

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

A. Water Supply Quantity

1. Surface Water Supply

Under its enabling legislation, the Kern County Water Agency (KCWA or Agency) was granted, among other things, the primary power to acquire and contract water supplies, and protect groundwater quality in Kern County. KCWA is a State Water Contractor and obtains water from the SWP for delivery to its 13 member districts (a.k.a., Member Units). BWSD is a California Water Storage District formed by interested landowners to provide a vehicle for construction, operation, and maintenance of an irrigation project. The District was formed on February 21, 1962, pursuant to Division 14 of the California Water Code, for the purpose of providing irrigation water from the State Water Project (SWP) to lands within the District. The contract between the District and the Agency was executed on October 4, 1966. After contract execution with the Agency, the District commenced water deliveries in 1968. The District's original contract amount was 163,000 AF.

Prior to construction of SWP, there was no land development except for oil fields. Agricultural activities were limited to sheep grazing on non-irrigated pasture.

BWSD's original 1967 Table A water supply contract with KCWA provided for an annual contract of 163,000 Acre-Feet (AF) of water. Since then, BWSD has permanently transferred a total of 41,492 AF of Table A contract water to other agencies. BWSD chose to transfer a portion of their Table A contract to reduce their SWP costs for a SWP contract supply that exceeded demand in BWSD. The District's annual Table A amount is currently 121,508 AF (water supply). Of the 121,508 AF of Table A water, 111,157 AF is under contract for agricultural use; 5,578 AF is under contract for industrial use and the balance, or 4,773 AF, is held for operational losses. The current water demands are approximately 125,000 AF per year. Presently, the water supply available to the District is inadequate to meet current and future water demands given a nearly 100% allocation from the State. No additional permanent transfers of Table A water outside BWSD are anticipated.

Table 31 shows the District's SWP Table A amounts and the actual allocations from DWR each year between 1979 and 2015. BWSD also has the ability to purchase water through various State and locally operated pools, several of which serve as important supplies for groundwater recharge. The availability of these supplies, however, has become scarcer over time.

Table 31. Surface Water Diversions (AF)		
SWP Diversions Year	District Table A Contract Water Amount	District Actual SWP Allocations
1979	116,800	116,800
1980	123,200	123,200
1981	129,800	129,800
1982	136,000	136,000
1983	140,800	140,800
1984	146,500	146,500
1985	150,600	150,600
1986	155,200	155,200
1987	158,500	158,500
1988	161,000	161,000
1989	162,400	162,400
1990	163,000	81,500
1991	163,000	0
1992	163,000	73,350
1993	163,000	163,000
1994	163,000	81,500
1995	163,000	163,000
1996	163,000	163,000
1997	147,508	147,508
1998	147,508	147,508
1999	143,508	143,508
2000	143,508	129,157
2001	123,727	48,254
2002	123,727	86,608
2003	123,727	111,354
2004	121,508	78,980
2005	121,508	109,357
2006	121,508	121,508
2007	121,508	72,905
2008	121,508	42,528
2009	121,508	48,603
2010	121,508	60,754
2011	121,508	97,206
2012	121,508	78,980
2013	121,508	42,528

2014	121,508	6,075
2015	121,508	24,302

Table 32. Surface Water Supplies (AF)							
Source	Diversion Restriction	Rep. Year 2012					Anticipated Changes
			2013	2014	2015		
Pre-1914 water rights	NA	0	0	0			
SWP Article 21 water	Delta BiOps	0	0	0			
SWP water contract	Delta BiOps	78,980	42,528	6,075	24,302		
Other imported surface water	Delta BiOps	25,781*	36,390	49,668	30,486		
Recovered banked groundwater**	NA	45,243	55,236	65,363	50,000		
Landowner transfers	NA	4,580	2,500	990	2,800		
Upslope drain water	NA	0	0	0			
Transfers /Exchanges***	NA	26,226	26,422	21,539	16,951		
Total		180,810	163,076	143,635			

Notes:
 * Includes 10,279 AF of water stranded in Lake Oroville because of BiOps and facility maintenance issues
 ** Recovered from projects located outside the district's boundaries
 *** Transfers/Exchanges in
 BiOps = Smelt and Salmon Biological Opinions
 Availability of Article 21 water will be limited by BiOps in the future.

Table 33. Restrictions on Water Sources			
Source	Restrictions*	Name of Agency Imposing Restrictions	Operational Constraints
SWP	ESA & Water Quality	NMFS & SWRCB	Restricted Delta Pumping
SWP	Facility maintenance	NA	Restricted Oroville and Delta exports

Notes:
 *ESA = Endangered Species Act protection measures
 *NMFS = National Marine Fisheries Service
 *SWRCB = State Water Resources Control Board
 *Water Quality restrictions relate to maintenance of Delta salinity standards.

2. Groundwater Supply

A few private groundwater wells have historically supplied limited amounts of water for blending with SWP water. This has become more common-place as the SWP reliability has decreased. No records are available of the quantity of water pumped, as these were private wells. The District does participate in the Berrenda Mesa and Pioneer groundwater-banking projects to supplement dry-year water supplies. Annually, the maximum amount BWSO can extract from both banking projects is about 15,000 AF. Currently, the District has banked a total of about 52,000 AF in these projects on behalf of Water Users and an additional 5,000 AF to cover operational losses (as previously mentioned above) in dry years when the District's annual water supply is not sufficient (from reduced allocations on the SWP). Both banking projects are operated and maintained by KCWA.

Table 34. Groundwater Basins			
Basin Name	Size (Sq. Mi.)	Usable Capacity (AF)	Safe Yield (AF/Yr)
BWSO portion of Kern sub-basin of Tulare Lake basin	152	Unknown and limited	Unknown and limited
Note: Area of main Tulare Lake Hydrologic Region: 5,149,000 acres = 8,045 sq. mi. Area of Kern County sub-basin: 1,950,000 acres = 3,047 sq. mi. (37.9% of Tulare Lake Hydrologic Region) Area of BWSO: 97,396 acres = 152 sq. mi. (5% of Kern County Sub-basin)			

Table 35. Groundwater Management Plan	
Written By	NA
Year	NA
Is Appendix Attached?	NA

Table 36. Groundwater Supplies (AF)								
Groundwater Basin	Diversion Restriction	Rep. Year 2012						Anticipated Changes
			2013	2014	2015	2016	2017	
Water Supplier Direct Pumping	None	0	0	0	0			
Private Pumping	None	0	0	0	0			
Transfers / Exchanges	None	0	0	0	0			
TOTAL		0	0	0	0			

3. Other Water Supplies

BWSD has no other water supplies besides those described before.

4. Drainage from the Water Supplier’s Service Area

The land serviced by BWSD does not have a subsurface drainage water problem. There are no on-farm subsurface tile drains (Table 37).

On-farm tail water (surface) drainage within the District is also minimal due to the use of pressurized irrigation systems. In the cases where on-farm tail water is generated, the water users typically contain it within the property. So, there are no drainage discharges from the District.

Table 37. Drainage Discharge (AF)								
Surface/ Subsurface Drainage Path	Rep Year 2012						End Use	Inside/ Outside Service Area
		2013	2014	2015				
Surface drainage	0	0	0	0				
Subsurface drainage	0	0	0	0				
Total	0	0	0					

B. Water Supply Quality

1. Surface Water Supply

There have been no water quality problems that limit the use of the SWP water within the District. The District does not monitor the surface water quality since all of the water delivered by the District is from the SWP. The DWR has an on-going monitoring program that monitors water quality in the Aqueduct on a monthly basis. The water is sampled at several locations along the Aqueduct and analyzed for electrical conductivity, standard minerals, selected trace elements and chemical residue. Table 38 presents historical water quality data for the months of January and June for the years 2010 through 2015. The water quality data shown in Table 38 was collected by DWR at Check 21 in the Aqueduct near Kettleman City, about 40 miles upstream of the District. TDS concentrations in the SWP water provided to BWSD generally ranges from 150 to 400 mg/L, suitable for agricultural use.

Table 38. Surface Water Supply Quality

Selected Laboratory Results													
Station Name/NR		CALIFORNIA AQU NR KETTLEMAN CK-21 (KA017226)											
		Sample Date											
Parameter	Units	01/12/10	06/15/10	01/18/11	06/14/11	01/17/12	06/19/12	01/15/13	06/18/13	01/14/14	06/17/14	01/20/15	06/16/15
Alkalinity as CaCO3	mg/L	78	76	47	40	77	73	72	72	89	93	95	92
Aluminum	mg/L	N/A	N/A	N/A	173,0.175*	0.077	0.092	0.124	0.048	r	r	0.015	r
Dissolved Ammonia	mg/L	0.04	0.01	0.05	<0.01	0.02	0.01	0.05	r	0.002	0.02	0.08	0.04
Dissolved Arsenic	mg/L	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.003	0.004	0.002
Arsenic	mg/L	N/A	N/A	N/A	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.003
Barium	mg/L	N/A	N/A	N/A	<0.05	0.039	0.033	0.033	0.037	0.031	0.026	0.045	0.039
Dissolved Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	r	r	r	r	r	r
Beryllium	mg/L	N/A	N/A	N/A	<0.001	<0.001	<0.001	r	r	r	r	r	r
Dissolved Boron	mg/L	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2
Cadmium	mg/L	N/A	N/A	N/A	<0.001	<0.001	<0.001	r	r	r	r	r	r
Dissolved Calcium	mg/L	22	21	15	12	22	20	22	22	25	25	26	25
Dissolved Chloride	mg/L	75	70	28	24	109	62	74	76	107	110	116	109
Dissolved Chromium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	r	r	r	r	r	r
Chromium	mg/L	N/A	N/A	N/A	0.001	0.003	0.001	r	r	r	r	r	r
Conductance (EC) µS/cm	µS/cm	496	449	259	223	630	426	474	469	624	648	671	645
Dissolved Copper	mg/L	0.002	0.002	0.008	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001
Copper	mg/L	N/A	N/A	N/A	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.002
Dissolved Hardness as CaCO3	mg/L	112	105	68	53	114	98	113	111	132	135	137	136
Dissolved Iron	mg/L	<0.005	<0.005	0.017	0.016	0.019	<0.005	0.034	r	0.005	r	r	r
Iron	mg/L	N/A	N/A	N/A	389,0.395*	0.131	0.12	0.14	0.08	0.017	0.017	0.017	0.023
Kjeldahl Nitrogen as N	mg/L	0.4	0.4	0.6	0.4	0.4	0.3	0.5	0.5	0.4	0.5	0.5	0.5
Dissolved Lead	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	r	r	r	r	r	r
Lead	mg/L	N/A	N/A	N/A	<0.001	<0.001	<0.001	r	r	r	r	r	r
Dissolved Lithium	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Magnesium	mg/L	14	13	8	6	15	12	14	14	17	18	18	18
Dissolved Manganese	mg/L	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	r	0.005	r	0.005	0.01	r
Manganese	mg/L	N/A	N/A	N/A	0.049,0.05*	0.014	0.021	0.007	0.015	0.008	0.015	0.023	0.017
Dissolved Mercury	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Molybdenum	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Nickel	mg/L	0.001	0.001	0.002	<0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001
Nickel	mg/L	N/A	N/A	N/A	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Dissolved Nitrate	mg/L	3.7	2.5	2.9	2.4	3.8	1.8	4.6	1.6	2.4	0.4	0.2	2
Dissolved Nitrate + Nitrite as N	mg/L	0.69	0.54	0.65	0.41	0.87	0.4	1	0.32	0.57	0.09	r	0.49
Dissolved Ortho-phosphate as P	mg/L	0.05	0.08	0.08	0.05	0.06	0.06	0.07	0.05	0.05	0.05	0.08	0.08
Phosphorus	mg/L	0.09	0.1	0.12	0.11	0.08	0.08	0.09	0.08	0.07	0.08	0.09	0.1
Dissolved Selenium	mg/L	0.001	0.001	0.001	<0.001	<0.001	0.001	r	r	0.001	0.001	0.001	0.001
Selenium	mg/L	N/A	N/A	N/A	<0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Silver	mg/L	N/A	N/A	N/A	<0.001	<0.001	<0.001	r	r	r	r	r	r
Dissolved Sodium	mg/L	52	50	24	21	68	46	56	54	76	80	79	71
Total Dissolved Solids	mg/L	275	274	151	124	347	236	270	261	345	367	370	357
Total Suspended Solids	mg/L	2	11	7	20	2	11	1	3	1	1	r	1
Volatile Suspended Solids	mg/L	1	<1	1	2	<1	3	r	1	1	r	r	r
Dissolved Strontium	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Sulfate	mg/L	42	43	26	25	45	35	44	40	52	52	47	52
Dissolved Zinc	mg/L	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	r	r	r	r	r	r
Zinc	mg/L	N/A	N/A	N/A	<0.005	<0.005	<0.005	0.005	r	r	r	r	0.007
pH		8	8.2	7.6	7.7	7.8	8.1	7.6	7.8	8.6	8.7	8	8.2

http://www.water.ca.gov/waterdatalibrary/waterquality/station_county/select_station.cfm?URLStation=KA017226&source=map

mg/L = milligrams per liter
µS/cm = microSiemens per centimeter

The SWP water quality is generally very good for irrigation purposes, although even good quality water contains some salt. The evapotranspiration (ET) process returns water to the atmosphere but leaves the salts behind in the soil. To avoid damaging buildup of salt in the crop root zone, water in excess of the crops' ET is required. The amount of excess water needed, known as the leaching requirement, varies with the crop, soil, climate and quality of the applied water and is used as an indicator of the minimum amount of water needed to flush salts from the root zone. Leaching, as described above, is minimal in the District even though native soils contain relatively high concentrations of naturally occurring salts.

2. Groundwater Supply

Groundwater quality has not been monitored on a consistent basis in BWS. The limited data and historical use indicate that the groundwater is saline. Total dissolved

solids (TDS) concentrations have ranged from 500 to over 6,000 mg/L. The groundwater quality of most wells in the District is not generally considered suitable for most agricultural applications unless it is blended with better quality water. By comparison, TDS concentrations in SWP water provided to BWSD generally ranges from 150 to 500 mg/L. In portions of BWSD, the groundwater also contains high boron and sulfate concentrations, which further reduces its suitability for agricultural purposes. Until recently, use of groundwater as a supplemental water supply was thought to be uneconomical. However, because recent reliability studies from DWR indicate reliable supplies on the SWP around 61% of Table A amounts, and given the tolerance of some crops, namely pistachios, to higher concentrations of salts in irrigation water, some landowners have blended a limited amount of groundwater with surface water to supplement their supplies. However, the viability of these sources as long-term supplies is still in question.

3. Other Water Supplies

Water transferred into the District and/or returned from banking projects has Aqueduct quality (because it is exchanged and conveyed in the Aqueduct).

4. Drainage from the Water Supplier’s Service Area

BWSD has no drainage water and therefore there are no drainage reuse effects.

C. Water Quality Monitoring Practices

1. Source Water

DWR conducts monitoring and maintains records of all water diversions, water quality, and storage operations related to the SWP. Operational reports are distributed weekly and monthly to the District and published annually in Bulletin 132. DWR maintains water quality standards for its downstream urban users (Metropolitan Water District of Southern California and Central Coast Water Authority).

DWR maintains an automated sampling station at Check 21 (just upstream from the District turnouts) that records electrical conductivity, water temperature, and turbidity on a daily basis. In addition, grab samples are taken on monthly intervals. Table 39 summarizes sampled constituents and sampling frequency.

Table 39. Water Quality Monitoring Practices			
Water Source	Monitoring Location	Measurement/ Monitoring Method or Practice	Frequency
Surface water	DWR California Aqueduct (Kettleman City) Check 21 Station KA017226	See DWR standards	DWR standards
Groundwater	NA		
Subsurface drainage water	Pond influent sumps and pond itself	Grab sampling of drainwater at influent sumps and evaporation pond	Quarterly

Table 40. Water Quality Monitoring Programs for Surface/Sub-Surface Drainage

Constituent	Units	Standard
Total Alkalinity as CaCO3	mg/L	Std Method 2320 B
Total Aluminum	mg/L	EPA 200.8 (T)
Dissolved Ammonia as N	mg/L	EPA 350.1
Dissolved Arsenic	mg/L	EPA 200.8 (D)
Total Arsenic	mg/L	EPA 200.8 (T)
Total Barium	mg/L	EPA 200.8 (T)
Dissolved Beryllium	mg/L	EPA 200.8 (D)
Total Beryllium	mg/L	EPA 200.8 (T)
Dissolved Boron	mg/L	EPA 200.7 (D)
Total Cadmium	mg/L	EPA 200.8 (T)
Dissolved Calcium	mg/L	EPA 200.7 (D)
Dissolved Chloride	mg/L	EPA 300.0 28d Hold
Dissolved Chromium	mg/L	EPA 200.8 (D)
Total Chromium	mg/L	EPA 200.8 (T)
Conductance (EC)	µS/cm	Std Method 2510-B
Dissolved Copper	mg/L	EPA 200.8 (D)
Total Copper	mg/L	EPA 200.8 (T)
Dissolved Hardness as CaCO3	mg/L	Std Method 2340 B
Dissolved Iron	mg/L	EPA 200.8 (D)
Total Iron	mg/L	EPA 200.8 (T)
Total Kjeldahl Nitrogen as N	mg/L	EPA 351.2
Dissolved Lead	mg/L	EPA 200.8 (D)
Total Lead	mg/L	EPA 200.8 (T)
Dissolved Lithium	mg/L	EPA 200.8 (D)
Dissolved Magnesium	mg/L	EPA 200.7 (D)
Dissolved Manganese	mg/L	EPA 200.8 (D)
Total Manganese	mg/L	EPA 200.8 (T)
Dissolved Mercury	mg/L	EPA 200.8 (Hg Dissolved)
Dissolved Molybdenum	mg/L	EPA 200.8 (D)
Dissolved Nickel	mg/L	EPA 200.8 (D)
Total Nickel	mg/L	EPA 200.8 (T)
Dissolved Nitrate	mg/L	EPA 300.0 28d Hold
Dissolved Nitrate + Nitrite as N	mg/L	Std Method 4500-NO3-F (28Day)
Dissolved Ortho-phosphate as P	mg/L	EPA 365.1 (DWR Modified)
Total Phosphorus	mg/L	EPA 365.4
Dissolved Selenium	mg/L	EPA 200.8 (D)
Total Selenium	mg/L	EPA 200.8 (T)
Total Silver	mg/L	EPA 200.8 (T)
Dissolved Sodium	mg/L	EPA 200.7 (D)
Total Dissolved Solids	mg/L	Std Method 2540 C
Total Suspended Solids	mg/L	EPA 160.2
Volatile Suspended Solids	mg/L	EPA 160.4
Dissolved Strontium	mg/L	EPA 200.8 (D)
Dissolved Sulfate	mg/L	EPA 300.0 28d Hold
Dissolved Zinc	mg/L	EPA 200.8 (D)
Total Zinc	mg/L	EPA 200.8 (T)
pH	pH	Std Method 2320 B

Source of data:

http://www.water.ca.gov/waterdatalibrary/waterquality/station_county/select_station.cfm?URLStation=KA017226&source=map