget of the implemented or planned implementation of the EWMPs is also included in the tables. This plan has updated and added to the discussion of the potential impacts of climate change on District operations.

The AWMP, as adopted by the District (see Appendix B for Resolution of Adoption), will be available on the District's Internet Web site. This plan will be placed alongside the previous AWMP and other documents (e.g. Groundwater Management Plan) for reference of updated District operations.

Section II. Description of the Semitropic Water Storage District and Service Area

The Semitropic Water Storage District is a public agency located in northwest Kern County, as shown in *Figure 1*, approximately 20 miles northwest of the City of Bakersfield. Prior to formation of the District, irrigated agriculture in the area relied solely on pumped groundwater. As with other areas reliant on groundwater, water levels declined as water was pumped for beneficial use on overlying lands. To address this problem, the District was organized in 1958 under the *California Water Storage District Law* (Division 14 of the *Water Code* of the State of California) for the purpose of developing conjunctive use programs and facilities and, in particular, to import water to supplement the area's water needs.

Semitropic began importing water from the State Water Project (SWP) in 1973 under a contract with the Kern County Water Agency (KCWA or Agency). As a result of regulatory constraints on water delivered via the SWP, the *2015 SWP Delivery Capability Report* predicted that the SWP average annual delivery is expected to be 62 percent of the contract amounts. Accordingly, on average, Semitropic can expect its 155,000 acre-foot contract to yield about 96,000 acre-feet annually.

During a recent 10-year period from 1999 through 2008, the District received about 18,900 acre-feet per year of SWP Article 21 water from KCWA (on average) during this 10-year period. However, due to restrictions on pumping water from the Sacramento-San Joaquin River Delta, the source of SWP water, Article 21 water is becoming less available to the District and other districts. Surface water supplies originating from the SWP have been supplemented from time to time by water from other sources, including water from Poso Creek (diverted under a water rights permit) and the CVP (delivered through the Friant-Kern Canal and Poso Creek).

District operations, as in many areas of California, depend on the conjunctive use of surface water and groundwater resources, that is, water supplies from the two sources are integrated to accomplish optimum utilization of each. The preferred method is the use of available surface water supplies in order to alleviate stress on the aquifer from heavy groundwater pumping and to maintain groundwater levels. However, when imported surface water supplies are short, the use of pumped groundwater is more significant. The District also manages a large Groundwater Banking Project (1994), covered in *Section III* of this plan. Surface water delivered into the District on behalf of banking partners is recharged into the groundwater. Ten percent of the water that is "banked" for the banking partners is left behind to address any loses and has the potential to improve the groundwater conditions in the basin. Since it began operation, Semitropic has delivered more than 6.7 million acre-feet of surface water as of the end of 2015. These deliveries have served to mitigate declining groundwater levels.

The District's distribution system and service areas are shown on *Figure 2*. The District relies on the aforementioned conjunctive management to ensure the long-term sustainability of its water resources. In addition, the District coordinates its activities with neighboring districts and

continually reviews and modifies its management practices to preserve and enhance the groundwater resources for the benefit of its landowners.

A. Physical Characteristics

A1. Size of the Service Area

The District currently covers a gross area of about 346 square miles (221,419 acres). Most of the District has been developed into irrigated agriculture for many years, which is comprised of the following service areas:

a. Contract surface water service area (44,000 acres);
b. Temporary surface water service area (25,000 acres);
c. In-lieu water service area (39,000 acres), and
d. Groundwater-only service area (40,000 acres).

Note: Non-contract water is available for contract, temporary, and in-lieu service areas.

The first three areas, which total about 108,000 acres, receive deliveries of imported surface water on an as-available basis. The "Groundwater-Only Service Area" contains 40,000 acres of irrigated lands which remain solely dependent on pumped groundwater for irrigation. While this latter area does not receive water deliveries from the District, it benefits from improved groundwater conditions due to the importation of surface water to the other service areas. These service areas are identified on *Figure 2*.

Semitropic delivers surface water from its SWP allocation to satisfy the irrigation water requirements of the contract surface water service area. Non-contract water is made available to all but the Groundwater-Only Service Area on a first-come first-serve basis. Landowners within Semitropic rely on groundwater pumped from on-farm wells to satisfy the irrigation water requirement not met by the surface water supplies delivered within each service area. Prices for non-contract water are set to be competitive with the grower's cost to pump groundwater through the use of on-farm deep wells. The District has expanded its irrigation distribution system many times over the years in order to turn off on-farm deep wells when surface water supplies are available to do so, and has plans to do more of the same in the future.

The cropping pattern within the District has shifted significantly from row crops (e.g. alfalfa, grain, and cotton) to permanent plantings (i.e., primarily nuts and some grapes). Currently, about 59 percent of the irrigated lands of the District are in permanent plantings; primarily almonds, with some pistachios and grapes. *Table 2* provides some relevant background regarding the District's formation, size, and sources of water.

Table 2. Water Supplier History and Size

Date of Formation	1958
Source of Water	
Federally Regulated Water[1]	X
State (DWR) Regulated Water	X
Local Surface Water[2]	X
Local Groundwater	X
Gross Acreage (Time of Formation)	221,000
Current Gross Acreage (2015 Service Area)	221,419[4]
Current Irrigated Acreage (2015)[3]	135,997

[1] Occasional water supplies from Central Valley Project (CVP).
[2] Occasional Poso Creek surface water supplies during particularly wet years.
[3] Irrigated acres based on District crop survey and includes duck ponds.
[4] Increase in acreage due to annexation.

Semitropic is governed by a seven-member Board of Directors. Each member represents a geographical area within the District known as a division. Board members must own land within the District (or be designated by a landowner) and are elected by the voters owning land within that division.

In 1992, the Semitropic Board of Directors introduced a multi-purpose environmental program which established approximately 34,000 acres in the northwest portion of the District as the Wildlife Improvement District (WID). The lands within the Wildlife Improvement District are identified in *Figure 2*. The WID includes most of the Kern National Wildlife Refuge; however, very little irrigated agriculture is included.

The largest city which is proximate to the District is the City of Wasco, which is centered just to the east of the District. Urbanization of District lands has not been an issue to date, and it is unlikely that this will change in the foreseeable future; however, it is noted that the Wasco State Prison is located within the District, and pays the General Project Service Charge in light of its reliance upon improved groundwater conditions as a result of the District's Project. Generally speaking, the size of the Semitropic service area, as well as most of the current irrigated land within the District, is expected to remain relatively stable as shown in *Table 3*.

Table 3. Expected Changes to the Service Area

Change to Service Area	Estimate of Magnitude	Cause of Change	Effect on Water Supplier
Reduced Service Area	Negligible		None
Increased Service Area	Minimal	Conversion of previously undeveloped land	No substantive impact[1]
Reduction in Irrigated Area	Unknown	Land Retirement	None
Increase in Irrigated Area	Minimal	Conversion of previously undeveloped or un-irrigated land	Potential increase in water demand

[1] Unless converted to irrigated area.

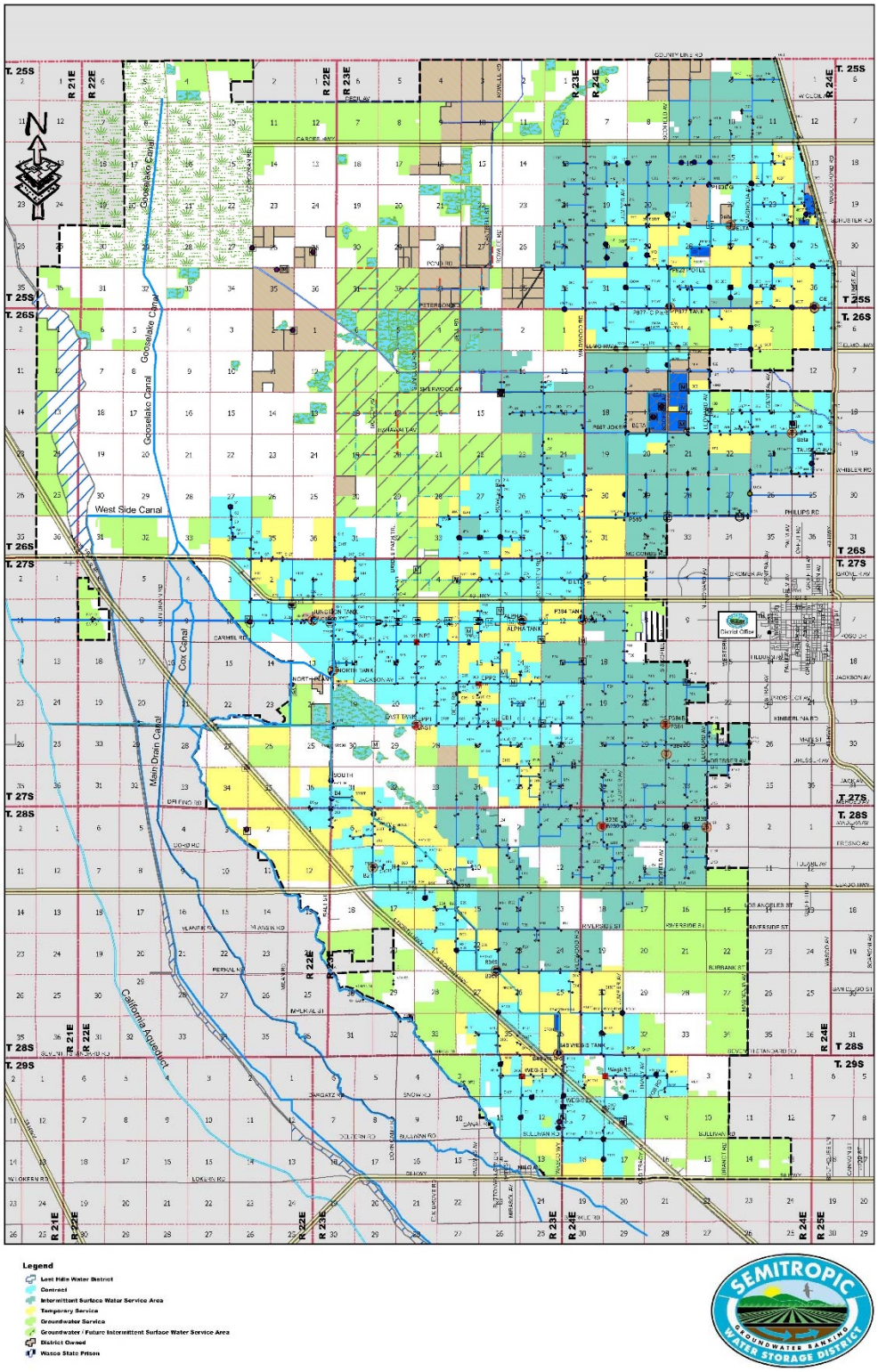

Figure 2 – Facilities and Water Service Areas

A2. Location of the Service Area and Water Management Facilities

Semitropic is located in Kern County, mostly east of Interstate 5, west of U.S. Highway 43, west of the City of Wasco, east of the City of Lost Hills, and northwest of the City of Bakersfield. *Figure 1* illustrates the District's location within the State and Kern County. Neighboring irrigation districts are Shafter-Wasco ID and North Kern WSD to the east, Buena Vista WSD to the west, and Rosedale Rio Bravo WSD to the south. Similar to Semitropic, these other districts deliver surface water supplies for irrigation from sources which include the State Water Project (SWP), the Central Valley Project (CVP), the Kern River, and Poso Creek. Both the Kern River and the CVP (Friant Unit) provide high quality runoff from the Sierra Nevada Mountains, while the SWP provides water from the Sacramento-San Joaquin River Delta, approximately 250 miles to the northwest.

In the 1960s, District landowners approved implementation of a project, which included construction of main conveyance and distribution facilities extending easterly from the California Aqueduct (Governor Edmund G. Brown California Aqueduct) of the State Water Project (SWP) to farm delivery locations (reference Figure 2). The Aqueduct extends northwest-southeast to the west of the District and along Interstate 5. The District's Project was predicated on the conjunctive use of imported SWP water with the underlying groundwater resource.

The delivery of water within the District is accomplished through a network of canals and pipelines heading from the District's three turnouts from the California Aqueduct. Collectively, the capacity to divert water from the Aqueduct through these three turnouts is about 1,740 cfs (Turnout No. 1 at 800 cfs, Turnout No. 2 at 300 cfs, and Turnout No. 3 at 640 cfs). Turnout Nos. 2 and 3 are also designed to allow water to be delivered into the Aqueduct in support of the District's Banking Program. One of the District's turnouts from the Aqueduct, Turnout No. 3, is shown in *Figure 3* at the time of its construction.

Figure 3. Semitropic's Turnout No. 3 from California Aqueduct (at time of construction)

The District's Intake Canal is supplied by Turnout Nos. 1 and 2 and delivers water to the Pond-Poso Canal system, which extends approximately 20 miles north-northeast through the District, and the Buttonwillow Ridge Canal system, which extends approximately 10 miles south-southeast. Water conveyed in the Intake Canal must be boosted into each of these two gravity canal systems. Turnout No. 3 connects with the Pond-Poso Canal via a 120-inch diameter pipeline, and is located approximately 2.5 miles north of the Intake Canal. The District also operates three spillway basins; one located near the end of each of the two canal systems to capture emergency and/or operational spills and return this water to the distribution system, and one located on the Intake Canal that can be pumped back into that canal. The main conveyance canals, spillways, and distribution laterals within Semitropic are shown in *Figure 2*. The distribution laterals consist of buried pressure pipelines which are supplied from the canal system by canal-side pumping plants.

The District owns and operates about 70 deep wells, at locations shown in *Figure 2*. On-farm (private) wells in the service areas total approximately 1,200. A typical District-owned groundwater well is shown in *Figure 4*.

Figure 4. Typical District-Owned Deep Well

Agreements are in place which provide for District use of a number of the on-farm wells under certain conditions. Through the use of both District-owned wells and a number of the on-farm wells, previously banked water is recovered and returned to the District's banking partners via exchange and/or direct delivery into the Aqueduct. District-owned wells are also used to supply water under emergency conditions, which is defined as a landowner well failure. From the District's perspective, emergency water is provided to landowners when a landowner well fails. Under this scenario, the District provides the landowner access to the District well capacity to pump the water the landowner would have pumped for himself absent a well failure.

Delivery of water into the Aqueduct requires pumping, which is accomplished at two locations: 1) the Junction Pumping Plant, which discharges into a 120-inch diameter pipeline in route to the Aqueduct; and 2) the Pump-Back Pumping Plant, which discharges into a 78-inch diameter pipeline paralleling the Intake Canal. *Figure 5* illustrates construction of the 120-inch pipeline which is about 7 miles in length and connects the Aqueduct with the Pond-Poso Canal.

Figure 5. Installation of 120-inch dia. pipeline connecting the Aqueduct with the Pond-Poso Canal

Streams, such as Poso Creek in the north portion of the District, provide an intermittent source of water, typically during "wet" seasons; however, no significant water bodies (e.g. continuously flowing rivers or creeks) extend through the District service area. *Table 4* provides a summary of the District's existing irrigation distribution facilities.

Table 4. Water Conveyance and Delivery System

System Type	Number of Miles	% of System
Unlined Canals	16	5%
Lined Canals	30	9%
Pipelines	270	86%
Drains	0[1]	0%

[1] No District-Managed Drains.

The District does not have access to surface reservoir storage to regulate seasonal or year-to-year water supplies. Semitropic does have three spill basins at the end of their main canal systems for use as regulation basins as part of their operations. Since this storage is used exclusively for canal regulation, this reservoir capacity is not included in *Table 5*. In 2010, the District

completed construction of the first phase of in-District spreading grounds to assist in absorbing wet period surface water supplies.

Table 5. Water Supplier Reservoirs

Reservoir	Capacity (AF)	SWP's Storage Rights (AF)
None	N/A	N/A

[1] N/A = not applicable

The majority of land within the District's service area is well drained, and the need for on-farm surface drainage is minimal for farmland irrigated with low-volume application methods. *Table 6* summarizes the existence of tailwater/operational outflow recovery systems. Currently, there are no District-operated tailwater recovery systems. Some on-farm drainage exists and farm tailwater is handled by individual growers through their own on-farm tailwater recovery systems.

Table 6. Tailwater/Operational Outflow Recovery System

System	Yes/No
District Operated Tailwater Recovery[1]	No
Landowner Operated Tailwater Recovery	Unknown
Intake Canal Spill Basin[1]	Regulating
Pond-Poso Canal Spill Basin[1]	Regulating
Buttonwillow Canal Spill Basin[1]	Regulating

[1] The District's Intake Canal Spill Basin is used as a regulation basin; approximately 100 acre-feet of the 250 acre-feet capacity fluctuates as part of the regulation operation. Pond-Poso Canal and Buttonwillow Canal Spill Basins are at the end of each canal and used as part of the regulation operation.

Key canal lining improvements were made to Semitropic's Pond-Poso and Buttonwillow Ridge canals prior to the first AWMP (2006). Since the 2006 AWMP, Semitropic has utilized local funding to add the P-1030 In-Lieu Service Area (4,200 acres, $13.7M) and the P-565 In-Lieu Service Area (3,600 acres, $15.5M). In this regard, Semitropic has expanded its surface water service area from about one-third of the irrigated acreage (in the 1970s) to about two-thirds at present, with plans to increase that percentage.

In cooperation with the Shafter-Wasco Irrigation District (Shafter-Wasco), North Kern Water Storage District (North Kern), Buena Vista Water Storage District, and the Belridge Water Storage District, Semitropic has constructed interconnection facilities for exchange of water supplies between the districts. The facilities aid districts in the delivery of additional supplies and the balancing of existing supplies and demands. In this regard, it is noted that Shafter-Wasco, as a CVP-Friant contractor, and North Kern, utilizing Kern River supplies, rely on different watersheds for their imported water supplies. From time to time, there are differences in hydrology between the SWP, Kern River, and the CVP's Friant Unit that create opportunities for mutually beneficial exchanges based on use of the interties between districts.

A3. Terrain and Soils

The Semitropic Water Storage District is located on the valley floor of the southern portion of the San Joaquin Valley, a physiographic trough. The northwest-southeast trending valley is bounded by the Sierra Nevada Range to the east, the Tehachapi Mountains to the south, and the Temblor Range and Coast Range to the west. The valley floor is characterized by low alluvial plains and fans and by overflow lands and old lakebeds.

Alluvial deposits in the Kern County subbasin generally consist of sand, silt, and clay laid down in a complex sequence, principally by the Kern River, Poso Creek, Deer Creek, the White River, small drainages along the Sierra Nevada Mountains to the east, and, to a lesser extent, by streams along the Coast Range to the west. The terminus for these flows in the geologic past was Tulare Lake, located to the north of Kern County on the west side of the San Joaquin Valley. The axis of the San Joaquin Valley Basin along the west side of the valley has been subsiding over time and, as a generalization, the sediments tend to dip and thicken towards the axis of the basin and pinch out on the east and west edges.

The topography of the District's service area is relatively flat with a mild westerly slope, generally less than one-quarter percent. Semitropic land surface elevations range from over 310 feet above mean sea level (MSL) on the east to less than 240 feet to the northwest. The topographic features within the District do not have any identifiable impacts upon water operations and management in the service area, as noted in *Table 7*.

Table 7. Landscape Characteristics

Topography Characteristic	% of the District	Effect on Water Operations and Drainage
Flat Land	100%	Land is adaptable to sprinkler and micro irrigation systems.
Rolling Land	0%	Not applicable to landscape in District Service Area.

The principal physiographic features within Semitropic include Buttonwillow Ridge, Semitropic Ridge, Kern River Flood Canal, Jerry Slough, Goose Lake, and the low alluvial fans of the Kern River and Poso Creek. The alluvial fan along the southeastern boundary of Semitropic is relatively flat, derived principally from materials deposited by the Kern River and Poso Creek. This is similar in character to the northern area of Semitropic, which has no abrupt changes in topographic relief. Streams, such as Poso Creek, that cross the valley typically flow intermittently during the wet season.

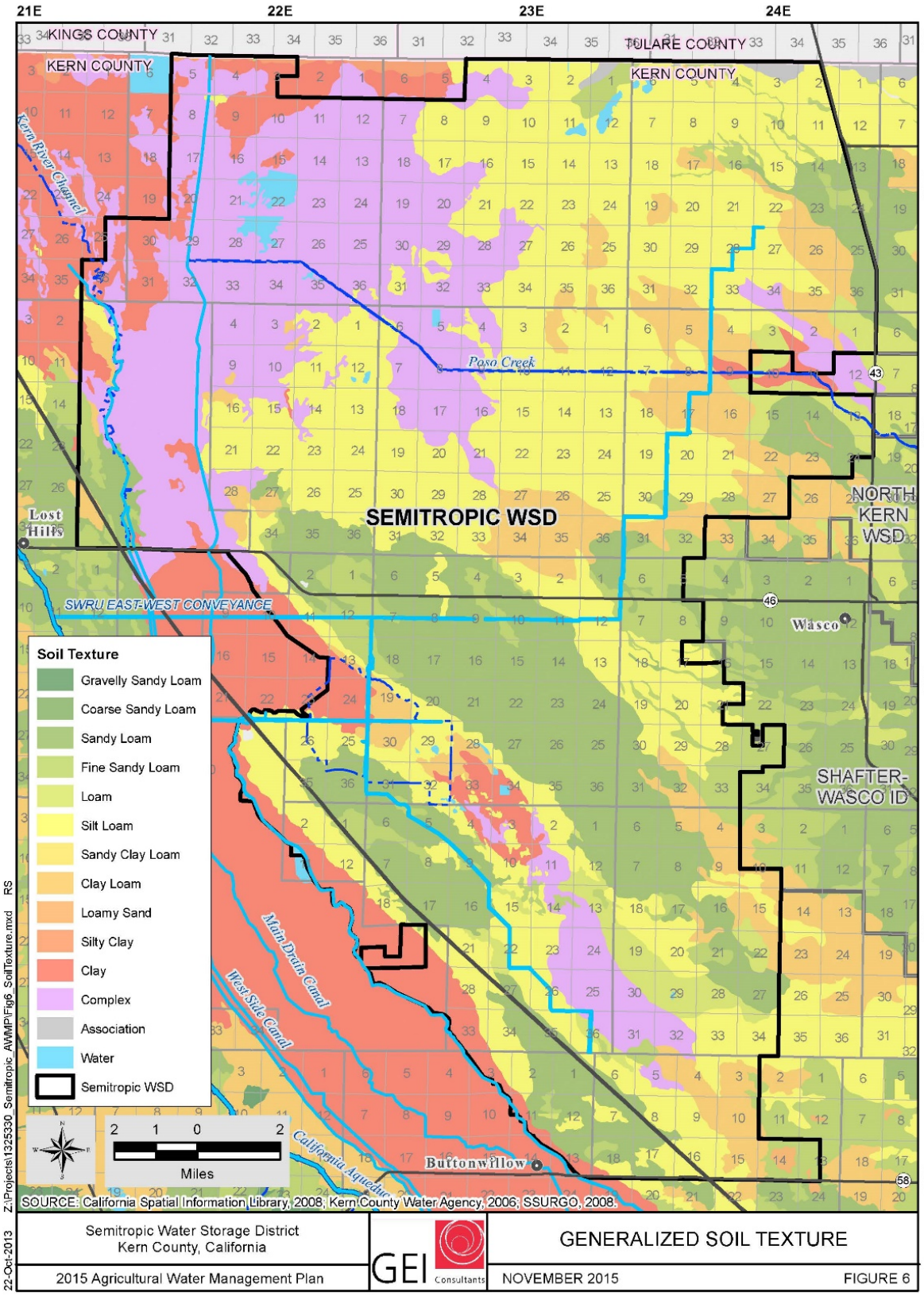

Figure 6 – Generalized Soil Texture

The soil types in Kern County vary in structure, texture, and chemistry with geographical location. Valley floor soils within Semitropic 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 are described in the published soil survey for northwestern Kern County and are presented in *Figure 6*. 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 are described in this plan in terms of associations because of the size of the District and because of their similarities to each other.

A4. Climate

Semitropic lies at the southern end of the San Joaquin Valley, a portion of the valley that is partially surrounded by a horseshoe-shaped ring of mountains. The Sierra Nevada to the east shuts out most of the cold air that flows southward over the continent in winter. It also catches and accumulates snow, the runoff of which provides water for many of the local surface water sources (e.g. Kern River).

Summers in the southern portion of the valley are typically hot and dry. The average length of the growing season is 265 days, typically lasting from March to November. Winters are mild and fairly humid. December and January 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 a high pressure system. In extreme cases, fogginess or cloudiness may occur continuously for two to three weeks. The depth of the fog or clouds is usually less than 3,000 feet. Under these conditions, there usually are clear skies and mild temperatures in the surrounding foothill and mountain areas. Most of the precipitation occurs in the winter, with little to none occurring during the summer months of June through August; the patterns for potential evapotranspiration and evaporation are the reverse.

Table 8 summarizes the average climate conditions for the area, measured at a nearby CIMIS station. The mean maximum temperatures in the summer are in the upper 90s and nights are fairly warm. Throughout the year, the mean temperatures vary from 45° F in January to 82° F in July. Precipitation typically ranges between five to seven inches. Typical climate characteristics found within the District are summarized in *Table 9*.

Table 8. Summary Climate Characteristics

Climate Characteristic	Monthly Value[1]
Average Precipitation	0.51 inches
Minimum Precipitation	0 inches
Maximum Precipitation	1.1 inches
Minimum Temperature (Avg. Winter)	34.2 ^{o}F (average December min)
Maximum Temperature (Avg. Summer)	95.1 ^{o}F (average July max)

[1] Obtained from DWR CIMIS data for Shafter/USDA Station #5, based on 30 year period of record (1985-2015).

Table 9. Detailed Climate Characteristics

Month/Time	Average Precipitation (inches)	Average Reference ET_o (inches)	Average Minimum Temperature, ºF	Average Maximum Temperature, ºF
January	1.1	1.3	36.6	57.2
February	1.2	2.2	39.5	63.7
March	1.0	4.0	43.3	69.9
April	0.5	5.6	46.1	75.7
May	0.2	7.4	52.3	83.6
June	0.1	8.0	57.5	90.1
July	0.0	8.1	62.6	95.1
August	0.0	7.4	60.7	94.5
September	0.1	5.7	56.0	90.5
October	0.4	3.9	47.9	80.7
November	0.6	2.0	38.9	66.4
December	1.0	1.3	34.2	56.6
*Wet Season**	5.0[1]	10.8[1]	38.5[2]	62.8[2]
*Dry Season**	1.2[1]	46.1[1]	54.7[2]	87.2[2]
Total	6.1[1]	56.9[1]	48.0[3]	77.0[3]

[1] Total seasonal and annual values.
[2] Average of monthly values for the season.
[3] Average of monthly values for the calendar year.
* All data obtained from DWR CIMIS Station No. 5 (Shafter/USDA) (1985-2015). "Wet Season" constitutes average of November through March; "Dry Season" covers remaining months (April through October).

B. Operational Characteristics

As stated previously, Semitropic has based its irrigation operations on conjunctive use and management of its surface water and groundwater resources in order to increase the efficient use of both resources. In addition, the District coordinates its activities with neighboring districts and continually reviews and modifies its management practices to preserve and enhance the groundwater resource for the benefit of its landowners. Over the years, Semitropic has implemented various measures to promote in-lieu recharge, enhance groundwater conditions, and ameliorate the consequences of water supply deficiencies of the SWP.

B1. Operating Rules and Regulations

Semitropic's adopted Consolidated Rules and Regulations for Distribution of Water (*Rules and Regulations*) is the guideline for District operations and delivery of water (included as Appendix D). The *Rules and Regulations* cover the procedures which are followed to distribute irrigation water in an orderly, efficient, and equitable manner.

As presented in the *Rules and Regulations*, orders to turn on and turn off water are accepted by the dispatcher for Tuesday-through-Friday deliveries by calling in the order before 8:00 a.m. the day before the water service. Water orders for Saturday through Monday must be called in by 8:00 a.m. on the preceding Friday. Orders are normally filled on the basis of continuous use of water during a 24-hour period commencing between 7:00 a.m. and 8:00 a.m. from October 1 through March 30 and commencing between 6:00 a.m. and 8:00 a.m. from April 1 through September 30. For the purpose of properly scheduling District activities and facilities, "turn off" orders are given at the same time as "turn on" orders.

On the day a water order is put into effect, the system attendant opens the turnout, in accordance with the scheduled delivery, at the time he passes the turnout on his regular run. Generally, turn ons, turn offs and adjustments are made by the District's system attendant in the mornings. In general, service is provided as requested; however, at times, the District may require the rescheduling of service due to capacity limitations within the District's distribution system or necessary shutdowns for emergencies beyond the District's control.

Table 10. Supplier Delivery System

Type	Check if Used	Percentage of System Supplied
On Demand		
Arranged Demand	X (48 hr notice)	100%
Rotation		
Other		

Semitropic WSD has an irrigation water allocation policy which establishes the allocation and cost of water to landowners. It is adopted by the Board of Directors annually. The allocation is made in a manner which is consistent with Section 7 of the District's Rules and Regulations and it primarily reflects the availability of surface water supplies from the SWP, which is influenced by hydrology and restrictions on pumping from the Sacramento-San Joaquin River Delta. The allocation is not finalized and adopted until after seasonal information has been made available to the District from the Department of Water Resources.

Table 11 illustrates factors used to allocate water in Semitropic. These factors are considered in setting the annual water allocation that is applied uniformly across the District.

Table 11. Water Allocation System

Basis of Water Allocation	(Check if applicable)			Allocation	
	Flow	Volume	Seasonal Allocations	Normal Year	Percent of Water Deliveries (%)[4]
Land within the Contract Service Area		X		Contract Amount of Water.[1]	100%
Land within Non-Contract Service Area				First come, first serve basis.[2]	
Other (Duck Club, Emergency[3] and Miscellaneous deliveries)					

[1] The District's average unit allocation is 3.5 AF/acre. To the extent that the District's allocation of SWP water is less than 100 percent, this unit allocation is reduced proportionally. The District has supplemented the allocation of SWP water to contract water users with other sources from time to time.
[2] Allocation on first-come first-serve basis; price is set to encourage use of surface supplies when available, in lieu of pumped groundwater.
[3] Emergency deliveries to protect crops are made when growers experience well failures.
[4] Approximate average percent of delivery for full (100%) allocation year.

Although the District makes every reasonable effort to comply with water orders, conveyance and delivery capacities occasionally make it necessary to run an essentially 24-hour daily operation, particularly during periods of peak irrigation use. In the event of emergencies, water users may turn off the supply of water to their turnout. In these events, water users must immediately notify the District office by telephone or in person. Water users who do not notify the District prior to the change are charged a special service fee for each occurrence. *Table 12* illustrates the typical water order lead times for the District's arranged-demand service.

Table 12. Water Order Lead Times

Operations	Hours/Days
Water turn on	24 hours
Water turn off	24 hours

B2. Water Delivery Measurements or Calculations

All of the District's irrigation deliveries are made at farm turnouts, all of which are metered using propeller meters equipped with totalizers. A flow totalizer is an instrument that measures the total flow rate (Q) and the duration of flow (t). The average flow rate (Q_{avg}) is thus converted into a delivered volume (V) using the following equation:

$$V = Q_{avg} t \qquad \textit{Eq. 1}$$

Since all propeller meters used by the District are equipped with totalizers that track the delivered volume at each turnout, the District can equate the calibrated accuracy of the flow

meter to volumetric accuracy. According to the manual *SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts* (prepared by the Irrigation Training & Research Center 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.

District System Operators use tablet computers in the field for entering meter readings. To reduce transcription errors, data are electronically uploaded into the District's dispatch software on a daily basis. Meter readings are taken every day that a turnout is running and also at the end of every month. The farm turnout propeller meters are periodically checked for maintenance requirements. The District's policy is that if a meter is questioned by a water user, that meter will be sent to the meter manufacturer for calibration (see *Section VIII* of plan). Diversions to the District from the California Aqueduct are measured through a flume or acoustic meters that are cleaned and calibrated several times each year by DWR personnel. *Table 13* provides this information in tabular form, along with the typical levels of accuracy for measurement devices which are in use.

Section VIII of this report discusses steps the District intends to take in the near future in order to maintain compliance with the water measurement requirements of SBx7-7. This includes the verification of metering device accuracy and a verification of delivery volumes at farm turnouts.

Table 13. Water Delivery Measurements

Type of Measurement	Measurement Frequency (Days)	Calibration Frequency (Months)	Maintenance Frequency (Months)	Est. Level of Accuracy (%)
Propeller Meters used at all farm turnouts	Daily[1]	Infrequent, minimum frequency of 120 months.	As needed	± 5%
Flume at Turnout No. 1 from the CA Aqueduct	Daily (DWR)	Monthly	Quarterly	< ± 5%
Acoustic Meters at Turnout Nos. 2 and 3 from the CA Aqueduct	Daily	Infrequent	As needed	± 5%

[1] Propeller meters measured while operating and contain totalizers. Once the District completes their meter testing facility, it is planned that a minimum of 10 percent of the approximately 1,000 propeller meters will be tested annually.

B3. Water Rate Schedules and Billing

The Semitropic Board of Directors annually establishes a General Project Service Charge which is applied on a per-acre basis and is based on budget requirements and Board policy. The General Project Service Charge is levied on all lands in the District which receive Surface Water from the District or which have developed in reliance on groundwater. Through this charge, landowners who rely solely on groundwater also pay a portion of the District's costs in recognition of the benefits they also receive from the District's project. Water rates are based solely on the volume of water delivered to users (reference *Table 14*), and is collected in the District's Water Use Charge; however, for Contract Water Users, effective 2016, the SWP Water Rate component will be based on the Water User's contract amount of water and the charge will be imposed regardless of the allocation that year.

Table 14. Water Rate Basis

Type of Billing	Check if Used	Percent of Water Deliveries	Description
Volume of Water Delivered	X	100%	All water billings are based on volume of water delivered.
Area (acres)			
Crop			
Land Assessment			

Each year, the District estimates the amount of money which must be raised during the year to recover costs incurred for construction, operation, and maintenance of the District's project in order to fulfill its obligations to provide water service. At the regular Board of Directors (Board) meeting in October, the Board fixes the preliminary level of funds to be raised, which in turn affects the setting of rates. Effective January 1, 2015, the average water charge is $110.00 per acre-foot for Contract water and for Non-Contract water. Contract water is an amount of SWP water that has been contracted by a landowner and must be applied to a specific parcel of land. Unlike contract water, non-contract water is available only in average or wet years. Because the availability of non-contract water is dependent on the amount of "surplus" water available, deliveries may be terminated at any time.

A uniform rate for Contract Water, based on their respective Contract Amount of Water, is set for all Contract Water users each year. Non-contract water is also set to a uniform rate on a seasonal (i.e. summer and winter) basis (reference *Table 15*).

Table 15. Rate Structure

Type of Billing	Check if Used	Description
Declining Block Rate		
Uniform	X	
Increasing Block Rate		
Other (Non-Contract Seasonal)	X	In wet years, Non-Contract water may have different summer and winter rates.

The District charges are paid by Contract water users in eight equal installments, each installment falling due on the tenth day of the months of February through September (reference *Table 16*). *Non Contract water use is billed monthly based upon usage.*

Table 16. Frequency of Billing

Frequency	Check if Used
Weekly	
Monthly	X
Seasonal	
Annual	

B4. Water Shortage Allocation Policies and Drought Management Plan

Water Shortage Allocation Policies

The District has a water shortage allocation policy as described in Section 7 of the *Consolidated Rules and Regulation for Distribution of Water* (*Appendix D*), which reads as follows:

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

a. For Contract Water Service, in any year when District's water supply from the Kern County Water Agency is less than the total of the Contract Amounts of Water for all Water Users, each Water User will be allocated a share of District's total supply in the ratio of said Water User's Contract Amount of Water to the total of Contract Amounts of Water of all Water Users. The District may supply all or a portion of the Contract Amount of Water allocated to a particular Water User from sources other than the Kern County Water Agency, including water it obtains for ground water banking and from the underground.

b. For Intermittent Water Service, as provided at paragraph 3(k) of the Intermittent Water Service contract, the Board shall determine from time to time the quantity available to such Water Users and the manner to allocate among such Water Users.

Features of the allocation policy and enforcement methods are noted in *Tables 17 and 18*.

Table 17. Decreased Water Supplies Allocation

Allocation Method	Check If Used
By Crop	
First-Come, First-Serve	
Area in District	
Other[1]	X
No Specific Policy	

[1] Allocation during shortage based on the ratio of each user's contract amount to the sum of the contract amounts of all District water users.

Table 18. Enforcement Methods of Allocation Policies

Enforcement Method	Check If Used
Fines/Penalties[1]	X
Shut-off Water	X
Other[2]	X

[1] Due to unscheduled turnoffs or shutoffs.
[2] Requirement for payment plus penalties and interest.

The District may refuse to deliver water to irrigators as a consequence for wasting water, either willfully, carelessly, or on account of defective ditches or pipelines. The District may also refuse to deliver water to inadequately prepared land or users who flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions. Water service may be resumed when these conditions have been remedied.

Drought Management Plan

The Drought Management Plan details how the District would prepare for droughts and manage water supplies and allocations during drought conditions. Some components or actions may require review of conditions, policy changes, and long-term capital improvements. Additionally, as conditions change and new technology and knowledge becomes available, opportunities and constraints will change. The drought management plan describes the following components prescribed in the Guidebook:

1) ***What hydraulic levels or conditions (reservoir levels, stream flows, groundwater, snowpack etc.) are monitored and measured to determine the water supply available and level of drought severity.***

   The primary source of surface supply for the District is its allocation to SWP water through the Kern County Water Agency (KCWA), the local contractor with the SWP. Hydrologic conditions affecting supply and operations of the SWP are extensively monitored by DWR and used to forecast allocations to each of the project's contractors. These allocations then determine the quantity of SWP water available to the District.

Deliveries from the California Aqueduct into the Semitropic system are measured. In addition, groundwater elevations are extensively monitored by the District to support operation of Semitropic's conjunctive management and banking operations and for compliance with DWR's CASGEM program.

Determinations of drought severity as it applies to the SWP are developed by DWR. Data on groundwater elevations are used by the District to assess drought severity.

2) The district's policy and process for declaring a water shortage and implementing the water shortage allocation and drought management plan.

Water supplies available from the SWP are governed by watershed precipitation, snow melt runoff and other hydrologic factors that affect the yield of the SWP. For SWP water, in any year when the District's water supply from the KCWA is less the total of the contract amounts for all water users, each Contract Water User is allocated a pro-rated share of the District's total water supply. The District may also supply a portion of the contract amount of water allocated to a particular water user from sources other than the KCWA, including water it returns as a delivery into the District from storage in banking projects located outside of the District.

During years when the availability of water from the SWP is limited, the District landowners increase reliance upon groundwater wells as part of the District's conjunctive management strategy. The District also recovers water from banking facilities that are located out of District. These facilities include the Pioneer Bank and the Kern Water Bank Authority.

3) Operational Adjustments – changes in district water management and district operations to respond to drought, including canal and reservoir operations and groundwater management.

Figure 7 shows the annual SWP allocation for the District in a recent period from 2004-2015, shown in percent of SWP contract allocation, as an indicator of hydrologic conditions. The figure illustrates that in a in a "dry" year, surface water supplies can be very limited as in 2014 when the SWP supplied only 5 percent, which was 7,750AF to the District. Under these conditions, pumping from both District-owned-and-operated wells and from privately-owned wells is significant. By contrast, in a recent "wet" year such as 2011, surface water deliveries exceeded 500,000 AF, with over 350,000 AF absorbed within the District and over 150,000 AF delivered to banking facilities located outside of the District. The "wet" year deliveries contribute to satisfy irrigation water requirements within the contract, intermittent, and temporary service areas (and thereby minimize the use groundwater). The wet year surface water deliveries include District surface water supplies and surface water deliveries on behalf of water banking partners. The District's average Contract Amount of SWP water to lands within the Contract Service Area is 3.5 AF/acre.

During droughts, because surface water supplies available to the District are minimal, measures to improve management of surface water through canal and reservoir operations have limited effectiveness. The District's response to dry conditions has been

to exercise conjunctive management by increasing extraction of groundwater from privately-owned wells to compensate for reduced deliveries of surface water. The District also call upon outside banking facilities to bring in water previously stored in the Kern Water Bank Authority and Pioneer Bank.

Due to its length and severity, the current drought has compelled the District to implement drought response measures that go beyond conjunctive management. In particular the District has 1) severely pro-rated allocations; and 2) implemented a land retirement program under which the District has purchased farm land for conversion to other land uses which do not require irrigation.

In addition to the drought response measures undertaken by the District, individual land-owners within the District service area have been actively managing land, water and other resources to minimize drought-induced impacts on their farming operations.

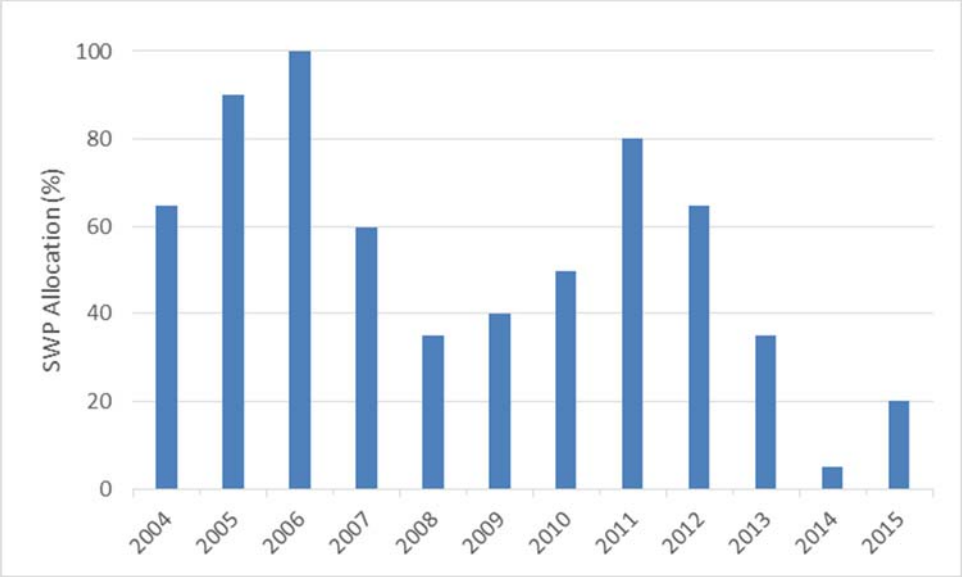

Figure 7. Annual State Water Project Allocations in Percent for 2004 - 2015

4) Demand Management – policies and incentives in addition to the water shortage allocation plan to lower on-farm water use.

The District's primary program for demand management has been purchase of farm land for conversion to other purposes. However, for the most part, rather than instituting district-governed policies and incentives to lower on-farm water use, the District's approach to demand management has been largely to provide the high degree of flexibility and responsiveness in deliveries necessary to enable growers to manage water efficiently under all conditions. These practices include use of district-owned conveyance facilities to transfer water among common landowners within the service area.

The District also provides clear estimates of water allocations so that growers can make well-informed farming decisions. The level of operational responsiveness provided by the District together with early projections of water allocations are particularly crucial

during droughts when farmers must make challenging decisions on how best to manage their farmland including decisions on planting and on allocation of water among established crops.

5) ***Alternative Water Supplies – discuss the potential if possible for the district to obtain or utilize additional water supplies. These supplies could include transfers from another water agency or district, the use of recycled water and desalination of brackish groundwater or drainage water.***

As previously mentioned, the District's principal source of surface water is its allocation of SWP water. In addition, the District can gain access to supplemental supplies of water, including water from the CVP and the Kern River, through exchanges and water purchases. Due to the conditions of reduced reliability of SWP water, prior to and during the drought, the District has initiated water supply development programs to enhance surface water supplies through water purchases and transfers. However, available supplies to purchase or transfer have been very limited during this extended drought. Throughout the drought, the District has adhered to its fundamental strategy of relying on groundwater recharged during wet years to serve as a reservoir that could be drawn upon during dry periods to satisfy demands within the District's service areas.

6) ***Stages of Actions – includes the stages of action and corresponding levels of drought severity that district will implement in response to the drought.***

Drought response in the District is a responsibility shared by the District and its growers. The District's drought response policies are intended to allocate available surface water, augmented by water recovered from the Districts outside banking facilities and privately-owned wells, in a manner that is equitable and consistent with the District's operational policies while maintaining the District's financial viability. An important objective of this approach is to provide growers with an accurate assessment of the volume and cost of water that will become available to them so they can utilize this water in a manner that is best suited to the requirements of their farming operations.

Because the quantity of SWP water available to the District in any given year is beyond the District's control, the District's drought response measures center on managing groundwater and idling land. Reduced allocations of District-supplied water have placed the responsibility of managing these reduced supplies on growers to determine how best to utilize limited water supplies through deficit irrigation, fallowing of annual crops and other water conservation measures.

7) ***Coordination and Collaboration – include a description of how coordination and collaboration with other local districts and water agencies or regional groups will be used in drought response.***

The Poso Creek Regional Water Management Group (RWMG) has proven itself to be an effective organization for operational coordination and for collaboration on development of water conveyance and groundwater management projects. These projects have enabled the District to expand its capacity to recharge the local aquifer and to return banked water to banking partners. From a regional perspective, the projects have

improved the ability to distribute water within the region and increased the capability of the RWMG's members to exchange and transfer water for irrigation application and for groundwater recharge. In addition to developing projects, the RWMG has been successful in obtaining state and federal funding for implementation of projects, all of which have improved regional resiliency to drought.

Implementation of the Sustainable Groundwater Management Act (SGMA) will provide yet another mechanism for regional collaboration and coordination. Regional efforts to implement this legislation will provide a firm, cooperative basis for management of groundwater during all conditions, but will be particularly important as a tool for drought response.

8) Revenues and Expenditures – describes how the drought and lower water allocations will affect the district's revenues and expenditures.

The Semitropic Board of Directors annually establishes a water allocation (which is applied per Contracts as described at Section B4as well as a General Project Service Charge (GPSC) which is also applied on a per-acre basis and is based on budget requirements and Board policy as limited by Proposition 218. The GPSC is structured to collect a significant portion of the District's fixed annual capital obligations relative to the District project which includes importation of surface water and the necessary conveyance facilities.

Because SWP water is delivered into the District's distribution system by gravity, the cost of distributing surface water in the pressurized distribution system is not closely tied to annual hydrology as most of the District's distribution cost is attributable to the fixed costs of operating and maintaining the canal system. By contrast, the costs to the District, as well as to private well owners, of increased groundwater pumping are substantial both because of the greater volumes of groundwater pumped during droughts and because the cost of pumping each unit of water increases as groundwater elevations decline.

The GPSC is a fixed revenue stream collected on each acre within the Semitropic Improvement District receiving District Surface Water or developed with reliance upon groundwater.

In Dry years the District does not benefit from water sales revenue and must rely upon the revenue from the GPSC and the revenue from the bank recoveries on behalf of its banking partners.

In wet years the District receives revenue from water sales along with revenue received from the District banking partners when depositing water into storage. Excess revenue generated during the wet years is placed into reserve accounts. These reserve accounts are accessed in dry years to mitigate the impact of decreased revenue from water sales. In 2013 the District increased the GPSC by $100 per developed acre to improve the ability of the District to fund reserves as well as to provide a funding mechanism for creation of additional water supply programs.

C. 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 year types (wet, intermediate/in-between, dry, and critical) were used to illustrate the District's operations for annual SWP Table A allocations. The final SWP "Table A" Allocation ranged from 80 down to 5 percent for the year types used in this plan. Supplies and demands for 2013, 2014, and the first half of 2015 are reported to meet the requirements for E.O. B-29-15. The use of multiple years with a range of hydrology conditions illustrates the variability in District operations from year to year. Since the years are recent years, they also reflect the "current" level of development and delivery capability.

In particular, 2013-2015 were particularly dry or critical years with 5-35 percent Final Table A Allocation, and the monthly precipitation levels for these years were well below normal. Moreover, there was a significant amount of groundwater pumping during these years to supplement District water demands due to limited surface water supplies. Conversely, 2011 was selected as a wet year with 80 percent Final Table A Allocation and precipitation levels were above average. To illustrate operations in between these two year types (wet and dry), 2012 was selected, with a Final Table A Allocation of 65 percent and weather patterns and surface water supplies were more moderate in comparison to the dry and wet scenarios. The District's cropping pattern evidenced some changes between these years, as shown later in *Tables 21a* through *21e*. The calendar years which were selected as illustrative of a range of District operations are identified in *Table 19*.

Table 19. Selected Years

Selected Year:	2011	2012	2013	2014	2015
Water Year "Type":	Wet	Intermediate	Dry	Critical	Critical
Year First Month:	Jan.	Jan.	Jan.	Jan.	Jan.
Year Last Month:	Dec.	Dec.	Dec.	Dec.	Dec.
Final SWP "Table A" Allocation:	80%	65%	35%	5%	20%

Section III. Description of Quantity of the Water Uses of the Agricultural Water Supplier

The total demand for irrigation water varies from year to year depending on the irrigated acres, types of crops in production, and the local climate. "Applied water" refers to that 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 imported surface water supplies is met with pumped groundwater.

A. Agricultural Water Use

Cropping patterns have varied over the years. In the 1970s, the majority of the cropped acreage was in annual crops; principally cotton, alfalfa (and pasture), and grain. Since that time, there has been a shift away from annual crops in favor of permanent crops. Today, 59 percent of the cropped acreage is planted to permanent crops, whereas it was less than five percent in the 1970s. As a generalization, the relatively large cotton acreage which persisted until the mid-1990s has since shifted to tree crops (nuts); primarily almonds and pistachios. The change from annual to permanent crops has led to a "hardening" of the District's total water requirement over time, especially in recent years. *Table 20* summarizes the annual agricultural water delivered by the District to agriculture use within the District. The District's deliveries to agricultural users, measured at the farm headgate, which includes both surface and ground water delivered in to the District's canal conveyance system is included in *Table 20*; private, on-farm pumping of groundwater occurs but the quantities are not reported to the District. Table 20 captures the headgate deliveries as measured at the District turnouts and is independent of the District's supply for the year.

Table 20. Annual Agricultural Water Use (AF)

Agricultural Water Supplier Delivered					
Source	**2011**	**2012**	**2013**	**2014**	**2015**
Delivery to Headgates[2]	315,970	192,024	75,183	37,667	52,170

SOURCE: Latis Server, SWSD Historical Deliveries File
[1] On-farm pumping exists, but is not reported to the District; however, it is estimated as part of the closure term in Water Budget shown in Table 48.
[2] Represents deliveries to agricultural users measured at the farm headgate.

The DWR guidelines suggest the agricultural water suppliers provide a tabulation of water delivered to all customers in the service area and, to the extent available, an estimate of the on-farm pumping and an estimation of other water sources used to meet agricultural water use demands in the service area from other sources such as recycled water, precipitation, return flows, and others. Within the District, which is within the Southern San Joaquin Valley, recycled water is not readily available as a source, precipitation is low, and any runoff effectively returns to the supply as a closed basin.

Tables 21a through *21e* present estimated water needs for specific crops grown within Semitropic's service area during each of the selected years. Total crop acreage is based on the District's annual crop survey for each year. The acres in the table represent net irrigated acres for a given year, which is less than the total of the gross acres shown on the District service area map (*Figure 1*). Average unit crop ET requirements were based on data developed by the ITRC and on information published by the University of California Cooperative Extension, Kern County Farm Advisor Crop Specialist. The order of magnitude of the annual rainfall that falls on the San Joaquin Valley floor area where irrigation occurs is comparable between dry, wet, critical, and intermediate year types. Accordingly, for the purposes of this Plan, the same unit values for crop water use were used for each of the years which were evaluated. The values in *Table 21a* have been reduced for the ET of rainfall; accordingly, they represent the ET of applied water (ETAW). In 2016, the District will undertake a study of the estimated applied water since early results of satellite imagery based ET indicate a much lower applied water. The estimates provided in this plan, based on the District Engineer assigned values, will be compared with satellite imagery for use in future plan updates.

Table 21a. Agricultural Crop Data for 2011 (Wet)

Crop	Total Acres	% of Irrigated Land	Estimated ETAW[2] (ft)	ETAW Req. (AF)
Alfalfa	21,009	16%	4.20	88,240
Cotton	9,530	7%	2.72	25,920
Duck Pond[1]	10,513	8%	1	10,510
Fruits	2,001	1%	3.32	6,640
Grain/Pasture	22,108	16%	1.09	24,100
Grapes	4,743	4%	2.31	10,960
Nursery	159	<1%	2.31	370
Nut Crops	62,087	46%	3.32	206,130
Vegetables	4,420	3%	1.44	6,360
Unidentified Crop[3]	1,088	1%	2.49	2,710
TOTAL	**137,658**	**100%**	**-**	**381,940**

[1]One-half foot per acre is typically used to initially flood duck ponds, with another one-half required to maintain the ponds. For the purposes of this Plan, the ETAW and the AW were assumed to be equal.
[2]Crop ETAW based on ITRC data and Kern County Extension Crop Specialist field measurements of ET for mature almonds, pistachios, and estimate of effective precipitation.
[3]Average of other crop ETAW values.

Table 21b. Agricultural Crop Data for 2012 (Intermediate)

Crop	Total Acres	% of Irrigated Land	Estimated ETAW[2] (ft)	ETAW Req. (AF)
Alfalfa	22,692	17%	4.20	95,310
Cotton	6,560	5%	2.72	17,840
Duck Pond[1]	10,452	8%	1	10,450
Fruits	2,089	2%	3.32	6,940
Grain/Pasture	20,330	15%	1.09	22,160
Grapes	5,344	4%	2.31	12,340
Nursery	70	<1%	2.31	160
Nut Crops	64,253	47%	3.32	213,320
Vegetables	4,028	3%	1.44	5,800
Unidentified Crop[3]	150	<1%	2.49	370
TOTAL	**135,968**	**100%**	**-**	**384,690**

[1] One-half foot per acre is typically used to initially flood duck ponds, with another one-half required to maintain the ponds. For the purposes of this Plan, the ETAW and the AW were assumed to be equal.
[2] Crop ETAW based on ITRC data and Kern County Extension Crop Specialist field measurements of ET for mature almonds, pistachios, and estimate of effective precipitation.
[3] Average of other crop ETAW values.

Table 21c. Agricultural Crop Data for 2013 (Dry)

Crop	Total Acres	% of Irrigated Land	Estimated ETAW[2] (ft)	ETAW Req. (AF)
Alfalfa	21,808	16%	4.20	91,590
Cotton	4,811	4%	2.72	13,090
Duck Pond[1]	10,295	8%	1	10,300
Fruits	2,048	2%	3.32	6,800
Grain/Pasture	20,083	15%	1.09	21,890
Grapes	5,639	4%	2.31	13,030
Nursery	310	<1%	2.31	720
Nut Crops	66,994	50%	3.32	222,420
Vegetables	4,558	3%	1.44	6,560
Unidentified Crop[3]	96	<1%	2.49	240
TOTAL	**136,642**	**100%**	**-**	**386,640**

[1] One-half foot per acre is typically used to initially flood duck ponds, with another one-half required to the ponds. For the purposes of this Plan, the ETAW and the AW were assumed to be equal.
[2] Crop ETAW based on ITRC data and Kern County Extension Crop Specialist field measurements of ET for mature almonds, pistachios, and estimate of effective precipitation
[3] Average of other crop ETAW values.

Table 21d. Agricultural Crop Data for 2014 (Critical)

Crop	Total Acres	% of Irrigated Land	Estimated ETAW[2] (ft)	ETAW Req. (AF)
Alfalfa	20,987	16%	4.20	88,150
Cotton	4,516	3%	2.72	12,280
Duck Pond[1]	10,295	8%	1	10,300
Fruits	1,397	1%	3.32	4,640
Grain/Pasture	18,743	14%	1.09	20,430
Grapes	5,915	4%	2.31	13,660
Nursery	254	<1%	2.31	590
Nut Crops	69,355	51%	3.32	230,260
Vegetables	3,817	3%	1.44	5,500
Unidentified Crop[3]	20	<1%	2.49	50
TOTAL	**135,299**	**100%**	**-**	**385,860**

[1] One-half foot per acre is typically used to initially flood duck ponds, with another one-half required to maintain the ponds. For the purposes of this Plan, the ETAW and the AW were assumed to be equal.
[2] Crop ETAW based on ITRC data and Kern County Extension Crop Specialist field measurements of ET for mature almonds, pistachios, and estimate of effective precipitation.
[3] Average of other crop ETAW values.

Table 21e. Agricultural Crop Data for 2015 (Critical)

Crop	Total Acres	% of Irrigated Land	Estimated ETAW[2] (ft)	ETAW Req. (AF)
Alfalfa	18,378	14%	4.20	77,190
Cotton	2,970	2%	2.72	8,080
Duck Pond[1]	10,332	8%	1	10,330
Fruits	1,147	1%	3.32	3,810
Grain/Pasture	17,826	13%	1.09	19,430
Grapes	5,779	4%	2.31	13,350
Nursery	468	<1%	2.31	1,080
Nut Crops	74,268	55%	3.32	246,570
Vegetables	3,561	3%	1.44	5,130
Unidentified Crop[3]	1,267	1%	2.49	3,150
TOTAL	**135,996**	**100%**	**-**	**388,120**

[1] One-half foot per acre is typically used to initially flood duck ponds, with another one-half required to maintain the ponds. For the purposes of this Plan, the ETAW and the AW were assumed to be equal.
[2] Crop ETAW based on ITRC data and Kern County Extension Crop Specialist field measurements of ET for mature almonds, pistachios, and estimate of effective precipitation.
[3] Average of other crop EAW values.

The District's gross area currently (2015) encompasses 221,419 acres, which has changed little over time. As shown in *Table 22*, the net irrigated acreage varies somewhat from year to year due to many factors.

Table 22. Irrigated Acres for Selected Years (acres)

	2011	2012	2013	2014	2015
Total Area District	221,419	221,419	221,419	221,419	221,419
Irrigated Area[1]	137,658	135,968	136,642	135,298	135,997
Irrigated Area as % of Total Area	62%	61%	62%	61%	61%

[1]Includes all irrigated lands, regardless of source of supply.

For the purposes of this report, cropped, irrigated net acres are based on the District's annual crop survey as shown in *Tables 21a* through *21e*. Inter-cropping is not a common practice within the Semitropic service area.

Table 23. Multiple Crop Information for Selected Years (acres)

Cropping	2011	2012	2013	2014	2015
Cropped	NA	NA	NA	NA	NA
Inter-cropping	NA	NA	NA	NA	NA
Double	NA	NA	NA	NA	NA

* On-farm cropping information not reported to district.
[1] NA = Data not available.

B. Environmental Water Use

The District deliveries for environmental purposes are presented in *Table 24*. As shown, these deliveries include local duck clubs or occasionally the Kern National Wildlife Refuge (KNWR). Other environmental water uses realized from District-maintained water supplies are incidental to the District's operations; in particular, to the extent that there is water in the District's canals and reservoirs which is available to local wildlife.

Table 24. Environmental Water Uses for Selected Years (AF)

Environmental	2011	2012	2013	2014	2015
Duck Clubs	1,394	119	0	0	0
Refuge Water[1]	493	0	0	1,697	666
TOTAL	**1,887**	**119**	**0**	**1,697**	**666**

SOURCE: Latis Server, SWSD Historical Deliveries File
[1] The Kern National Wildlife Refuge receives its primary water supply from non-District sources.

C. Recreational Water Use

The District does not supply water to recreational facilities within the service area, which is noted in *Table 25*.

Table 25. Recreational Water Uses for Selected Years (AF)

Recreational Facility	2011	2012	2013	2014	2015
	N/A	N/A	N/A	N/A	N/A

D. Municipal and Industrial Water Use

All M&I water use in the vicinity of the District service area is supplied by groundwater. Although no small communities are located within the District, a supply well for an adjacent community is located within the District; a State prison relies on groundwater; and rural residences and businesses pump groundwater for domestic and commercial uses. The District's importation of surface water reduces reliance on the underlying groundwater, thereby supporting all users of groundwater. In other words, the same groundwater system supplies both agricultural and M&I uses and provides storage for groundwater banking.

The District delivers only raw (non-potable) water throughout its service area; accordingly, there are no direct deliveries to M&I water use, which is indicated in *Table 26*.

Table 26. Municipal/Industrial Water Uses for Selected Years (AF)

Municipal Entities					
Entity	**2011**	**2012**	**2013**	**2014**	**2015**
	N/A	N/A	N/A	N/A	N/A
Industrial Entities					
Entity	**2011**	**2012**	**2013**	**2014**	**2015**
	N/A	N/A	N/A	N/A	N/A
TOTAL	**0**	**0**	**0**	**0**	**0**

* There is no water consumption assigned to M&I water uses.

E. Groundwater Recharge Use

Indirect recharge occurs to the extent that the District delivers surface water in lieu of pumped groundwater to satisfy irrigation water requirements. Sometimes referred to as "in-lieu recharge", this has been the District's mainstay since the first SWP water was imported in the early 1970s. The District's Groundwater Banking Program (see below) is predominately based on in-lieu recharge; however, in 2008, the District added the Pond-Poso Spreading Grounds, a 525-acre direct recharge facility. In addition, the District banks water outside of its immediate (service) area through its participation in the Kern Water Bank and the Pioneer Project (both of which are water banking projects and are located on the Kern River fan). These projects rely on direct recharge and are used as an additional source of supply in "dry" years. During particularly "wet" years, direct recharge through the use of these spreading ponds is significant in the basin. Their locations are shown in *Figure 3*, while *Figure 8* shows a picture of the District's Pond-Poso Spreading Grounds.

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 Pond-Poso spreading ponds, or the dry channel of Poso Creek, 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.

Table 27 lists the volume of direct in-District groundwater recharge. Note that the wet-year figures illustrate the disparity in the use of spreading ponds when water supplies are readily available as opposed to the other years (i.e. "dry" and "critical" versus "wet" years).

Table 27. Groundwater Recharge Water Uses for the Selected Years (AF)

Location/ Groundwater Basin	Method of Recharge	2011 (Wet)	2012 (Intermediate)	2013 (Dry)	2014 (Critical)	2015 (Critical)
District Spreading	Spreading in percolation	18,953	212	0	0	22
District Canal[2] Losses		16,630	10,107	3,957	1,982	2,581
Poso Creek[1]		NA	NA	NA	NA	NA
TOTAL		35,583	10,319	3,957	1,982	2,603

SOURCE: Latis Server, SWSD Historical Deliveries File

[1] Groundwater seepage from District canals and Poso Creek also recharge the groundwater; however, the data are not available to estimate these volumes (NA = Data not available).

[2] Reflects an estimate of 6% losses of all water delivered for agricultural uses (differential of Aqueduct delivery and head gate deliveries) and wheeling losses.

Figure 8. Pond-Poso Spreading Grounds

E1. Groundwater Banking Program

In 1988, the District initiated a study of a groundwater banking program which was ultimately included in the District's 1992 Improvements Project. This has developed into the Semitropic Groundwater Banking Project, which is a long-term water storage project designed to optimize the distribution and use of water resources between the District and its banking partners.

Water banking involves the regulation of wet-year surface water supplies through available groundwater storage for subsequent recovery during times of water supply deficiencies. Water is placed in storage through either indirect or direct recharge. Indirect recharge is based on the delivery of surface water for irrigation in lieu of pumping groundwater for irrigation. The preponderance of direct recharge is based on the surface spreading and percolation of surface water supplies in basins or ponds.

The original District projects were planned and designed to deliver supplemental surface water to farms relying exclusively on groundwater. Imported surface water from the SWP and the associated reduction in groundwater pumping has helped maintain a viable agricultural economy in the area. The Groundwater Banking Project is a continuation of Semitropic's efforts to make the best use of the underlying groundwater resources, including unused storage capacity.

Semitropic has long-term contracts with several water banking partners, including the Metropolitan Water District of Southern California, the Santa Clara Valley Water District, Zone 7 Water Agency, Alameda County Water District, Newhall Land and Farming Company, San Diego County Water Authority (through the Semitropic-Rosamond Water Bank Authority), and the City of Tracy, Poso Creek Water Company, and Castaic Lake Water Agency.. Semitropic receives SWP or CVP surface water from its banking partners in years of ample supplies and delivers it to landowners for irrigation use in lieu of groundwater pumping. Groundwater which otherwise would have been pumped remains in storage, credited to the account of the banking partner. In times of surface water shortages, the water may be withdrawn by the banking partner. At that time, Semitropic will return the banked water to the California Aqueduct, either from its own supply of SWP water by exchange, and/or by pumping of District and landowner wells for delivery into the Aqueduct. At the end of 2015, the District will have more than 600,000 acre-feet in groundwater storage held on behalf of its banking partners. This banked water has a positive impact on groundwater levels, which reduces the cost of power and energy for groundwater pumping.

To the extent that the District is unable to divert and use all of the water available to it in a very wet year, the District makes use of two out-of-district water banking projects located on the Kern River fan, which are briefly mentioned in the sections which follow. More description of the Groundwater Banking Project is covered in Semitropic's *2012 Groundwater Management Plan*.

E2. Kern Water Bank Authority

Under implementation of the Monterey Agreement in 1996 by the California Department of Water Resources and the State Water Contractors, Semitropic obtained a 6.67 percent share of the Kern Water Bank Authority. With a gross area of about 20,000 acres, the Kern Water Bank is located south of the District, astride the Kern River. It is a direct recharge-based project, with about 7,000 acres of spreading basins. To reach these facilities, water is diverted from the Aqueduct into the Kern Water Bank Canal. To the extent there has been unused recharge or recovery capacity, Semitropic has at times exercised considerably more than its share of the available capacity.

E3. Pioneer Project

The Pioneer Project is operated by the Kern County Water Agency as a direct recharge-based water banking project, located on the Kern River fan, adjacent to the Kern Water Bank. There are "recharge participants" and "recovery participants"; the former are vested with a first priority right to use of the recharge facilities, and the latter are vested with a first priority right to the use of the recovery facilities. Semitropic is a "recovery participant" with a 14 percent share of the Project's recovery capacity, thus the District's right to use recharge capacity is second in priority to the "recharge participants". Water is delivered to this facility by diverting water from the Aqueduct into the Cross Valley Canal.

F. Transfer and Exchange Use

With the existing regional conveyance facilities, Semitropic can participate in exchanges involving not only SWP water, but CVP water and Kern River water as well. Though not a long-term CVP contractor, Semitropic has purchased CVP-Friant water that has been available from time to time, typically during the peak runoff period of wet years. In this regard, it is noteworthy that the District has used North Kern WSD's turnouts from the Friant-Kern Canal to facilitate such purchases. In addition, Semitropic's immediate neighbors are CVP-Friant contractors; namely, the Southern San Joaquin Municipal Utility District and the Shafter-Wasco Irrigation District. To facilitate mutually beneficial transfer and exchange arrangements, as well as water banking exchanges, with neighboring water agencies, the District has constructed facilities that have added inter-district conveyance capacity, which include interconnections with the following districts:

a. Buena Vista Water Storage District (60 cfs);
b. Shafter-Wasco Irrigation District (30-35 cfs each way); and
c. North Kern Water Storage District (30-40 cfs each way).

In general, the District uses the connections with Shafter-Wasco ID and North Kern WSD for Ag to Ag wheeling of supplies and sometime purchases water from BVWSD. In addition to moving water between districts from time to time, Semitropic uses its distribution system to move water

around within its boundaries on behalf of its growers. Accordingly, this practice of wheeling has a neutral effect on the District's water budget. *Table 28* summarizes this activity for the selected years.

Table 28. Transfers and Exchanges Water Uses for Selected Years (AF)

From What Agency	To What Agency	Type of Transfer or Exchange (Ag to M&I, M&I to Ag, or Ag to Ag)	2011	2012	2013	2014	2015
Private Landowners and Neighboring Districts	Private Landowners and Neighboring Districts	Ag to Ag (Wheeling)	N/A[1]	N/A	N/A	N/A	N/A

[1] N/A = not applicable

The exchanges for Ag to Ag wheeling are mainly used to provide flexibility for delivery of water to neighboring water districts and private landowners within the District; hence, they help with regional operation and flexibility of water delivery, but, are a neutral component of the District water budget therefore not shown in *Table 44*.

G. Other Water Use

All water uses of any significance have been described previously in this section. Negligible volumes of water are used within the District for livestock watering, mixing with agricultural chemicals before spraying, and dust abatement, which is indicated in *Table 29*.

Table 29. Other Water Uses for Selected Years (AF)

Water Use	2011	2012	2013	2014	2015
No other uses of significance.	N/A[1]	N/A	N/A	N/A	N/A

[1] N/A = not applicable

H. Projected Water Use

Deliveries of SWP water to the District have been significantly reduced and there is the potential for additional reductions in the future. SWP water supplies are constrained by the following factors, which directly affect the amount of surface water delivered to the District annually under its SWP contract and reduces the amount of SWP water supplies available to the Water Banking Partners.

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;

c. Because the annual allocation of water from the SWP during a given year is a moving target until as late as August of that year, District growers must make decisions regarding annual plantings before knowing their water allocation; and

d. While CVP 215 water has been an infrequent and relatively small source of supply, recent actions to "restore" the San Joaquin River are expected to reduce the availability of such supplies in the future.

Reductions in the availability of SWP water during a given year have resulted in commensurate increases in the use of groundwater to meet irrigation water requirements. As a result of the above-noted factors, it is reasonable to expect that an increased reliance on pumped groundwater will continue going forward.

Due to the conditions of reduced reliability of SWP water, prior to and during the drought, the District has initiated water supply development programs to enhance surface water supplies through water purchases and transfers. Some of the water supply development programs include investigations into capture of flood flows in the Tulare Lakebed Water Storage Project, Delta Land Fallowing and Wetlands Management, and long-term Water Transfers.

Currently, there is little pressure to convert large sections of irrigated land within the District to urban uses (i.e. from Wasco or other local communities). If irrigated agricultural lands are converted to urban uses, the total demand may or may not change depending on a number of factors, including the density of the urban development. There may be less recharge with urban development, owing to impervious surfaces and piping of wastewater to treatment facilities for reuse.

Section IV. Description of Quantity and Quality of the Water Resources of the Agricultural Water Supplier

A. Water Supply Quantity

A1. Surface Water Supply

Under a contract with the Kern County Water Agency (KCWA), the District imports SWP water as its primary source of surface water supply. The District's annual contract amount (or Table A amount) is 155,000 acre-feet. Other surface water sources are available from time to time, including water from Poso Creek and the Central Valley Project (CVP); however, these sources are comparatively small and are typically limited to very wet years.

SWP water is diverted from the California Aqueduct through three turnouts into two main conveyance routes. Main conveyance within the District is accomplished by two canal systems; one serving the northern portion of the District and the other serving the southern portion. Distribution of water to farm turnouts is accomplished by pressure pipeline systems which are supplied by canal-side pumping plants. The District's primary and secondary surface water sources are shown, for the years 2011-2015, in *Table 30*. Table 30 highlights surface water deliveries to In-District facilities over the last 5-year period indicating differences in dry and wet year operations.

Table 30. District Surface Water Supplies (AF)

Source	Diversion Restriction	2011[4]	2012	2013	2014	2015
SWP (via CA Aqueduct) [1]	Water year type and	191,934	92,196	48,814	9,440	30,989
Poso Creek	Water year type and	5,785	0	0	0	0
Other Water Supplies[2]	Water year type and	10,126	4,543	202	1,757	1,190
GW Banking-Leave Behind[3]	Water year type and	26,810	8,737	161	0	0
TOTAL		**234,655**	**105,476**	**49,177**	**11,197**	**32,179**

[1] Includes all available water supplies from the State Water Project, including District Table A Allocation, Annual Carryover, DWR Pool A and B, Article 21 water supplies, and other water-purchase programs. Source: KCWA SWP Supply and Delivery Summary.

[2] Includes the following: 1) Reclamation water purchased from Buena Vista WSD at intersection of Main Drain Canal and Intake Canal; 2) Buena Vista East Canal deliveries; and 3) water deliveries through interconnections with neighboring districts, including SWID and NKWSD. Source: LATIS-SERVER, SWSD District Source Deliveries.

[3] Reflects ten percent of banking deliveries that are left behind in SWSD. Source SWSD History of Water Banking Activity.

Table 31 lists restrictions or imposed limitations on the sources of the District's surface water supplies, in particular, the District's supply of State Water Project (SWP) water. Restrictions on Semitropic's water supply generally result from Court Orders and regulatory actions of wildlife agencies related to endangered species issues and actions of the State Water Resources Control Board (SWRCB) that restrict pumping from the Sacramento-San Joaquin River Delta, which is managed by the Department of Water Resources.

Table 31. Restrictions on Water Sources

Source	Restrictions or Imposed Limitations	Name of Agency Imposing Restrictions	Operational Constraints
State Water Project (SWP)	Surface Water (CA Aqueduct) Supply	DWR	Reduced reliability of SWP deliveries south of the Sacramento-San Joaquin Delta due to court-ordered and regulatory constraints on pumping.

A2. Groundwater Supply

All developed lands within the District overlie useable groundwater, which is the primary source of supply. *DWR Bulletin 118 (Update 2003)* defines the groundwater subbasin as "Kern County" (5-22.14), as indicated in *Table 32* and shown in relation to the District service area in *Figure 9*. The Kern County subbasin is part of the Central Valley aquifer system, which has been well-studied, with major investigations having been conducted by both state and federal agencies. To the extent that surface water supplies are imported and delivered within the District's service area, groundwater pumping is reduced by a like amount.

Table 32. Groundwater Basins

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

DWR San Joaquin District Kern County Groundwater Basin Information:
http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/5-22.14.pdf

The geology of the aquifer underlying the District's service area is described in Semitropic's *2012 Groundwater Management Plan*. *Table 33* lists the firm responsible for preparation of that plan. Depending on location, confined, unconfined, and shallow zones are present in the Tulare Basin and the Kern County subbasin.

Table 33. Groundwater Management Plan

Prepared By:	GEI Consultants
Year:	2012
Is Appendix Attached?	No, but is available upon request.

The average depth to groundwater in the District has ranged from around 180 feet at the end of a "wet" period (2006) to approaching over 300 feet during this extended "dry" period (2015). Over the last 20 years, the annual (average) spring water levels have fluctuated within a band of around 120 feet. Seasonal fluctuations can be significant and are a function of the amount of groundwater pumping in a given year and the location within the District.

Long-term water-level data in selected wells representing the unconfined to semiconfined aquifers are used to evaluate groundwater movement, storage conditions, and pumping costs. Historically, water levels in supply wells have been measured twice a year, in both the "spring" and "fall", with the timing of these measurements intended to coincide with the annual water level high and low, respectively. In general, the measurement of water levels will continue to be performed in both spring and fall in order to show seasonal variations in water levels throughout the District. In addition to these manual measurements, continuously recording water-level sensors are now installed in several District monitor wells. Under DWR's CASGEM program, the District reports groundwater levels which are recorded at select well locations.

The District is a member of the Kern Groundwater Authority (KGA) and anticipates complying with the new requirements of the Sustainable Groundwater Management Act (SGMA), through the KGA. To what extent SGMA will ultimately affect the availability of groundwater within the District is presently unknown.

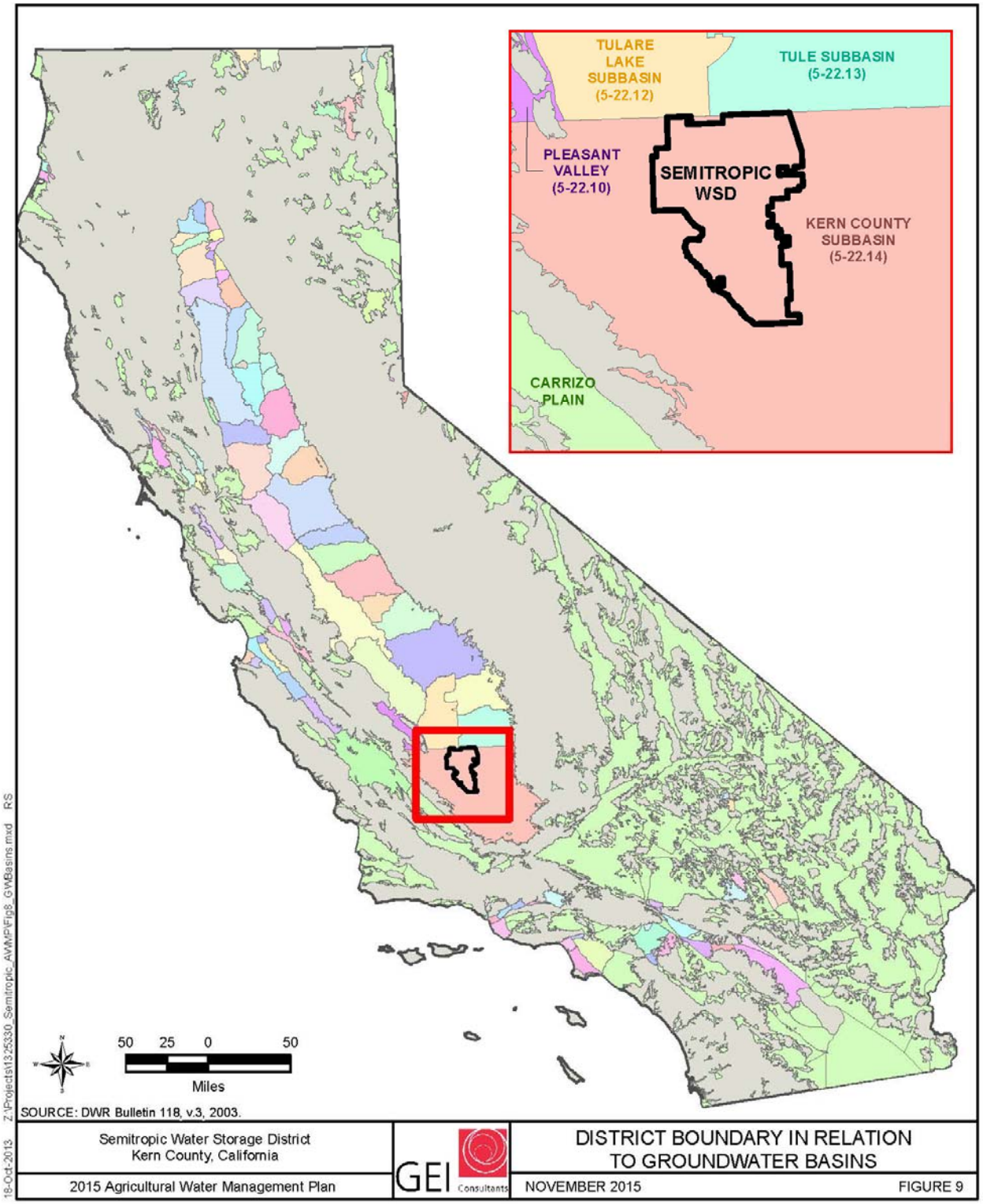

Figure 9 – District Boundary in Relation to Groundwater Basins

Irrigation Wells

Typical District-constructed wells vary from 700 to 1,300 feet in depth, with 16-inch to 18-inch diameter casing and gravel pack installed in a 28-inch (minimum) diameter bore hole. The length of perforated casing typically ranges from 300 to 900 feet. Little detailed construction information is available for landowner wells; however, newer landowner wells are similar in construction to District wells. A view of a typical District-owned deep well is shown earlier in *Figure 4*.

Pumping lifts vary with hydrology and with location; however, the average lift is estimated to have ranged from 300 to 340 feet over recent years. The at-well pumping drawdowns during the irrigation season can exceed 100 feet, but are typically about 50 to 75 feet. In 2005 and 2006, District staff located all wells in the District, which numbered more than 1,240 wells at that time. The District has made an effort to keep these figures "current" by working with the County of Kern which administers permitting for both the construction and abandonment of wells.

The volume of measured landowner groundwater pumping within the boundaries of Semitropic for the selected years is shown in *Table 34*. The amount of pumping from privately-owned wells which is reported in Table 34 reflects only that water which was pumped by the landowner and discharged into the District's distribution system for wheeling. For these wells, the pipelines which discharge into the District's distribution system are equipped with flow meters. All other use of privately-owned wells is not reported to the District and data is not available.

Table 34. Groundwater Supplies for Selected Years (AF)

Groundwater Basin	2011 (Wet)	2012 (Intermediate)	2013 (Dry)	2014 (Critical)	2015 (Critical)
Privately-Owned Wells-Wheeling ("GWEP In")[1]	1,329	38,695	71,661	82,372	85,672
Privately-Owned Wells[2]	NA	NA	NA	NA	NA
Total[1]	**1,329**	**38,695**	**71,661**	**82,372**	**85,672**

SOURCE: SWSD Historical Deliveries File
Data Not Available "NA".
[1] Represents the amount of landowner groundwater pumping into District facilities for wheeling and it is a supply consumed within the District.
[2] Information on groundwater supplies from private wells is not available as information is not reported to the District.

A3. Other Water Supplies

The location of the Semitropic WSD does not lend itself to uncontrolled inflows from water sources not measured by the District with the exception of Poso Creek which is dry most years and historically floods on a 7 to 10 year interval. This type of inflow is considered essentially non-existent. The District is located between the State Water Project (SWP) and Central Valley Project (CVP) north-to-south conveyances. As noted earlier, this makes the District's location ideal for groundwater storage and banking, and participation in exchanges with neighboring districts to supplement local water supplies. Currently no other substantive water supply can be reported, however, prior to and during the drought, the District has initiated water supply development programs to enhance surface water supplies through water purchases and transfers. Some of the water supply development programs include investigations into capture of flood flows in the Tulare Lakebed Water Storage Project, Delta Land Fallowing and Wetlands Management, and long-term Water Transfers.

A4. Drainage from the Water Supplier's Surface Area

Drainage wells and surface drainage systems are not employed by the District. In some areas, groundwater below the root zone from deep percolation is recoverable for irrigation uses. In these areas, the recovered water is generally of poorer quality than surface water, but it is typically suitable for agriculture. As noted in *Table 35*, there are no flows to saline sinks and flows to a perched water table are minimal.

Table 35. Drainage Discharge for Selected Years (AF)

Surface/Subsurface Drainage	2011	2012	2013	2014	2015
Flows to saline sink	N/A	N/A	N/A	N/A	N/A
Flows to perched water table	Minimal	Minimal	Minimal	Minimal	Minimal

B. Water Supply Quality

The quality of water delivered to the District from the State Water Project (SWP) is relatively good and suitable for irrigation. This water is pumped from the Sacramento-San Joaquin River Delta and conveyed in the California Aqueduct to Semitropic's turnouts. The total dissolved solids (TDS) concentration has averaged 262 mg/L TDS over a recent five-year period (DWR). Measurements representing the quality of the California Aqueduct water are taken at Kettleman City (Station C21, KA017226), which is located upstream of the turnouts used for deliveries to the District.

The District's groundwater quality is generally good to excellent; however, constituents of concern for agriculture are primarily related to TDS (and include chloride), while arsenic and nitrates are constituents of concern in limited areas with regard to drinking water supplies. In general, groundwater in the west has higher TDS content relative to the eastern part of the District.

The District is a member of the Kern River Watershed Coalition Authority (KRWCA), 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.

B1. Surface Water Supply

The District has coordinated with and relied on other agencies for the purpose of characterizing the quality of surface water received, especially since its main surface water supply consists of imported SWP water. Water is diverted from the California Aqueduct through three turnouts and is conveyed into the District using two conveyance routes; the District's Intake Canal and the 120-inch pipeline. The quality of water in the California Aqueduct is regularly monitored by DWR at several locations, including Check 21, which is located at Kettleman City (Station C21, KA017226), upstream of Semitropic's turnouts. *Table 36* presents average concentrations of selected parameters based on DWR sampling at Check 21 over the five-year period extending from 2008 through 2012.

Table 36. Surface Water Supply Quality (SWP)

Parameter	Units	Concentration
Ca	mg/L	20
Mg	mg/L	13
Na	mg/L	53
Alkalinity	mg/L (as $CaCO_3$)	72
Cl	mg/L	75
SO_4	mg/L	37
B	mg/L	<0.2
TDS	mg/L	260
Hardness	mg/L (as $CaCO_3$)	102
Specific Conductance	µS/cm	467

Source: DWR Bulletin 132-09 through -13.

B2. Groundwater Supply

The main production zones beneath the District are of good water quality; however, three areas of potentially poor quality are found within the District and the groundwater basin; shallow groundwater, deep groundwater, and west-side groundwater. The high salinity shallow groundwater is only characteristic where there is perched water; however, the transition zone and saline water below the production zone are typical of the entire District. Prevention of migration from the poor quality areas to the high quality areas is a critical management goal of the District.

Groundwater of poor quality, typically a sodium chloride or sodium chloride-sulfate type with high concentrations of dissolved solids and chlorides, can be found extensively along the west

side of the San Joaquin Valley. "Stabilization" of groundwater levels beneath most of the District has served to limit migration of poor quality groundwater into the District from the west.

Groundwater of poor quality also can be found in the unconfined aquifer, particularly with perched water. Some areas of the unconfined aquifer are significantly saline, others brackish, due to "spills" from the perched zone, leakage through domestic well borings, and deep seepage of irrigation water. The E-clay largely prevents this water from entering the main aquifer or production zone. Accurate identification of the E-clay, proper and sufficient length of annular seals through the E-clay, and proper materials and methods of well construction are critical to maintaining good water quality in the main aquifer.

Some groundwater of poor quality can be found in the main aquifer, principally in the deeper zones of the Tulare Formation. The depth to the base of fresh water varies significantly across the District. Pockets of connate saline water may also be trapped in shallower zones under the Buttonwillow and Semitropic ridges. The District has reviewed extensive geologic data and District wells are intentionally constructed sufficiently above the saline boundary to maintain water quality.

B3. Other Water Uses

There are no additional uses other than those described in this plan.

B4. Drainage from the Water Supplier's Service Area

The District does not provide any drainage facilities, nor does it control or monitor any on-farm subsurface drainage systems. Therefore, limitations on drainage reuse are not included in the District's operations, as indicated in *Table 37*. As a service to its landowners, the District does participate in and help facilitate the Irrigated Lands Regulatory Program through the KRWCA (reference Section B above). The District also participates in a cooperative program to monitor the quality of water in Poso Creek.

On-farm tailwater drainage within the District's service area is minimal due to the prevalence of low-volume and level-basin irrigation systems. In cases where on-farm tailwater is generated, the water users typically contain it within their property.

Table 37. Drainage Reuse Effects

Analyte	Drainage Reuse Limitations				
	Increased Leaching	Blending Supplies	Restricted Area of Use	Restricted Crops	Other
N/A	N/A	N/A	N/A	N/A	N/A

C. Water Quality Monitoring Practices

C1. Source Water

The Department of Water Resources regularly monitors the quality of surface water in the California Aqueduct. In particular, water samples are collected at several locations, including Check Structure C21 (KA017226), which is located approximately 20 to 30 miles northwest of the Semitropic service area. In addition, Semitropic will periodically monitor the incoming water in its two main conveyances from the Aqueduct (the District's Intake Canal and the 120-inch pipeline). Under the District's current program, water samples are also collected annually from a representative network of wells located throughout the irrigated areas of the District in order to monitor groundwater quality. For in-District use of groundwater, water quality testing has historically involved parameters relevant to an irrigation water analysis. However, when previously-banked groundwater is recovered and delivered into the Aqueduct, testing is more extensive, both in terms of the number of tests and the constituents that are included in the tests. Additional information regarding the testing of water quality under the District's Groundwater Banking Project is covered in Semitropic's *2012 Groundwater Management Plan*. *Table 38* provides general information on monitoring of source water quality.

Table 38. Water Quality Monitoring Practices

Water Source	Monitoring Location	Monitoring Practice	Frequency of Analysis
SWP	CA Aqueduct at Check C21	Automated Station Data Grab Sample Data	Daily, hourly, and monthly grab
Groundwater	District Wells	Grab Sample Data	Monthly during operation

C2. Drainage Water

Drainage water is essentially non-existent in the District. As noted in *Table 39*, Semitropic will conduct monitoring of surface water and groundwater on as an as needed basis to confirm the suitability of water for District purposes.

Table 39. Water Quality Monitoring Programs for Surface/Sub-Surface Drainage

Monitoring Program	Analyses Performed	Frequency of Analysis
Surface Water and Groundwater	Agricultural Suitability	As needed

Section V. Water Accounting and Water Supply Reliability

A. Quantification of Water Supplies

A1. Agricultural Water Source Quantities

Diversions of SWP water from the California Aqueduct vary from year to year depending on the state-wide weather, the amount of snowmelt runoff, and operational and regulatory considerations, particularly with regard to pumping from the Sacramento-San Joaquin River Delta. Delivery of SWP water to Semitropic is based on KCWA's contract with the Department of Water Resources. For the purposes of this AWMP, multiple years were chosen (reference *Table 19*) to reflect operations in wet, intermediate, dry, and critical water years. *Table 30,* under the "SWP" source, summarizes annual surface water diversions from the California Aqueduct and other supplies as available (e.g. Poso Creek) during the wet, intermediate and dry years. These values represent surface water deliveries from the various sources ("Total Delivered"). The surface water deliveries for the District were not able to be tabulated monthly for this report and accordingly, *Table 40* (reference *DWR Guidebook to Assist Agricultural Water Suppliers*) was not included in this plan.

Groundwater pumped within the District for irrigation and domestic uses is pumped from the Kern County Subbasin (reference *Table 32*). Groundwater pumping in the District includes over 1,200 privately-owned (or on-farm or non-district) wells. Recall that annual volumes pumped from the on-farm wells are not reported to the District unless they are discharged into the District's distribution system. The 70 district-owned wells are used mainly for recovery of previously-banked water.

Table 34 summarizes the groundwater pumped by private wells into the District facilities for wheeling and is a supply consumed within the District during each of the representative years. Information on groundwater supplies from privately-owned wells is not available as information is not reported to the District. The portion of the total delivered to farm turnouts is shown in *Table 43*. The wheeling water was not able to be tabulated monthly and *Table 41* (reference *DWR Guidebook to Assist Agricultural Water Suppliers*) was not included in this plan.

A2. Other Water Source Quantities

Semitropic actively manages deliveries of imported surface water and of previously-banked water which is recovered. Effective precipitation, however, constitutes an uncontrolled source of supply which reduces the applied irrigation water requirement within the District service area. The estimated agricultural crop water demands in *Tables 21a* through *21e* are based on the ET of applied water, which accounts for effective precipitation. Accordingly, *Table 42* (reference *DWR Guidebook to Assist Agricultural Water Suppliers*) was not included in this plan.

B. Quantification of Water Uses

Table 43 shows the total volume of water delivered to the District's irrigation customers in each of the selected years. The volume of water delivered is based on flow measurements at the farm turnouts and represents head-gate deliveries.

Table 43. Applied Water for Selected Years (AF)

	2011	2012	2013	2014	2015
Contract	109,268	89,706	53,778	20,387	27,203
Non- Contract	205,451	94,147	10,620	4,483	11,493
GWEP Out[1]	1,329	38,504	71,257	81,774	84,951
SAW[2]	0	4,594	7,870	9,874	10,042
Emergency and Transfer	1,251	3,577	2,915	2,924	3,432
District Deliveries to Farm Turnouts	**317,299**	**230,527**	**146,440**	**119,441**	**137,121**

SOURCE: Latis Server- SWSD Classifications Delivery by Delivery System

[1] Represents the amount of landowner groundwater pumping into District facilities for wheeling and it is a supply delivered to farm turnouts and consumed within the District.

[2] Supplemental Ag Water

Table 44 summarizes water uses within the District's service area. Drain water is not applicable to District operations; accordingly, this is so noted in *Tables 45* and *46*.

Table 44. Quantify Water Use for Selected Years (AF)

Crop Water Use	2011	2012	2013	2014	2015
1. Crop Water Requirement[1]	381,940	384,690	386,640	385,860	388,120
2. Leaching[2]	--	--	--	--	--
3. Cultural Practices	--	--	--	--	--
Conveyance and Storage System	**2011**	**2012**	**2013**	**2014**	**2015**
4. Conveyance Seepage & Evaporation[3]	16,630	10,107	3,957	1,982	2,581
5. Conveyance Operational	N/A	N/A	N/A	N/A	N/A
6. Reservoir Evaporation [4]	N/A	N/A	N/A	N/A	N/A
7. Reservoir Seepage [4]	N/A	N/A	N/A	N/A	N/A
Environmental	**2011**	**2012**	**2013**	**2014**	**2015**
8. Environmental Use – Wetlands	0	0	0	0	0
9. Environmental Use – Other	1,887	119	0	1,697	666
10. Riparian Vegetation	0	0	0	0	0
11. Recreational Use	0	0	0	0	0
Municipal and Industrial	**2011**	**2012**	**2013**	**2014**	**2015**
12. Municipal (from *Table 26*)	0	0	0	0	0
13. Industrial (from *Table 26*)	0	0	0	0	0
Transfers and Exchanges	**2011**	**2012**	**2013**	**2014**	**2015**
14. Transfers or Exchanges out of Service Area (from *Table 28*)[5]	N/A	N/A	N/A	N/A	N/A
Other Water Uses	**2011**	**2012**	**2013**	**2014**	**2015**
16. Other (from *Table 29*)	0	0	0	0	0
SUBTOTAL	**400,457**	**394,915**	**390,597**	**389,540**	**391,367**

[1] Based on ET of applied water (reference *Tables 21a* through *21e*).
[2] Included in Item 1, see *Tables 21a* through *21e*.
[3] Reflects 6% losses of all water delivered for agricultural uses *(see Table 27).*
[4] Not applicable to District.
[5] Does not reflect transfers or exchanges for Groundwater Banking Purposes; these transfers are not applicable to agricultural water uses within the District.

Table 45. Quantify Water Leaving the District for Selected Years (AF)

Drain Water	2011	2012	2013	2014	2015
Surface drain water leaving district.	N/A	N/A	N/A	N/A	N/A
Subsurface drain water leaving district.	N/A	N/A	N/A	N/A	N/A
SUBTOTAL	**0**	**0**	**0**	**0**	**0**

Table 46. Irrecoverable Water Losses for Selected Years (AF)

Drain Water	2011	2012	2013	2014	2015
Flows to saline sink.	N/A	N/A	N/A	N/A	N/A
Flows to perched water table.	N/A	N/A	N/A	N/A	N/A
SUBTOTAL	**0**	**0**	**0**	**0**	**0**

C. Overall Water Budget

Table 47 summarizes the total water supplies delivered by the District within its service area in each of the selected years. These supplies include imported surface water; groundwater pumped from the District-owned wells; and groundwater pumped from non-District wells which is discharged into the District's distribution system (under agreements between individual landowners and the District). The water supplies shown in *Tables 47* and *48* do not include the on-farm pumping and use of groundwater which occurs on all developed lands within the District. The budget summary includes an estimate of the total use of water, regardless of the source of supply.

Table 47. Quantify Water Supplies for Selected Years (AF)

Water Supplies	Wet (2011)	Intermediate (2012)	Dry (2013)	Critical (2014)	Critical (2015)
1. Surface Water (Summary Total, *Table 30*)	234,655	105,476	49,177	11,197	32,179
2. Groundwater (Summary Total, *Table 34*)[3]	1,329	38,695	71,661	82,372	85,672
3. Annual Effective Precipitation (Summary Total)[1]	NA	NA	NA	NA	NA
4. Water Purchases[2]	--	--	--	--	--
5. Transfers or Exchanges into District[2]	--	--	--	--	--
TOTAL INPUT TO DISTRICT	**235,984**	**144,171**	**120,838**	**93,569**	**117,851**

SOURCE: Latis server, SWSD District Source Deliveries.
[1]Effective precipitation is accounted for in the ETAW values; see *Tables 21a* through *21e* and preceding text
[2] Included in item 1.
[3] Represents the amount of landowner groundwater pumping into District facilities for wheeling and it is a supply consumed within the District.

Table 48. Budget Summary for Selected Years (AF)

Water Accounting	Wet (2011)	Intermediate (2012)	Dry (2013)	Critical (2014)	Critical (2015)
1. Subtotal of District Water Supplies[1] (*Table 30*)	234,655	105,476	49,177	11,197	32,179
2. Subtotal of Water Uses[2] (*Table 44*)	400,457	394,915	390,597	389,540	391,367
3. On-farm Drainage Water Leaving Service Area (*Table 45*)	0	0	0	0	0
Water budget summary closure term.[3]	(165,802)	(289,439)	(341,420)	(378,343)	(359,188)

[1] Does not include wheeled water as this value is meant to represent District supplies only.
[2]This value does not include groundwater recharge as that water was stored to be used as future supply.
[3] The closure term is the difference between estimated ETAW (ET of applied water demand), identified as water uses by DWR, and the district water supplies. Accordingly, this term primarily reflects the on-farm pumping which is not reported to the District.

The "water balance closure term" represents an estimate of the difference between the total water uses (water demand) and the District water supplies for each of the 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.

The water budget closure term provides a relative estimate of the amount of on-farm groundwater pumping necessary to meet water uses within the District's service areas. District deliveries in 2011 were the most the District has delivered in a given year; accordingly, the implied on-farm pumping was substantially reduced relative to the other years.

D. Water Supply Reliability

As indicated elsewhere in this Plan, Semitropic imports most of its surface water from the SWP under a contract with KCWA, which is delivered via the California Aqueduct. Due to the incomplete status of SWP facilities and new regulatory restrictions on pumping from the Sacramento-San Joaquin River Delta, shortages in SWP supplies have been more frequent and larger than originally envisioned. DWR Bulletin 160-09 (2009) articulated some of the "challenges" facing the Tulare Lake Basin; in particular, reductions in the amount of surface water diverted into the District and the region, which 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 could worsen delivery reliability issues of imported water from the CVP and SWP and accelerate the conversion of crop acreage of permanent crops.
c. The San Joaquin River Settlement will impact water diverted into the Friant-Kern Canal, possibly as much as 15 percent of supply (on average) as interim flows began in fall 2009.

Furthermore, according to the 2011 "Draft Delivery Reliability Report" as prepared by the State of California, Natural Resources Agency, Department of Water Resources, the long-term reliability prediction of surface water supplies to Southern California from the Delta is expected to average 60 percent. Therefore, efficient water management practices and conjunctive management (i.e. the coordinated use of surface water and groundwater sources) are critical for the well-being of the communities and districts that depend on the SWP as a source of water. Federal and State regulatory agencies have also placed additional constraints on pumping from the SWP's Banks Pumping Plant, which has resulted in reductions in reliability and yield of the District's contract supply of SWP water (i.e. court-ordered constraints and regulatory restrictions

on pumping SWP from the Delta). As mentioned previously, SWP contract supplies have been supplemented from time to time by other sources, including Poso Creek, Central Valley Project (CVP) water, and local Kern River water; however, these have been comparatively small and limited to very wet years.

More reliance is placed on pumped groundwater when imported supplies are reduced. Accordingly, decline in groundwater levels will result from reductions in historically available surface water supplies. This situation is likely to be exacerbated by the shift to permanent crops (both within the District and in the region) and increased groundwater pumping in unorganized areas adjacent to the District (generally located to the north and northeast, as well as to the southeast) which rely exclusively on pumped groundwater for irrigation to support permanent crops. As the groundwater levels decline, water will become more energy intensive to extract and land subsidence will likely become more evident. A greater reliance on groundwater will also presumably place more stress on the aquifer during recovery periods of the Groundwater Banking Project.

In 2007, Semitropic joined several neighboring water agencies in adopting an Integrated Regional Water Management Plan (*Poso Creek IRWMP*) which identified water supply reliability as the Region's principal water resources concern going forward. The *Poso Creek IRWMP* identified and prioritized a number of projects to mitigate anticipated reduction in water supply reliability, several of which have been constructed, are under construction, or will be under construction in the near term. Some examples of the efforts Semitropic is making through the IRWMP, regarding improvements to district facilities and management, are illustrated in *Sections II* and *VII* of this Plan.

E. Future Water Supply

The future of Semitropic's surface water supply will likely be driven by regulatory restrictions in the Delta, any state-wide changes in hydrology (e.g. volume, nature, and timing of precipitation), and future modifications to SWP conveyance and/or conservation facilities. The discussion presented in *Section VI* of this plan addresses the potential effects to Semitropic assuming future climate change, specifically with regard to the allocation of SWP water and groundwater.

Semitropic must also deal with the uncertainty that comes from the inherent randomness of events in nature, such as the occurrence of an earthquake or a flood affecting the ability to divert water from the Delta. Future protections for endangered species may also require modifications in water operation procedures that are unknown today. The District is committed to adapting its water management practices to respond to these changes as best it can. This may involve adaptive management strategies for water consumers or the acquisition of supplemental water through transfers and exchanges with neighboring districts.

Section VI. Analysis of Effect of Climate Change

A. Effects of Climate Change on Water Demand

A study of the possible effects of climate change to surface and groundwater sources in the Central Valley was conducted by the *USGS California Water Science Center* (CAWSC). In this study (USGS 2012), models were used to quantify the hydrological effects of warming climate scenarios including a model of runoff and recharge from the watersheds of the Sierra Nevada Mountains and a model of agricultural water deliveries and use in the Central Valley. 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 (GHG) emissions. The scenarios predict California's climate as becoming warmer (+2 to +4° C) and drier (10-15 percent) during the mid- to late-21st century, relative to historical conditions. The California Energy Commission's Cal-Adapt Web site predicts temperature differences in the District service area from a baseline historical average (1961 to 1990) to a projected average (2070 to 2090). The projection shows an increase in annual average temperature of about 3.6°F to 6.2°F under a low carbon and high carbon emission scenario, respectively.

Based on these projections, climate change could result in increased demands for irrigation water with reduced surface water deliveries that would be met by increasing groundwater pumpage. This in turn, would likely lead to the following impacts:

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

These combined effects have the potential to shift the District from surface water supplies, relying on groundwater as a supplemental source of water during years when surface supplies are inadequate to meet demand, to groundwater (Water Resources Research, 2012). All other things being equal, increased depths to groundwater will result in increased power and energy requirements for groundwater pumping, which has its own GHG implications. According to another CAWSC study (Proceedings of the Eighth International Symposium on Land Subsidence, 2010), Kern County may experience substantial land subsidence due to the increased demand on groundwater that may result from climate change.

Climate change is also expected to increase both daytime and nighttime temperatures in the Central Valley resulting in lengthening of the growing season. Cal-Adapt predicts that the number of days exceeding the "extreme heat threshold" of 104°F for the District service area will increase from a historical baseline average of 4 extreme heat days (1961-1990) to a projected average of 24 extreme heat days (2070-2090). Using the same baseline and projection years, the number of nights exceeding the "warm night threshold" of 73°F is expected to increase from 4

nights to about 26 nights. This general increase in temperatures coupled with greater variability and unpredictability in precipitation (depicted in decadal average projections by Cal-Adapt) is expected to lead to increases in evapotranspiration resulting from warmer seasons, thereby creating an increase in demand for irrigation water and an increase in the year-to-year variability of demand.

Temperate fruit and nut trees such as almonds, pistachios, and apples require adequate winter chill to produce economically viable yields. As explained above, the number of warm nights will increase, and therefore the number of winter chill hours will decrease, causing adverse effects on the yield of these orchard crops which currently account for approximately 60 percent of total crops in Semitropic. 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). By the end of the century, the safe winter chill needed for almonds, pistachios and apples is predicted to disappear. In addition, areas with predominately permanent crop acreage, like Semitropic, may have reduced flexibility for adapting to changing climatic conditions since they require water in all types of water years, therefore "hardening" the demand.

B. Effects of Climate Change on Agriculture's Water Supply

The future of the District's water supply will be driven mainly by changes in hydrology and particularly by the volume, variability, and timing of precipitation of the Sacramento-San Joaquin River Delta, as the receiving watershed area is the source of supply for the SWP, the primary source of surface water for Semitropic. 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 CVP) due to climate change. The 12 scenarios represent projections from six Global Climate Models for higher and lower GHGs 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, average annual SWP exports under future climate scenarios from 2013 to 2033 conditions are projected to decrease 5.6 percent (DWR, 2013). Current long-term reliability predictions of SWP Table A deliveries, modeled under historic (1921-2003) precipitation and runoff patterns and accounting for future conditions such as land use and climate change, are expected to decrease 6 percent from the historic average (DWR, 2013). These decreases in annual Delta exports would reduce water deliveries south of the Delta, which directly affects the water volume supplied to Semitropic. These effects would be magnified by similar changes to other potential surface water supplies, which have been used in the past by the District when water is available (e.g. Kern River, Poso Creek, etc.).

Groundwater banking performed by the District offers the flexibility to respond to climate variability, as water can be stored during "wet" periods for use in "dry" ones. This will become

increasingly important as climate change is projected to increase the frequency and intensity of extreme weather events, including floods and droughts. Banking may also become more challenging as it will require additional monitoring and assessment of groundwater levels and quality, especially if the District is limited by constraints on conveyance that reduce reliability of available surface supplies to shift use to groundwater as its reliable water source. Local communities, rural residences, and businesses also rely on groundwater from the Kern County Subbasin as a main supply.

The combination of groundwater use in dry years and less recharge in wet years jeopardizes the District's ability to balance water supplies with the existing level of demand, as shown in *Table 34*. Should climate change further reduce water available from the SWP, or other entities for groundwater banking purposes, this may prompt Semitropic to increase the amount of groundwater pumping leading to a decrease in groundwater storage without the necessary, reliable surface supplies available as a means of replenishing the depleted storage.

C. Vulnerability Assessment

The Modified IRWMP Climate Change Vulnerability Assessments Matrix below provides an assessment of the regional vulnerability to the potential climate change impacts, using the 'Vulnerability Assessment Checklist' found in the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011). As previously mentioned, Semitropic Water Storage District is a member of the Poso Creek Regional Water Management Group (RWMG). This checklist is a modified version of the checklist provided in the 2014 Poso Creek IRWM Plan Update, gearing answers more specifically to Semitropic, and provides a further evaluation of the effects on regional water demands and supplies, as well as water quality, flooding events, environment and ecosystems, and hydropower systems.

Vulnerability ratings, identified in the matrix, are based on presumed level of impact to Regional conditions based on climate change considerations given in the checklist. For this assessment, the following rating system was used:

- "High" rating: expected impacts of climate change on listed item pose a severe risk to regional or District operations in the future, including, impacts that greatly inhibit the ability to deliver water supplies to users within the region or District.
- "Medium" rating: expected impacts of climate change on listed item pose a moderate risk to regional or District operations in the future, including, impacts that require management and planning changes in order to mitigate adverse effects.
- "Low" rating: expected impacts of climate change on listed item pose a low risk to regional or District operations in the future, including, impacts that may be mitigated through relatively simple planning or management changes, but are not critical to regional or District operations.
- "Not Applicable" (N/A) to the region or District, or impacts that will not affect regional operations.

Modified IRWMP Climate Change Vulnerability Assessments Matrix

List No.[1]	Checklist Item	Regional Conditions	Vul. Rating[2]
I. Water Demand Assessment			
I.A	Are there major industries that require cooling/process water in your planning region?	Currently, requirements for cooling/process water are insignificant in Semitropic.	Low
I.B	Does water use vary by more than 50% seasonally in parts of your region?	Yes. Irrigated agriculture is the predominant use of water in the District. While annual water demands are fairly consistent from year to year, there is considerable seasonal variation, with the highest demands occurring in the summer and lowest demands in the winter.	Medium
I.C	Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as long heat lingers before night-time cooling, be prohibitive for some crops?	All crops grown in Semitropic are climate sensitive to some extent. Modest shifts in heating and cooling patterns are likely to affect crop yield; however, significant shifts could affect the viability of continuing to grow certain crops. As explained previously, the number of extreme heat days and warm nights is expected to increase in the area, which is likely to affect the quality and yield of crops.	Medium
I.D	Do groundwater supplies in your region lack resiliency after drought years?	Groundwater levels will decline with a period of dry years. Though the District's extensive banking program strengthens groundwater levels, the resiliency of the District's groundwater resource is directly related to the reliability of imported surface water supplies since groundwater is used to meet demands that are not fulfilled by surface water supplies. To this extent, "resiliency" has been reduced.	High
I.E	Are water use curtailment measures effective in your region?	There has been a trend in Semitropic toward permanent crops. To this extent, the potential to curtail water use in any given year by fallowing has been reduced. Water use efficiency (WUE) improvements within a conjunctive use basin, overlying usable groundwater, may improve the effectiveness of water use; however, the WUE improvements do not curtail consumptive water use.	Medium
I.F	Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	While there are no in-stream flow requirements within Semitropic, the surface water supplies which are available to the District may be affected by such requirements at the sources of SWP supplies.	Low

[1] Numbers based on checklist shown in Section 4.3 of the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011).

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.	Checklist Item	Regional Conditions	Vul. Rating
II. Water Supply Assessment			
II.A	Does a portion of the water supply in your region come from snowmelt?	Yes. All surface water inflows are primarily a function of snowmelt runoff; however, the snowmelt does not occur within the Region[2].	High
II.B	Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?	Yes. The District participates in exchanges for water diverted from the Delta through the SWP and occasionally for water from the Friant Unit of the CVP.	High
II.C	Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	No.	N/A
II.D	Would your region have difficulty in storing carryover surpluses from year to year?	There is limited carryover available for SWP water in San Luis Reservoir. Carryover of CVP water in Millerton Reservoir is essentially non-existent. The most effective means of local regulation is through the use of available groundwater storage. The District utilizes unlined canals, as well as in-lieu recharge programs and spreading ponds for direct recharge to facilitate replenishment of groundwater.	High
II.E	Has your region faced a drought in the past during which it failed to meet local water demands?	No. Water demands have been met through the use of groundwater which, during drought, can result in significant declines in groundwater levels. To the extent that surface water supplies are reduced in the future (as a result of climate change and/or regulatory constraints), recharge will be reduced, which will affect the availability of groundwater for meeting local water demands. In addition, hardening of the District's demand (with an increased percentage of permanent crops) increases the likelihood of water supply deficiencies going forward.	High
II.F	Does your region have invasive species management issues at your facilities, along conveyance structure, or in habitat areas?	Invasive species issues are minimal in Semitropic, primarily consisting of algae growth in canals during times of low conveyance with low velocities or ponded water conditions.	Low

[2] For the entirety of this checklist, "Region" refers to the Poso Creek RWMG Region.

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.	Checklist Item	Regional Conditions	Vul. Rating
III. Water Quality Assessment			
III.A	Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?	Wildfires are not a threat within Semitropic; however, depending on timing, direct recharge of groundwater in spreading ponds could be adversely impacted. There would be no threat to M&I uses within the District since all such uses are met with groundwater.	Low
III.B	Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?	Some local and regional canals seasonally have algae blooms that require maintenance, including minimal treatment or cleanup efforts. Algae blooms may become more frequent with climate change as a result of increased temperatures in Semitropic and less water moving through the canals.	Low
III.C	Are seasonal flows decreasing for some water-bodies in your region? If so, are the reduced low flows limiting the water-bodies' assimilative capacity?	Poso Creek is the only "water body" in Semitropic with seasonal flows; however, whether seasonal flows are decreasing is unknown.	N/A
III.D	Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?	No.	N/A
III.E	Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?	No. M&I uses in Semitropic are supplied by groundwater pumping and surface water supplies are not treated for irrigation use.	N/A

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.	Checklist Item	Regional Conditions	Vul. Rating
IV. Sea Level Rise Assessment			
IV.A	Has coastal erosion already been observed in your region?	Semitropic is located in the Southern San Joaquin Valley, and the concerns regarding coastal regions are not applicable.	N/A
IV.B	Are there coastal structures, such as levees or breakwaters, in your region?		N/A
IV.C	Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level in your region?		N/A
IV.D	Are there climate-sensitive low-lying coastal habitats in your region?		N/A
IV.E	Are there areas in your region that currently flood during high tides or storm surges?		N/A
IV.F	Do tidal gauges along the coastal parts of your region show an increase over the past several decades?		N/A
V. Flooding Assessment			
V.A	Does critical infrastructure in your region lie within the 200-year floodplain?	Although flows in Poso Creek are infrequent, flooding of adjacent lands has occurred from time to time. The Poso Creek floodplain traverses the northern portion of the Region from east to west. Most of the area within the floodplain consists of irrigated agriculture.	Medium
V.B	Does part of your region lie within the Sacramento-San Joaquin Drainage District?	No.	N/A

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.	Checklist Item	Regional Conditions	Vul. Rating
V. Flooding Assessment (cont.)			
V.C	Does aging critical flood protection infrastructure exist in your region?	No.	N/A
V.D	Have flood control facilities (such as impoundment structures) been insufficient in the past?	While there are no flood control impoundment structures in Semitropic, investigations have been conducted in the past to determine the technical and economic feasibility of constructing a dam on Poso Creek. Up to this point, the dam has not proven to be economically feasible.	Low
V.E	Are wildfires a concern in parts of your region?	As noted in III.A (above), wildfires are not a concern in Semitropic; however, wildfires are a concern in the watersheds that provide the District with its surface water supplies.	Low
VI. Ecosystem and Habitat Vulnerability Assessment			
VI.A	Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?	Coastal aquatic habitats are not applicable to the District. The potential for erosion or sedimentation exists along the channel of Poso Creek. Significant flow in Poso Creek is very infrequent.	Low
VI.B	Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?	No.	Low
VI.C	Do climate-sensitive fauna or flora populations live in your region?	No.	Low
VI.D	Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?	Yes. They consist of San Joaquin Kit Fox, Tipton Kangaroo Rat, and San Joaquin Wooly Threads. Whether or not changes in species distribution have occurred is unknown. The District supports the management efforts for endangered and threatened species led by the Tulare Basin Wildlife Partners, who actively monitor species distribution and habitat changes in the Region.	Medium
VI.E	Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?	Recreational water use in Semitropic is limited to duck clubs which rely on seasonal flooding of ponds which have been developed for that purpose.	Low

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.	Checklist Item	Regional Conditions	Vul. Rating
VI. Ecosystem and Habitat Vulnerability Assessment (cont.)			
VI.F	Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?	No.	N/A
VI.G	Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?	The Kern National Wildlife Refuge is located within the Region and manages some wetlands; however, coastal storms are not possible in Semitropic, owing to its location in the southern San Joaquin Valley.	N/A
VI.H	Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?	No. The Central Valley of California, where the District is located, is not listed as one of the 'Top 10' habitats vulnerable to Climate Change according to the 'It's Getting Hot Out There: Top 10 Places to Save for Endangered Species in a Warming World' Report (Endangered Species Coalition, 2010).	N/A
VI.I	Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Is there infrastructure projects planned that might preclude species movement?	The Region includes the Kern National Wildlife Refuge, the Goose Lake bed, temporary wetlands in the form of duck clubs, and the channel of Poso Creek. Poso Creek traverses the Region from east to west and connects with the Refuge. The channel of Poso Creek provides an east-west movement corridor for wildlife, which extends from the foothills in the east to the trough of the San Joaquin Valley in the west. Flow in this reach of Poso Creek is infrequent. While infrastructure projects are planned which involve Poso Creek, they would not adversely affect the use of Poso Creek as a wildlife movement corridor. In particular, maintenance of the channel's flow carrying capacity is compatible with its use as a movement corridor. The RWMG has planned some projects and programs to improve existing facilities while not changing the movement corridors.	Low

Modified IRWMP Climate Change Vulnerability Assessments Matrix (continued)

List No.[1]	Checklist Item	Regional Conditions	Vul. Rating
VII. Hydropower Reliance Assessment			
VII.A	Is hydropower a source of electricity in your region?	PG&E and SCE provide electrical service in Semitropic, and their sources of electricity are many and varied. As of 2012, SCE's electrical generation portfolio included less than 10% hydropower, while PG&E's was a little more than 10%. In both cases, the hydrogenation takes place outside of the Region, though there is small hydro generation operated by Semitropic. For example, the District is currently installing an 80 cfs, 300 HP turbine at the District's existing Junction Pumping Plant.	Low
VII.B	Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?	It is reasonable to expect that energy needs in Semitropic will increase in the future as a result of several factors, which include changes in land use from agricultural uses to urban uses; increases in groundwater pumping with reductions in historically available surface water supplies (i.e., as a result of climate-induced changes in hydrology and/or increased regulatory constraints on surface water supplies imported to the District); and increases in groundwater pumping to satisfy higher ET requirements for irrigated agriculture (i.e., to the extent that "climate change" results in higher ET). There is one existing small hydropower facility in the Region and there is one under development. The existing facility is driven by imported SWP supplies and the same will be true of the facility which is under development. The combined capacity will be very small compared to the energy requirements of the Region, particularly during "dry" years. Future plans for hydropower generation facilities in the Region are unknown; however, any such plans would be limited to small hydropower which is incidental to the operation of irrigation conveyance and distribution systems. In this regard, based on currently available technology, solar generation has and will continue to be the dominant source of renewable energy for the District.	Low

The score sheet below summarizes the results of the vulnerability assessment presented in the Modified IRWMP Climate Change Vulnerability Assessments Matrix. The seven sections of the assessment are listed in order of vulnerability, from highest to lowest.

IRWMP Climate Change Vulnerability Assessment Score-Sheet

Section No. [1]	Section Title	Vulnerability Rating			
		High	**Medium**	**Low**	**N/A**
II	Water Supply Assessment	4	0	1	1
I	Water Demand Assessment	1	3	1	1
VI	Ecosystem and Habitat Vulnerability Assessment	0	1	5	3
V	Flooding Assessment	0	1	2	2
III	Water Quality Assessment	0	0	2	3
VII	Hydropower Reliance Assessment	0	0	0	2
IV	Sea Level Rise Assessment	0	0	0	6
Total Climate Change Assessment Score		**5**	**7**	**11**	**18**

[1] Numbers based on checklist shown in Section 4.3 of the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011).

Based on the vulnerability assessment summarized in the score sheet, "Water Supply" and "Water Demand" appear to have the highest level of vulnerability to potential Climate Change impacts for the District. This confirms the projected outlook for the District presented in Sections B and A, respectively. The remaining sections assessed in the matrix, while important, do not pose as much of a projected risk to District water resources operations or management efforts.

D. Response to Effects of Climate Change

The District is committed to monitoring key indicators of climate change that affect the hydrology of the Sacramento-San Joaquin River Delta which, which in turn influences allocations of SWP water. The following are ways in which the District, as well as the RWMG, are responding to the above mentioned effects of climate change.

Water Supply

The goal of the District is to utilize the available surface water and groundwater resources as effectively as possible in meeting the requirements of the District's water users. The District will work with the Department of Water Resources and applicable regulatory agencies to ensure there are adequate surface water supplies available to meet the growing conditions in the District's service area. The 2014 Poso Creek IRWMP Update provided the following strategies which were deemed the most practical and effective for climate change preparation in the Region, while also providing measurable benefits to current water management practices:

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- Expand in-lieu service areas in the Region, by expanding water conveyance to lands which are currently dependent solely on groundwater supplies (i.e., reduce dependency on groundwater basin during “wetter” periods).
- Improve agricultural and urban water use efficiency.
- Expand groundwater recharge and banking efforts through expansion of spreading pond acreage to capture surplus wet-period water supplies and thereby help to maintain groundwater levels.
- Encourage changes in regional crop varieties that are more resistant to climate change.

Water Demand

Some farmers are beginning to overcome climate changes, specifically reduced winter chill, by planting trees closer together and using new varieties. Studies are also now underway to prepare farmers for the likely impacts of climate change. Studies include breeding varieties of fruit trees which can withstand the decreased water chill hours, developing tools to aid crops in coping with insufficient 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 may not be feasible for many irrigators.

The District will work to implement these strategies as applicable. As the District’s control over water supplies is limited, management practices used to respond to climate change will need to be adaptive in nature.

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Section VII. Water Use Efficiency Information

A. EWMP Implementation and Reporting

Table 49 describes the Efficient Water Management Practices (EWMPs) implemented in the District and identifies the EWMPs planned. Each EWMPs is sequenced with the same number referenced from the DWR publication *A Guidebook to Assist Agricultural Water Suppliers.*

Table 50 of this report provides an estimate of efficiency improvements that have occurred since the last AWMP. *Table 51* identifies an implementation schedule, finance plan, and budget allotment for EWMPs implemented by the District. Although the District does not explicitly budget for each EWMP, it does maintain an annual budget for capital improvements and general operations. The District has identified the type of District Staff that is responsible for implementing each EWMP and has also identified the type of funding that supports implementing the EWMP.

The 2016 Semitropic Operations Budget for capital improvements contains $3.2 million for direct capital expenditures and additional funding for general operations. The description of implemented EWMPs shown here is supplemented by a specific list of recent improvements made to Semitropic maintained canals and conveyance channels, in *Section I.A* of this plan.

Table 49. Report of EWMPs Implemented/Planned

EWMP No.*	Description	EWMP Implemented	EWMP Planned
Critical EWMPS			
1	*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.* **Description:** All deliveries to growers are metered at the farm turnout. Typical farm turnouts serve 160 acres although some serve areas as small as 20 acres. Water usage is reported to growers in their monthly invoices. In this regard, the District has implemented a water accounting system (Water Information Management System) that enhances the District's ability to provide detailed and timely data on water usage. The District is committed to comply with the requirements of SBx7-7 by verifying the accuracy of measurement of irrigation water deliveries using the methodology described in Section VII of this report.	X	
2	*Adopt a pricing structure for water customers based at least in part on quantity delivered.* **Description:** The District charges water users based on the volume of water delivered.	X	
Conditional EWMPS			
1	*Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.* **Description:** The District will continue to support voluntary land retirement as a means of reducing local demands upon the groundwater basin. Since the early 2000's the District has acquired and retired more than 11,377 acres from irrigated agriculture. There are some lands within the District with drainage problems. Years ago, a study was performed of the so-called Jerry Slough area to evaluate the potential to extract relatively shallow groundwater for water supply benefits and to mitigate shallow groundwater conditions. The water supply that could be developed in this area was much less than the District envisioned; accordingly, the project was not pursued. In addition, as the irrigation application method was converted to drip, the deep percolation was reduced and the corresponding drainage problems reduced.	X	

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Table 49. Report of EWMPs Implemented/Planned

EWMP No.*	Description	EWMP Implemented	EWMP Planned
3	*Facilitate financing of capital improvements for on-farm irrigation systems.* **Description:** The District provides financial support to the local Resource Conservation District (RCD), which conducts on-farm testing regarding irrigation management practices. These services are available upon request to the Resource Conservation District, subject to their staffing capabilities. In addition, the District has received additional funding through the NRCS for conversion of on-farm irrigation systems to drip; $1M in 2011 and approximately $1M in 2015. Regarding conjunctive use improvements, the District has facilitated the construction of pipelines connecting landowner wells to the District's distribution/conveyance system. Typically, this has been done to allow District use of the well for conjunctive use and banking purposes when not needed for landowner purposes. District use is governed by an agreement with the given landowner.	X	
4	*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.* **Description:** Historically, the District sets the price of water such that it is competitive with the cost to produce groundwater, i.e., the District encourages the use of imported surface water supplies when they are available, so as to reduce groundwater pumping (which amounts to in-lieu recharge). Further, the District has policies in place which are designed to maximize its importation of surface water. In particular, the District will make non-contract water deliveries early in the year, before the year's water supply is "known", and will backstop these deliveries with pumped groundwater later in the year, if the water supply is short. District use of short-term price changes to non-contract lands are an additional element of the District's pricing policy. An objective of the pricing strategy is to maintain a long-term balance between groundwater and surface water use.	X	

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Table 49. Report of EWMPs Implemented/Planned

EWMP No.*	Description	EWMP Implemented	EWMP Planned
5	*Expand line or pipe distribution system, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.* **Description:** When originally constructed, the District's main conveyance facilities, all open canals, were unlined. However, over the years, the District has gradually installed concrete lining. Only a few miles of the Pond-Poso Canal are unlined, along with a portion of the District's Intake Canal which is in an area of historically shallow groundwater levels, i.e., seepage is probably not measurable in the shallow groundwater area. The District completed additional in-lieu distribution systems and canal conveyance improvements since the initial AWMP.	X	
6	*Increase flexibility in water ordering by, and delivery to, water customers within operational limits.* **Description:** The District's ability to operate on an on-demand basis is limited, inasmuch as the District's source of surface water, the State Water Project, does not provide flexibility to the District in the water that it orders and receives. In addition, the District has limited capacity in its distribution system to regulate mismatches in supply and demand. Nevertheless, during the off-peak period the District has sufficient control of water levels in its canals to provide some flexibility in water deliveries.	X	
7	*Construct and operate supplier operational outflows and tailwater recovery systems.* **Description:** The District operates three spillway basins, two located at the ends of canals to capture emergency spills and return this water to the distribution system and one on the intake canal that can be pumped back into the canal. As a result, there is no uncontrolled spillage into Poso Creek. Farm tailwater is handled by individual growers through their own on-farm tailwater recovery systems.	X	
8	*Increase planned conjunctive use of surface water and groundwater within the supplier service area.* **Description:** The District was originally based on conjunctive use of surface water and groundwater. Over the years, these conjunctive use practices have greatly expanded and now include providing water banking service to other agencies. The District continues to expand its conjunctive use practices by constructing distribution systems to deliver surface water to land otherwise reliant on groundwater for irrigation, thereby accomplishing in-lieu recharge.	X	

Table 49. Report of EWMPs Implemented/Planned

EWMP No.*	Description	EWMP Implemented	EWMP Planned
9	*Automate canal control structures.* **Description:** The District has upgraded its SCADA facilities to provide better measurement and control of water. The resulting increased reliability of water delivery will help the District and growers to reduce the use of pumps. Given the complex and variable nature of their operations, the District is not persuaded that fully automated operation of facilities would be effective; however, at this time water level control in District canals is adequate to provide operational flexibility during off-peak periods.	X	
10	*Facilitate or promote customer pump testing and evaluation.* **Description:** The District has installed water flow meters on all District-owned pumps, but does not allocate a portion of budget or capital for on-farm improvements. The District promotes testing of meters by external entities, is developing its own meter testing facility, and provides some minor services (e.g. video inspection) for wells.	X	
11	*Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.* **Description:** The function of Water Conservation Coordinator is performed by the District Engineer.	X	
12	*Provide for the availability of water management services to water users.* **Description:** The District provides water management services to customers that include maintaining a district website, maintaining an engineering and operations staff, and providing funding support for a mobile irrigation evaluation laboratory.	X	
13	*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.* **Description:** The District receives surface water from the SWP, contracted with KCWA, and is party to turn-in agreements and point-of-delivery agreements with DWR. The District occasionally receives "215 water" from Reclamation; however, the Friant San Joaquin River Settlement has affected the availability of this supply. The District has completed environmental documents that allows for banking, transfer, and exchange of available water supplies with neighboring districts with federal and state water contracts.	X	
14	*Evaluate and improve the efficiencies of the supplier's pumps.* **Description:** The District is investigating opportunities to replace the PG&E pump testing program that was previously terminated. The District owns and operates a well drilling rig and a well service rig.	X	
OTHER Optional EWMPs			

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Table 49. Report of EWMPs Implemented/Planned

EWMP No.*	Description	EWMP Implemented	EWMP Planned
1999 AWMC MOU A-4	*Improve communication and cooperation among water suppliers, users, and other agencies.* **Description:** The District cooperates directly with the Kern County Water Agency, is active in the Semitropic Groundwater Monitoring Committee, is the lead agency of the Poso Creek Integrated Regional Water Management Group, and is active in the Water Association of Kern County. Communication and cooperation among regional water suppliers are well established. It provides the on-going mechanism to build on established relationships and to enhance cooperation.	X	
1999 AWMC MOU B-4	*Facilitate voluntary water transfers.* **Description:** The District has supported the transfer of a landowner's SWP water from another district into the Semitropic; given they are a landowner in both districts, i.e., the water would be moved from the landowner's land in another district to the landowner's holdings in Semitropic. These transfers have been on a case-by-case and year-by-year basis and also require approval of KCWA. Semitropic has also allowed landowners to move their SWP water around within the District; however, this involves the same landowner moving water from one of his parcels in SWSD to another. Semitropic also allows landowners to use the District's conveyance system to wheel water within the District in the same manner.	X	

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Table 50. Report of EWMPs Efficiency Improvements

Corresponding EWMP No.*	EWMP	Estimated Water Use Efficiency Improvements That Occurred Since Last Report (December, 2013)	Estimated Water Use Efficiency Improvements 5 and 10 years in Future
1	Alternate Land Use	Prior to the 2013 Plan, the District converted 800 acres of irrigated land to spreading basins for use as a direct recharge and recovery facility. Since 2013, the District has retired 1,148 irrigated acres. Since early 2000's, District has retired over 11,377 irrigated acres.	District owns 960 acres of irrigated land that can be converted to spreading basins to add capacity to their direct recharge and recovery facility. The District is considering additional purchases of irrigated land to remove from production (i.e. retire irrigated lands) to reduce demand.
2	Recycled Water Use	In the past, limited opportunities existed for recycled water use within the District. Since 2013, a proposed project with the City of Delano is under consideration and other small scale project to reclaim and reuse naturally impaired groundwater are being considered.	The District will continue to look at small scale projects to reclaim and reuse naturally impaired groundwater. The District also plans to look into different technologies to "treat" water from bad WQ wells in the District, which may lead to a recycled water project.
3	On-Farm Irrigation Capital Improvements	In 2015, the District obtained over $1M for Growers to convert on-farm irrigation systems to drip through the NRCS EQIP program.	District will apply for grants to obtain funding for Growers to convert on-farm irrigation systems to drip through the NRCS EQIP program.
4	Implement an incentive pricing structure	The District has completed a 218 election to modify rate structure during the drought.	The District is evaluating payment for new water supply projects to offset reductions in surface supply from the SWP and from drought.
5	Infrastructure Improvements	District completed equipping existing wells to increase return capacity and added additional pumps, motors, and VFDs at strategic locations to reduce bottlenecks in conveyance.	District will continue to equip existing wells and add additional pumps, motors, and VFDs at strategic locations to reduce bottlenecks in conveyance. The District will add a turbine generator and solar facilities.
6	Order/Delivery Flexibility	Nothing to report.	Nothing to report.

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Table 50. Report of EWMPs Efficiency Improvements

Corresponding EWMP No.*	EWMP	Estimated Water Use Efficiency Improvements That Occurred Since Last Report (December, 2013)	Estimated Water Use Efficiency Improvements 5 and 10 years in Future
7	Supplier Operational Outflow and Tailwater Systems	Nothing to report.	Nothing to report.
8	Conjunctive Use	Prior to the 2013 update, the District added two in-lieu distribution systems in area that were served by groundwater only.	District may construct several additional in-lieu systems; systems X, Y, and Z plus add in-lieu systems where land is served by groundwater only.
9	Automated Canal Controls	District continues to complete improvements to SCADA system and link operations to water ordering.	District will continue to implement automated canal controls that allow staff to monitor operations and multi-task.
10	Customer Pump Test/Evaluation	N/A	N/A
11	Water Conservation Coordinator	District Staff assignment.	District will continue to support by assigning this responsibility to a District Staff person.
12	Water Management Services to Customers	District has maintained and improved communication with Growers during the drought.	District to consider additional water purchases and develop water supply projects to improve long-term water balance in-district.
13	Identify Institutional Changes	District utilized a recently completed environmental document with neighboring SWP, CVP, and Kern River Contractors that allows the districts to bank, transfer, and exchange surface water supplies for 25 years.	District to participate in developing regional groundwater management plans with neighboring districts in accordance with the State of California, Sustainable Groundwater Management Act.

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Table 51. Schedule to Implement EWMPs

EWMP No.[1]	Description	Implementation Schedule	Finance Plan	Budget Allotment[2]
Critical EWMPS				
1	Water Measurement	On-going service	Operations	District Staff Time
2	Volume-Based Pricing	On-going service	Operations	Management
1	Alternate Land Use	On-going service	Capital Improvement	Board Approved Opportunities
2	Recycled Water Use	To be considered	Capital Improvement	District Staff / Planning Funds
3	On-Farm Irrigation Capital Improvements	On-going service	Private or NRCS Funding	Grant Funded Opportunities
4	Incentive Pricing Structure	On-going service	Operations	District Staff
5	Infrastructure Improvements	Already Implemented and On-going service	Capital Improvement	District Staff and Grant Funded Opportunities
6	Order/Delivery Flexibility	Already Implemented	Operations	District Staff and SCADA Improvements
7	Supplier Operational Outflow and Tailwater Systems	Already Implemented	Operations	District Staff
8	Conjunctive Use	On-going service	Capital Improvement	District Staff and Grant Funding
9	Automated Canal Controls	Already Implemented	Operations	District Staff and SCADSA Improvements
10	Customer Pump Test/Evaluation	On-going service	Operations	District Staff
11	Water Conservation Coordinator	On-going service	Operations	District Staff
12	Water Management Services to Customers	On-going service	Operations	District Staff
13	Identify Institutional Changes	On-going service	Operations	Management
14	Supplier Pump Improved Efficiency	On-going service	Operations	District Staff
NA	Improve Communication Among Suppliers	On-going service	Operations	N/A
NA	Facilitate Voluntary Water Transfers	On-going service	Operations	N/A

[1] EWMP numbers correspond to Water Code §10608.48(c).
[2] The District has allocated a percentage of the annual budget to cover implementation of the EWMPs under the operations and capital improvements projects.

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B. Documentation for Non-Implemented EWMPs

Semitropic has chosen to implement each of the recommended EWMPs other than those categorized as being "Not Applicable". Non-implemented EWMPs are either considered 'technically infeasible' when considering district water management operations, or not 'cost-effective' as summarized in *Table* 52. None of the EWMPs are listed in this category.

Table 52. Non-Implemented EWMP Documentation

EWMP No.	Description			Justification/Documentation*
		Technically Infeasible	Not Locally Cost-Effective	

[1] EWMP numbers correspond to Water Code §10608.48(c).

Section VIII. Supporting Agricultural Water Measurement Regulation Documentation

A. Description of Water Measurement Best Professional Practices

Section 10608.48(b) of the California Water Code requires that agricultural water suppliers governed by this section of the code, "Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10" of the legislation. Further, 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."

Semitropic's ability to comply with these requirements rests on the fact that all irrigation deliveries made by the District are measured to support the District's volumetric water pricing to its customers. All District deliveries are made through piped turnouts, with the diameters of the pipes ranging between 6 and 14 inches. *Figure 10* is a photograph of a typical farm turnout from a District canal with a privately-owned well and District tie-in.

Figure 10. Typical Semitropic Irrigation Turnout

Deliveries at farm turnouts are measured with propeller flowmeters manufactured by Water Specialties. The propeller meters are mounted within the turnout piping following accepted engineering practices and measure flow rates and also record the total volume of water delivered.

Data on volumes of delivered water recorded by the District are updated on a daily basis. System operators enter water delivery readings into the District's water management software by selecting the appropriate turnout on their tablet and entering the reading from the water meter. The information is uploaded into the District's water management software daily and reviewed by a supervisor as a quality control procedure. Irrigated acreage is determined based upon an annual crop survey conducted each spring. These crop reports include information obtained directly from water users that identify the crop type, irrigation method and acreage. The irrigated acreage values are verified by checking the acreage identified in the Semitropic Assessor's Parcel Number database and are field confirmed by Semitropic field staff. As all turnouts at Semitropic deliver water to grouped acres, potentially more than one field, there is a direct correspondence to the size of a turnout and the number of acres served by that turnout.

Water delivery data are made available to water users whenever it is requested throughout the season, which enables irrigators to monitor their water usage. The District's billing system uses the pricing structure adopted by Semitropic's Board of Directors and the flowmeter readings at a given farm turnout to determine the water bill associated with District deliveries through that turnout.

B. Engineer Certification and Apportionment Requirement for Water Measurement

The methodology used to determine the individual device accuracy values found in Section 597.3(a) will be verified by a Professional Engineer using industry accepted standards. These methods will take into account the differential in water levels and/or fluctuations in the flow rate or velocity during the delivery event and the type, size and characteristics of the measuring device being verified.

Flow meters at each farm turnout measure District deliveries to each irrigator's place of use. The flow meter indicates the cumulative total of water delivered with the instantaneous flow rate calculated by an on-board "totalizer" device. In practice, meters are only repaired or replaced when a meter is observed to be malfunctioning or when a water user questions a meter's accuracy. In the latter case, if the questioned flow meter is tested and found to be within an acceptable accuracy then the water user must pay for the testing process. Conversely, the District will fund the process to repair or replace the flow meter if the flow meter is not within an acceptable accuracy range.

Semitropic plans to adopt a methodology for testing existing flow meters in a District Testing Facility and to present a report approved by a California-registered Professional Engineer as the basis for ongoing compliance with SBx7-7. The methodology is presented later in this section.

C. Documentation of Water Measurement Conversion to Volume

SBx7-7 requires an annual volumetric accuracy of within ±12 percent on existing devices. Since flow measurement devices at Semitropic include totalizers (which directly record cumulative flow volume), the devices' accuracy in measuring flow rates is representative of their ability to measure volumetric deliveries. Therefore, the discussion presented later in this section that relates testing the accuracy of measurement of flow rates applies equally to determination of the accuracy of measurement of volumes of delivered water.

D. Legal Certification and Apportionment Required for Water Measurement Lack of Legal Access to the Farm-gate

Semitropic staff has legal access to install, measure, maintain, operate and monitor measurement devices at all farm delivery points, also referred to as "farm-gates" within the District. Therefore 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.

E. Device Corrective Action Plan Required for Water Measurement

Semitropic has approved $20,000 per year in its Water Operations Budget program for this activity, including the budget allocation of $242,000 for construction of a Meter Testing Facility to assess and improve the accuracy of District flow meters and measurement devices. Semitropic will monitor this activity on an ongoing basis to determine whether or not this level of effort is sufficient and effective, and will make adjustments, as needed, in order to meet the compliance schedule. The time frame for compliance allowed in the regulation can be met with staff resources and the grant funding received to finish construction of the Meter Testing Facility.

Devices identified to have measurement accuracies that departed by more than ±12 percent from flows measured by the Testing Facility will be sent to the district shop for assessment. If the meter is older (i.e. installed over 20 years prior to test date) it will be replaced, otherwise the shop will make an attempt at repairing the meter. If the shop is not able to correct the inaccuracy in flow measurement, the device will be replaced. After installation in the field, the accuracy of repaired meters will be verified using a calibrated device, and an affidavit will be submitted by a California-registered Professional Engineer certifying the accuracy of each repaired meter to be within ±10 percent by volume. New replacement meters will be laboratory certified by their manufacturer prior to installation to have an accuracy measurement within ±6 percent by volume. Repair or replacement of these flow meters will be completed within three years of approval of this testing program by the DWR. If approved, the meter testing program is being scheduled to be completed along with other programs and projects that Semitropic is engaged in that are considered to be high priority such as distribution system maintenance, expansion of the Groundwater Banking Program, and other planned capital improvements.

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F. Farm Gate Measurement and Device Accuracy Compliance

SB7-7 requires that agricultural water suppliers measure the volume of water delivered to customers with sufficient accuracy to comply with certain standards described in the legislation. These standards are described below:

F1. Measurement Options at the Delivery Point or Farm-gate of a Single Customer

An agricultural water supplier shall measure the volume of water delivered at the delivery point or farm-gate of a single customer. If a device measures a value other than volume, for example, flow rate, velocity or water elevation, the accuracy certification must incorporate the measurements or calculations required to convert the measured value to volume. An existing measurement device shall be certified to be accurate to within ±12 percent by volume.

F2. Initial Certification of Device Accuracy

For existing measurement devices, the device accuracy shall be initially certified and documented by either:

a. *Field-testing that is completed on a random and statistically representative sample of the existing measurement devices. Field-testing shall be performed by individuals trained in the use of field-testing equipment and documented in a report approved by an engineer.*
b. *Field-inspections and analysis completed for every existing measurement device. Field-inspections and analysis shall be performed by trained individuals in the use of field inspection and analysis, and documented in a report approved by an engineer.*

F3. Protocols for Field Testing

Field-testing shall be performed for a sample of existing measurement devices according to manufacturer's recommendations or design specifications and following best professional practices. It is recommended that the sample size be no less than 10 percent of existing devices, with a minimum of 5, and not to exceed 100 individual devices for any particular device type. Alternatively, the supplier may develop its own sampling plan using an accepted statistical methodology.

If during the field-testing of existing measurement devices, more than one quarter of the samples for any particular device type do not meet the relevant accuracy criteria, the agricultural water supplier shall provide in its Agricultural Water Management Plan a plan to test an additional 10 percent of its existing devices, with a minimum of 5, but not to exceed an additional 100 individual devices for the particular device type. This second round of field-testing and corrective actions shall be completed within three years of the initial field-testing.

Field-inspections and analysis protocols shall be performed and the results shall be approved by an engineer for every existing measurement device to demonstrate that the design and installation standards used for the installation of existing measurement devices meet the relevant accuracy standards and that operation and maintenance protocols meet best professional practices.

F4. Semitropic WSD Program for Compliance with Water Measurement Requirements

SBx7-7 offers the water supplier the opportunity to "develop its own sampling plan using an accepted statistical methodology". Following completion of the meter testing facility described above, Semitropic plans to test all flow meters on a regular basis with the testing cycle initially focusing on the oldest meters active in the District and those delivering the largest volumes of water. Before adopting this testing program, the District will confirm with DWR that the program satisfies the requirements of SBx7-7.

The testing approach proposed by Semitropic responds to the condition that of the 1,116 total number of meters in the District, approximately 19 percent of them are over 20 years old. Due to their age, these meters are assumed to contain the flow meters most likely to be outside the acceptable ±12 percent accuracy limit imposed by SBx7-7. Therefore, rather than relying on a random selection of measurement devices, Semitropic proposes to begin their testing program by concentrating on the turnouts most likely to be out of compliance with the accuracy requirements of SBx7-7. Semitropic believes that selection of this stratified sample population will generate the greatest benefits with respect to improving measurement accuracy from operation of their new testing facility. The likely outcome would be a selection of 10 percent of the total number of turnouts from this population based on age, working from the oldest turnout moving towards the newest that represents the assumed lowest accuracy value from District turnout sampling. As noted above, the sampling design is to ensure the District tests and finds any problematic flow meters sooner than later in using the newly constructed in-District Meter Testing Facility.

To develop a methodology where the selected samples also account for the volume of water delivered, in effect the specific turnout size, the total number of samples assessed will be increased until the representative amount of each size is approximately equal. This may result in a selection of turnouts greater than 10 percent of the total number within the District. There are only four different sized flow meters used by the District, with only one meter per turnout.

A preliminary estimate indicates that, when accounting for turnout age and size as described above, at least 19 percent of the District's turnouts would likely be assessed to perform the compliance testing. The sequence of steps proposed to identify a representative population of turnouts for verification of flow measurement is as follows:

Step 1: *Formulate a list of meters* together with the relative age and volume of water supplied by each turnout (i.e. size of turnout, of four different sizes from Table 52).

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Step 2: *Select the set of oldest meters* that represents at least 10 percent of the total number of District turnouts. Once a particular device is selected, that device would be designated for testing and the numbers associated with that device will be withdrawn from the pool available for future selection. This procedure will be followed until devices that represent approximately 10 percent of the Semitropic turnouts and an approximately equal number of the four different sized turnouts are identified for testing.

This procedure improves upon the example given in §597.4(b)(1) of the legislation, in that devices representing the oldest turnouts will be selected for opportunity sampling or a preferred sample population rather than a simple random sample of devices that would have simply represented all functioning turnouts in the District. As stated above, this approach supports the purpose to find the turnouts with meters most likely to be outside an acceptable ±12 percent accuracy limit imposed by SBx7-7 by testing the older metered turnouts first.

Step 3: *Evaluate selected meters and record data*, at the District Testing Facility. Flow measurement devices at turnouts selected for testing in Step 3 will be evaluated by Semitropic for accuracy and measured accuracy will be retained for ten years or two AWMP cycles as per §597.4(c).

Step 4: *Determination of compliance.* Semitropic will estimate the annual volumetric accuracy of measurement of the selected sample of flow measurement devices. The District will expand their number of turnout samples if the accuracy is determined to be outside the limit imposed by SBx7-7 to determine the extent of any measurement issues. Non-compliant turnouts will be repaired or replaced by the District.

Section IX. List of Plan References

The following is a list of publications and documents referenced in the plan. They are listed in order of appearance.

a. California Code of Regulations; Title 23; Water; Division 2, DWR. Chapter 5.1 Water Conservation Act of 2009. Article 2. Ag Water Measurement

b. California Department of Water Resources. 2010. "The State Water Project Delivery Reliability Report 2009."

c. California Department of Water Resources. 2012. "A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan."

d. California Department of Water Resources. 2014. "The State Water Project Final Delivery Reliability Report 2013."

e. California Department of Water Resources. 2014. "The State Water Project Final Delivery Capability Report 2015."

f. California Water Code Section 20500. 1887. California Irrigation Districts Act.

g. Chung et al. California Department of Water Resources. 2009. "Using Future Climate Projections to Support Water Resources Decision Making in California."

h. Hanson, R.T.; Flint, A.L.; Flint, L.E.; Faunt, C.C.; Schmid, W.; Dettinger, M.D.; Leake, S.A.; and Cayan, D.R., 2010. "Integrated Simulation of Consumptive Use and Land Subsidence in the Central Valley, California, for the Past and for a Future Subject to Urbanization and Climate Change". Proceedings of the Eighth International Symposium on Land Subsidence (EISOLS).

i. Irrigation Training and Research Center. 2012. "SBx7 Compliance for Agricultural Districts."

j. Kern County Water Agency. 2008. "Water Supply Report: 2008"

k. Kern County Water Agency. 2013. "Consolidated Contract through Amendment No. 36", Dept. of Water Resources website. SWP A0 – Water Supply Contracts.

l. Kern River Watershed Coalition Authority. 2013. Memorandum for comments on Kern River Watershed Coalition Authority re-draft of "Waste Discharge Requirements General Order for Discharges from Irrigated Lands within the Central Valley Region for Dischargers not Participating in a Third-Party Group." (November 2012 Draft).

m. Luedeling, E; Zhang, M; Girvetz, E.H., July 2009. "Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950-2099". PLoS ONE 4(7).

n. Poso Creek Integrated Regional Water Management (IRWM) Group. Adopted 2007. "IRWM Plan (Poso Creek IRWMP)."

o. Semitropic Water Storage District. 2005. "Consolidated Rules and Regulations for Distribution of Water in the Semitropic Water Storage District."

p. Semitropic Water Storage District. 2012. "2012 Groundwater Management Plan."

q. United States Geological Survey. Fact Sheet 2009-3074. September 2009. “Effects of Climate Variability and Change on Groundwater Resources in the United States”.
r. Water Resources Research, Vol. 48, 2012. “A Method for Physically Based Model Analysis of Conjunctive Use in Response to Potential Climate Change”.

Appendix A. Public Hearing Notice - Proof of Public Hearing

1101 Central Avenue, P.O. Box 8043, Wasco, California 93280-0877

Telephone: (661) 758-5113 Bakersfield: (661) 327-7144
Facsimile: (661) 758-3219 Email: mail@semitropic.com
Website: www.semitropic.com

January 20, 2016

Kern County Water Agency
1121 L Street, Suite 810
Sacramento, CA 95814

RE: Semitropic Water Storage District, 2015 Agricultural Water Management Plan – Public Hearing Notice

To Whom it May Concern:

The Semitropic Water Storage District (WSD) is scheduled to hold a review and public comment period on the proposed 2015 update to the Semitropic WSD Agricultural Water Management Plan (AWMP) from January 20, 2016 through February 10, 2016.

A public hearing is scheduled to be held at 2:00 PM on February 10, 2016 at the Semitropic WSD office located at 1101 Central Avenue, Wasco, CA 93280. At the hearing, the Semitropic WSD Board will receive public comments on the draft 2015 AWMP and will consider adoption of the 2015 AWMP. All persons interested in this matter should appear at the public hearing to comment, or submit written comments as described below.

The 2015 AWMP includes a discussion of Semitropic WSD 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. Copies of the draft plan are available for review at the Semitropic WSD office and the District website (www.semitropic.com).

Any comments prior to the hearing should be submitted to:

Semitropic Water Storage District
1101 Central Avenue
Wasco, CA 93280

Any specific questions regarding the draft 2015 AWMP or the adoption processes should be directed to (661) 758-5113 or mail@semitropic.com.

Sincerely,

Jason Gianquinto
General Manager

Letter Recipients (*as per Table 1 of Draft AWMP*):

- Kern County Water Agency
- California Dept. of Water Resources
- County of Kern
- City of Wasco
- City of Lost Hills
- Shafter-Wasco ID
- North Kern WSD
- Buena Vista WSD
- Kern-Tulare WD
- Cawelo WD
- Rosedale-Rio Bravo WSD
- Delano-Earlimart ID
- Southern San Joaquin MUD

PROOF OF PUBLICATION

RECEIVED
FEB 08 2016

The BAKERSFIELD CALIFORNIAN
P.O. BOX 440
BAKERSFIELD, CA 93302

SEMITROPIC WATER STGE & BNKNG
P.O. Box 8043
WASCO, CA 93280

Ad Number:	14059812	**PO #:**	S.W.S.D.
Edition:	1TBC	**Run Times**	2
Class Code	Legal Notices		
Start Date	1/20/2016	**Stop Date**	1/27/2016
Billing Lines	34	**Inches**	204.95
Total Cost	$ 419.86	**Account**	1SEM05
Billing Address	SEMITROPIC WATER STGE & BNK P.O. Box 8043 WASCO,CA 93280		

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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: 1/20/16
1/27/16

ALL IN YEAR 2016

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

Myana Lorence

DATED AT BAKERSFIELD CALIFORNIA FEB 04 2016

Solicitor I.D.: 0

First Text
PUBLIC HEARING NOTICENotice is hereby gi

Ad Number 14059812

PUBLIC HEARING NOTICE

Notice is hereby given that the Semitropic Water Storage District (SWSD) will hold a public hearing on:
February 10, 2016 at 2:00 P.M.

Regarding:

2015 Agricultural Water Management Plan

The Water Conservation Act of 2009 requires certain agricultural water suppliers in California to prepare Agricultural Water Management Plans (AWMP). Executive Order B-29-15 required an AWMP to include detailed drought management plans, as well as the quantification of water supplies and demands for 2013, 2014, and 2015. To meet the requirements of this legislation, SWSD is updating the AWMP. The AWMP includes a discussion of SWSD and its irrigation facilities, water supply and demand, and various planning in the coming years. The SWSD Board of Directors will hold a hearing to consider public comments on the proposed 2015 AWMP.

A copy of the 2015 AWMP may be reviewed at the SWSD office (1101 Central Avenue, Wasco, CA 93280) or on the District's website (www.semitropic.com). Written comments, submitted prior to the hearing should be directed to:

Jason Gianquinto
Semitropic Water Storage District
1101 Central Avenue, ~~Shafter,~~ Wasco CA 93280

Comments may also be provided at the hearing.

If you have questions regarding the AWMP, please contact Jason Gianquinto at (661) 758-5113.

January 20, 27, 2016
14059812

Appendix B. Resolution of AWMP Adoption

BEFORE THE BOARD OF DIRECTORS OF
SEMITROPIC WATER STORAGE DISTRICT ON BEHALF OF IT'S SELF
AND SEMITROPIC IMPROVEMENT DISTIRCT

IN THE MATTER OF: **RESOLUTION NO. ST 16-01**

ADOPTION OF 2015 AGRICULTURAL WATER MANAGEMENT PLAN UPDATE

WHEREAS, the Semitropic Water Storage District completed an Agricultural Water Management Plan (AWMP) in 2006 pursuant to the Agricultural Water Suppliers Efficient Water Management Practices Act of 1990, AB 3616. The District completed a 2013 AWMP Update in accordance with the requirements of the Water Conservation Bill of 2009 (SBx7-7) and approved by the California Department of Water Resources (DWR). The District prepared a 2015 AWMP Update to comply with Executive Order B-29-15; and

WHEREAS, this AWMP update conforms to the revised framework presented in A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan issued by the California Department of Water Resources (DWR) in June, 2015 to aid water suppliers in preparing Agricultural Water Management Plans; and

WHEREAS, the requirements in SBx7-7 and in the Executive Order B-29-15 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; and

WHEREAS, included in Section VII of this plan is a listing of the efficient management practices which have been implemented or planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the District completed their last AWMP update in 2013, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future; and

WHEREAS, the District is an authorized local agency and may therefore adopt and implement such an agricultural water management plan; and

WHEREAS, the District's consultant prepared a 2015 Agricultural Water Management Plan Update at the direction of the District Board; and

WHEREAS, a public hearing was held on February 10, 2016, to consider adoption of the proposed 2015 Agricultural Water Management Plan Update and no comments were submitted nor formal protests were submitted on such proposal; and

WHEREAS, the Board believes that the adoption of the proposed 2015 Agricultural Water Management Plan Update 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 2015 Agricultural Water Management Plan in accordance with the Executive Order B-29-15, as prepared by the District's consultant.

(3) The Board hereby authorizes the officers and staff of the District to execute all documents and take any other action necessary or advisable to carry out the purpose of this resolution.

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

AYES: Directors Fabbri, Portwood, Thomson, Toretta, Tracy, Waterhouse and Wegis

NOES: None

ABSTAIN: None

ABSENT: None

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 9th day of March 2016.

WITNESS my hand and seal of said Board of Directors this 9th day of March 2016.

[SEAL]

Assist. Secretary of the Board of Directors

Appendix C. Notification Letters for AWMP Copies Sent

1101 Central Avenue, P.O. Box 8043, Wasco, CA 93280-9419

Telephone: (661) 758-5113 Bakersfield: (661) 327-7144
Facsimile: (661) 758-3219 E-mail: mail@semitropic.com
Website: www.semitropic.com

March 14, 2016

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 Semitropic Water Storage District's 2015 Agricultural Water Management Plan.

Please direct any questions to Jason Gianquinto, General Manager, at (661) 758-5113, or by email to jgianquinto@semitropic.com.

Sincerely,

Jason Gianquinto
General Manager

Enclosed: Electronic copy of the AWMP and all applicable documentation is being delivered by email to: cslgps@library.ca.gov

1101 Central Avenue, P.O. Box 8043, Wasco, CA 93280-9419

Telephone: (661) 758-5113 Bakersfield: (661) 327-7144
Facsimile: (661) 758-3219 E-mail: mail@semitropic.com
Website: www.semitropic.com

March 14, 2016

Agricultural Water Use Efficiency
Department of Water Resources
Statewide Integrated Water Management
Water Use and Efficiency Branch
Attn: Sabrina Cook
901 P Street, Room 313A
Sacramento, CA 95814

Subject: Agricultural Water Management Plan submission

To Sabrina Cook:

Please find enclosed one hard copy of the Semitropic Water Storage District's 2015 Agricultural Water Management Plan. An electronic copy is being sent by email to agwue@water.ca.gov.

Please direct any questions to Jason Gianquinto, General Manager, at (661) 758-5113, or by email to jgianquinto@semitropic.com.

Sincerely,

Jason Gianquinto
General Manager

Enclosed: Hard copy of the AWMP and all applicable documentation

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Appendix D. DWR Agricultural Water Management Plan Checklist

Below is the plan checklist according to the DWR *Guidebook to Assist Agricultural Water Suppliers to Prepare a 2015 Agricultural Water Management Plan.*

AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Section I	1.4	AWMP Required?	10820, 10608.12
Sect. I-A1	1.4	At least 25,000 irrigated acres At least 10,000 irrigated acres	10853 Executive Order B-29-15
N/A	1.4	10,000 to 25,000 irrigated acres and funding provided.	10853
Section I	1.4	December 31, 2015 update July 1, 2016 2015 AWMP for agricultural water suppliers to 10,000 to 25,000 irrigated acres	10820(a) Executive Order B-29-15
Section I	1.4	5-year cycle update	10820(a)
Section I	1.4	New agricultural water supplier after December 31, 2012 – AWMP prepared and adopted within 1 year.	10820(b)
N/A	1.5, 5	USBR water management/conservation plan:	10828(a) Executive Order B-29-15
N/A	1.5, 5.1	Adopted and submitted to USBR within the previous four years, AND	10828(a)(1)
N/A	1.5, 5.1	The USBR has accepted the water management/conservation plan as adequate.	10828(a)(2)
	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
Sect. I-A	3.1 A	Description of previous water management activities.	10826(d)
Sect. I-B2	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)
Sect. I-B1	3.2 B.2	Was the proposed plan available for public inspection prior to plan adoption?	10841
Appendix 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
Appendix A	3.1 B.2	14 days notification for public hearing?	GC 6066
Appendix B	3.1 B.2	Two publications in newspaper within those 14 days	GC 6066
Appendix B	3.1 B.2	At least 5 days between publications? (not including publication date)	GC 6066

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AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Appendix 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
Sect. I-C	3.1 C.1	After hearing/equivalent notice, was the plan adopted as prepared or as modified during or after the hearing?	10841
Sect. I-B2	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)
Sect. I-B2	3.1 C.2	The department.	10843(b)(1)
Sect. I-B2	3.1 C.2	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	10843(b)(2)
Sect. I-B2	3.1 C.2	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	10843(b)(3)
Sect. I-B2	3.1 C.2	Any urban water supplier within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(4)
Sect. I-B2	3.1 C.2	Any city or county library within which jurisdiction the agricultural water supplier provides water supplies.	10843(b)(5)
Sect. I-B2	3.1 C.2	The California State Library.	10843(b)(6)
Sect. I-B2	3.1 C.2	Any local agency formation commission serving a county within which the agricultural water supplier provides water supplies.	10843(b)(7)
Sect. I-C	3.1 C.3	Adopted AWMP availability.	10844
Sect. I-C	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)
Sect. I-C	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
Section II	3.2	Description of the agricultural water supplier and service area including:	10826(a)
Sect. II-A1	3.2 A.1	Size of the service area.	10826(a)(1)
Sect. II-A2	3.2 A.2	Location of the service area and its water management facilities.	10826(a)(2)
Sect. II-A3	3.2 A.3	Terrain and soils.	10826(a)(3)
Sect. II-A4	3.2 A.4	Climate.	10826(a)(4)
Sect. II-B1	3.2 B.1	Operating rules and regulations.	10826(a)(5)
Sect. II-B2	3.2 B.2	Water delivery measurements or calculations.	10826(a)(6)
Sect. II-B3	3.2 B.3	Water rate schedules and billing.	10826(a)(7)
Sect. II-B4	3.2 B.4	Water shortage allocation policies. Drought Management Plan	10826(a)(8) Executive Order B-29-15
Section III	3.3	Water uses within the service area, including all of the following:	10826(b)(5)

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AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Sect. III-A	3.3 A	Agricultural.	10826(b)(5)(A)
Sect. III-B	3.3 B	Environmental.	10826(b)(5)(B)
Sect. III-C	3.3 C	Recreational.	10826(b)(5)(C)
Sect. III-D	3.3 D	Municipal and industrial.	10826(b)(5)(D)
Sect. III-E	3.3 E	Groundwater recharge.	10826(b)(5)(E)
Sect. III-F	3.3 F	Transfers and exchanges.	10826(b)(5)(F)
Sect. III-G	3.3 G	Other water uses.	10826(b)(5)(G)
Sect. IV-A	3.4 A	Description of the quantity of agricultural water supplier's supplies as:	10826(b)
Sect. IV-A1	3.4 A.1	Surface water supply.	10826(b)(1)
Sect. IV-A2	3.4 A.2	Groundwater supply.	10826(b)(2)
Sect. IV-A	3.4 A.3	Other water supplies.	10826(b)(3)
Sect. IV-B4	3.4 A.4	Drainage from the water supplier's service area.	10826(b)(6)
Sect. IV-B	3.4 B	Description of the quality of agricultural waters suppliers supplies as:	10826(b)
Sect. IV-B1	3.4 B.1	Surface water supply.	10826(b)(1)
Sect. IV-B2	3.4 B.2	Groundwater supply.	10826(b)(2)
Sect. IV-B3	3.4 B.3	Other water supplies.	10826(b)(3)
Sect. IV-C	3.4 C	Source water quality monitoring practices.	10826(b)(4)
Sect. IV-B4	3.4 B.4	Drainage from the water supplier's service area.	10826(b)(6)
Section V	3.5	Description of water accounting, including all of the following:	10826(b)(7)
Sect. V-A	3.5 A	Quantifying the water supplier's water supplies.	10826(b)(7)(A)
Sect. V-B	3.5 B	Tabulating water uses.	10826(b)(7)(B)
Sect. V-C	3.5 C	Overall water budget.	10826(b)(7)(C)
Sect. V-D	3.5 D	Description of water supply reliability.	10826(b)(8)
Section VI	3.6	Analysis of climate change effect on future water supplies analysis.	10826(c)
Section I	3.7	Water use efficiency information required pursuant to Section 10608.48.	10826(e)
Sect. VII-A	3.7A	Implement efficient water management practices (EWMPs).	10608.48(a)
Sect. VII-A	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)
Sect. VII-A	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)
Sect. VII-A	3.7 A.2	Implement additional locally cost-effective and technically feasible EWMPs.	10608.48(c)
Sect. VII-B	3.7 B	If applicable, document (in the report) the determination that EWMPs are not locally cost-effective or technically feasible.	10608.48(d)
Sect. VII-A	3.7 A	Include a report on which EWMPs have been implemented and planned to be implemented.	10608.48(d)

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AWMP Location	Guidebook Location	Description	Water Code Section (or other, as identified)
Sect. VII-A	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)
N/A	5	USBR water management/conservation plan may meet requirements for EWMPs.	10608.48(f)
Sect. VIII-D	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)
Sect. VIII-A	6 C	Description of water measurement BPP.	CCR §597.4(e)(2)
Sect. II-B2	6 D	Conversion of measurement to volume.	CCR §597.4(e)(3)
Section VIII	6 E	Existing water measurement device corrective action plan? (if applicable, including schedule, budget and finance plan)	CCR §597.4(e)(4)

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WATER STORAGE DISTRICT