7.2 SURFACE WATER AND GROUNDWATER QUALITY (NEW)

7.2 SURFACE WATER AND GROUNDWATER QUALITY (NEW)

7.2.1 INTRODUCTION

7.2.1.1 Content

The proposed project analyzed in the Monterey Plus EIR was the Monterey Amendment and the Settlement Agreement. The Monterey Plus EIR considered five "elements" of the Monterey Amendment as follows:

- *Changes in the procedures for allocation of Table A water and surplus water among the SWP contractors;*
- *Approval to permanent transfers of 130,000 acre feet and retirement of 45,000 acre-feet of SWP long-term water supply contracts' Table A amounts;*
- *Transfer of property known as the "Kern Fan Element property" in Kern County;*
- *Water supply management practices; and*
- *Restructured water rates.*

This REIR has changed the description of the Kern Fan Element property transfer to be:

- *Transfer of property known as the "Kern Fan Element property" in Kern County and its development and continued use and operation as a locally owned and operated groundwater banking and recovery project.*

There are no revisions to the other elements of the Monterey Amendment or of the Settlement Agreement, and no changes have been made relating to them in this REIR. (See discussion in Introduction/Executive Summary.)

This REIR does not supersede the analysis of the Monterey Plus EIR but supplements the Monterey Plus EIR. The Monterey Plus EIR focused on the transfer of the KFE property, which was fully analyzed in the Monterey Plus EIR. This REIR did not identify any new impacts or changes to impacts caused by the transfer of the KFE property. Therefore, this REIR focuses on the development and continued use and operation of the KWB as a locally owned and operated groundwater banking and recovery project ("KWB activities").

The Monterey Plus DEIR Sections 7.1 and 7.2 identified potential impacts to surface water hydrology, water quality, and water supply, and groundwater hydrology and quality, respectively, as a result of the transfer of the Kern Fan Element. This section describes the potential impacts of KWB activities on surface water and groundwater water quality. It contains substantial new information developed specifically for this REIR. Consequently, this section replaces in their entirety those parts of DEIR Sections 7.1 and 7.2 relating to impacts of KWB activities on surface water and groundwater water quality.

In addition to the impacts discussed below, impacts of KWB activities on surface water and groundwater hydrology, including drainage modifications, alterations of groundwater levels and flow directions, and flood hazards, are analyzed in Section 7.1, Surface Water and Groundwater Hydrology.

Section 7.11, Hazards and Hazardous Materials, discusses hazards from past and present environmental contamination, pesticide use and residual agricultural chemicals, third-party oil and gas production, and other activities with the potential to release hazardous materials into the environment. Impacts related to construction-related erosion are analyzed in Section 7.9, Geology, Soils, and Mineral Resources.

7.2.1.2 Analytical Method

The geographic extent of the water quality analysis for the underlying groundwater aquifer extended beyond KWB Lands to the California Department of Water Resources (Department or DWR) Kern Water Bank Model (DWR KWB Model) boundaries as follows: northern edge, 6 miles; southern edge, 5.2 miles; eastern edge, 10 miles; and western edge, 7.7 miles. The analysis of impacts on local surface water quality includes the Kern River and associated channels and interties, and the following primary surface water conveyance facilities: California Aqueduct, Cross Valley Canal (CVC), and KWB Canal (Figures 7.2-1 and 7.2-2).

The following impacts were evaluated:

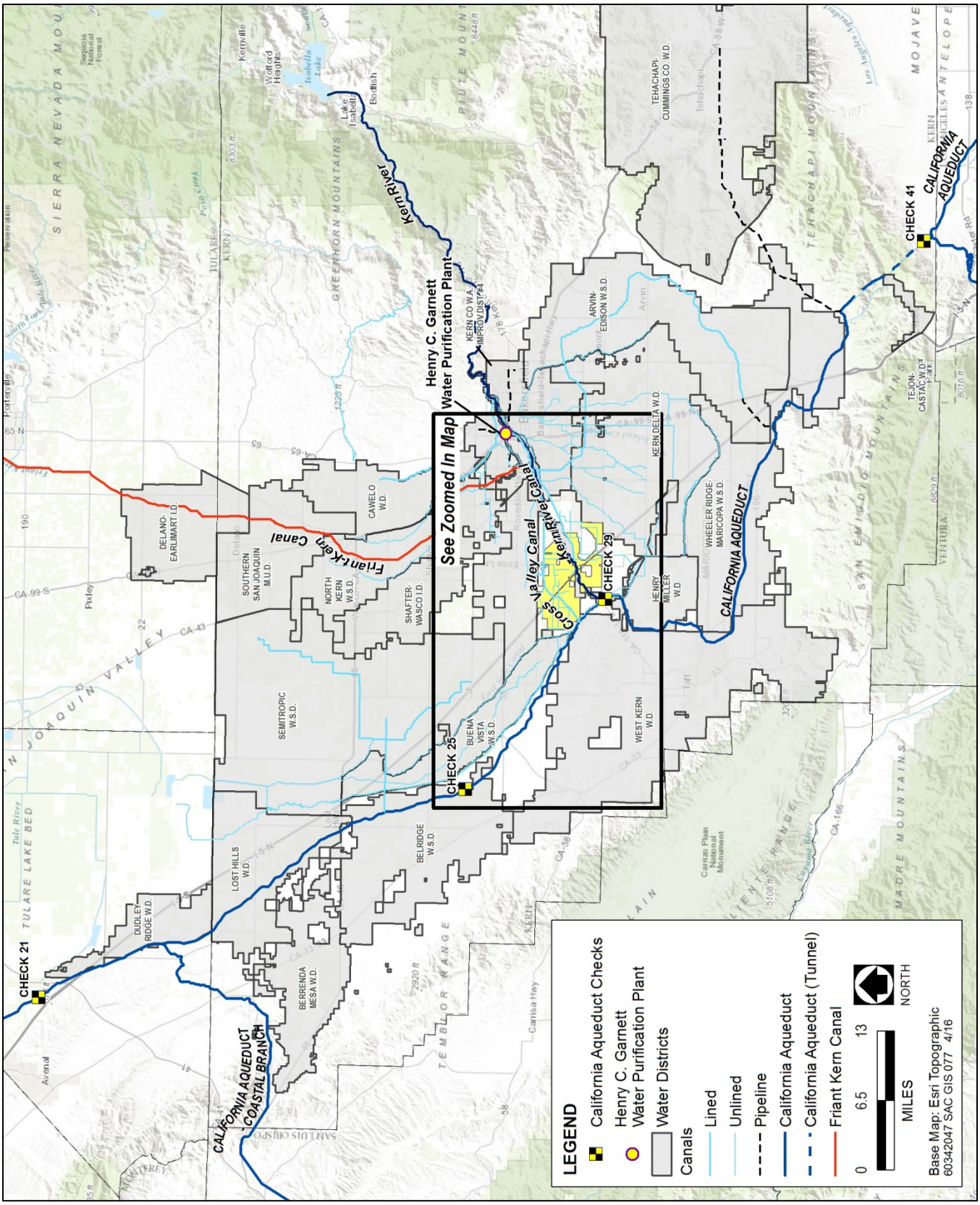
- construction and development of existing and future KWB facilities, as well as KWB continued use, operation, and maintenance (KWB activities);
- soil erosion, such as sediment transport into waterways during KWB activities;
- potential leaching of surface contamination to groundwater during KWB water recharge activities;
- water quality effects associated with recharging and recovering groundwater, including lateral and vertical migration of water quality constituents of concern (COC); and
- impacts on the water quality of drinking water supplies.

An assessment of water quality impacts was conducted in accordance with standard professional practices for EIRs. To examine the effects of KWB activities on surface water quality and groundwater quality, readily available historical water quality data were collected and analyzed. Water quality data for 1984–2015 were collected to identify possible water quality changes associated with KWB activities. A summary of the data collected for this analysis is presented in Appendix 7-3.

The COCs considered for the impact analysis were identified by the Kern Fan Monitoring Committee (KFMC) or recognized in the SWP Non-Project Water Acceptance Criteria, or both. These COCs were also included in the water quality objectives established in Article 19 of the long-term water supply contracts for SWP water, and for surface water quality objectives established in the *Water Quality Control Plan (Basin Plan) for the Tulare Lake Basin* (Tulare Lake Basin Plan). The applicable water quality criteria for each of these COCs are presented in Tables 7.2-1, 7.2-2, and 7.2-3.

Water quality data published in the KFMC operations and monitoring reports were used in this groundwater quality impact analysis.[1,2,3,4,5] Data sets used for the surface and groundwater quality analysis are presented in Appendix 7-3, and Table 7.3-1 in Appendix 7-3 includes a set of reference wells selected for this analysis which includes 121 wells (38 production or recovery wells and 83 monitoring wells). Additional KWB on- and off-site production and monitoring wells were also used to support aquifer zone specific and areal coverage, as needed.

The analysis was performed using data from the Kern County Water Agency (KCWA) groundwater quality monitoring database[6], and the KCWA pump-in blending operations data set. The analysis compared database results for reference wells and COCs exceeding Maximum Contaminant Levels (MCLs).



Source: Source: KWBA

FIGURE 7.2-1. Surface Water Conveyance Facilities in Kern Water Bank Area

The impact analysis for groundwater quality considered three aquifer zones for presenting results: shallow, middle, and deep. The three zones are: (1) an approximately 100- to 200-foot thick shallow unconfined zone located less than 300 feet below ground surface [bgs]; (2) a 250-foot thick semiconfined middle zone, the main water-producing zone located approximately 300–550 feet bgs; and (3) an approximately 350-foot thick semiconfined zone located approximately 550–900 feet bgs. These thicknesses are generally consistent with KFMC definitions, which in turn are generally consistent with the layering used in the DWR KWB Model (see Appendix 7-2). Note that some of the reference wells are screened across multiple zones, in particular the production wells.

This water quality analysis also includes a review of the 1995 environmental setting, impacts, and mitigation measures related to water quality presented in the 1997 Monterey Initial Study (IS) and Addendum (see Appendix 7-6a), and KWB operational criteria specified in the 1995 Kern Water Bank Memorandum of Understanding (1995 KWB MOU), KWB Interim Operations Plan, and KWB Long-term Operations Plan (see Appendices 7-5a, 7-5b, and 7-5c, respectively).

7.2.1.3 Standards of Significance

The following standards of significance are based in part on Appendix G of the California Environmental Quality Act (CEQA) Guidelines and the 1995 KWB MOU. For the purposes of this REIR, a significant impact related to surface water quality or groundwater quality would occur if KWB activities would:

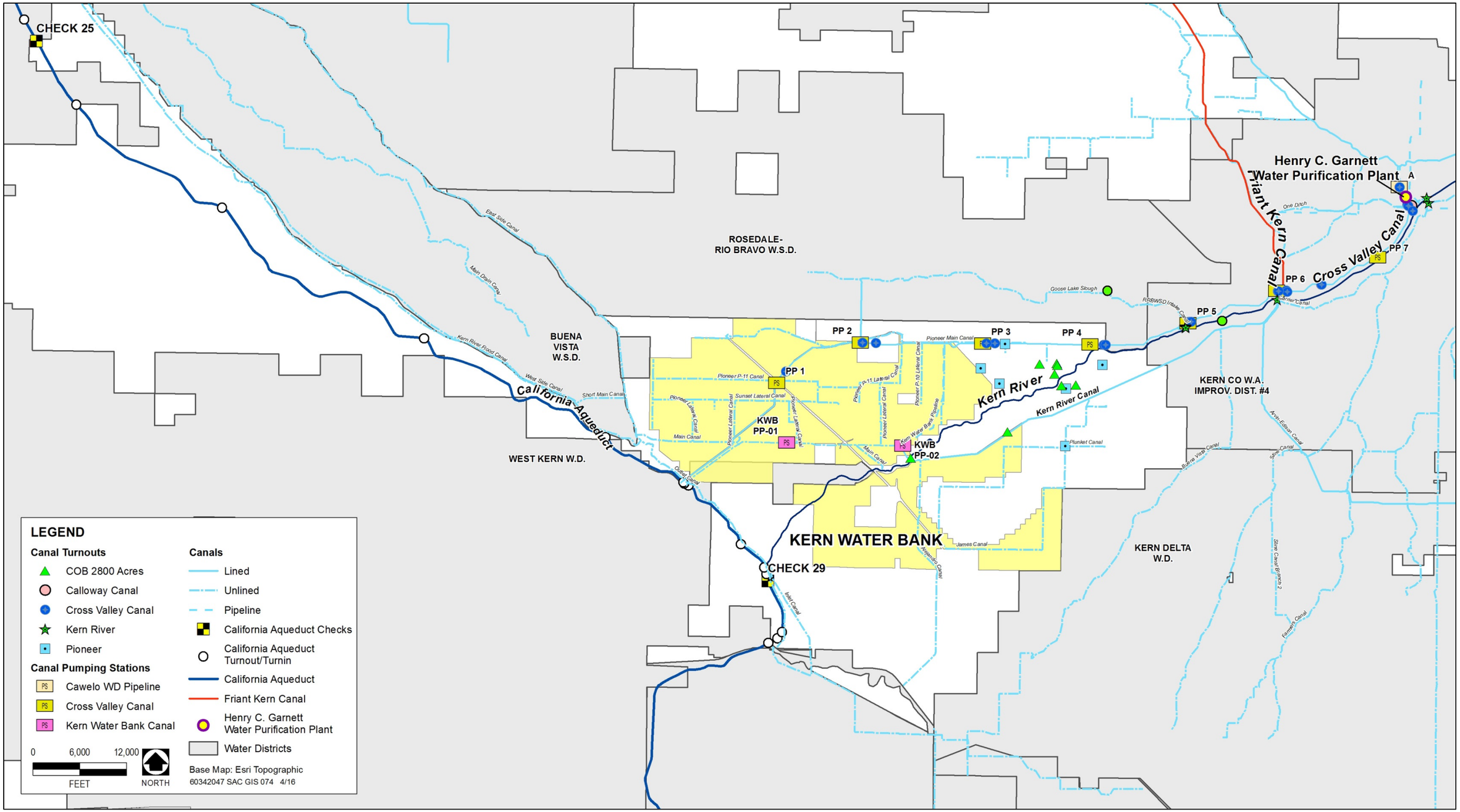
- substantially violate any water quality standards, policies, or waste discharge requirements (WDRs);
- create or contribute runoff water that would provide substantial additional sources of polluted runoff;
- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;
- substantially alter surface water quality in the California Aqueduct such that the Department's Non-Project Water Acceptance Criteria are not met;
- result in the substantial migration of areas of poor-quality groundwater within the underlying aquifer or mobilize surface contamination into an uncontaminated groundwater supply; or otherwise substantially degrade water quality or water supplies.

Substantial changes are defined as changes beyond those normally observed in historical records, and that are disproportionate to any documented information on surface water or groundwater in the basin. Poor water quality is defined as water that does not meet California Code of Regulations (CCR) Title 22 standards (see Table 7.2-1).

7.2.2 ENVIRONMENTAL SETTING

7.2.2.1 Physical Setting in 1995

The physical setting in 1995 is presented to provide background conditions at the start of KWB operations.



Source: KWBA

FIGURE 7.2-2. Surface Water Conveyance Facilities at the Kern Water Bank

TABLE 7.2-1

MAXIMUM CONTAMINANT LEVELS FOR SELECT CONSTITUENTS

Constituent of Concern	California Maximum Contaminant Level[1]	Detection Limit for Reporting	Reporting Units
Arsenic	10	2	µg/L
Barium (Ba)	1000	100	µg/L
Benzene	1	0.5	µg/L
Cadmium (Cd)	5	1	µg/L
Chlordane	0.1	0.1	µg/L
Chloride	250[2]		mg/L
Chromium (Total Cr)	50	10	µg/L
Chromium, hexavalent (Cr VI)	10	1	µg/L
Color, Apparent (Unfiltered)	15[2]		color units
Combined Ra 226 + Ra 228	5		pCi/L
Di(2-ethylhexyl)phthalate (DEHP)	0.004	0.003	mg/L
Dibromochloropropane (DBCP)	0.2	0.01	µg/L
Ethylene Dibromide (EDB)	0.05	0.02	µg/L
Fluoride (F) (Natural-Source)	2	0.1	mg/L
Foaming Agents (MBAS)	0.5[2]		mg/L
Iron (Fe)	300[2]	100	µg/L
Alpha	15	3	pCi/L
Manganese (Mn)	50[2]	20	µg/L
Methyl tert-Butyl Ether (MTBE)	13/5[2]	3	µg/L
Nitrate (as NO_3)	45	2	mg/L
Nitrate + Nitrite as Nitrogen (N)	10000	400	µg/L
Nitrite as Nitrogen (N)	1000	400	µg/L
Odor Threshold @ 60 C	3[2]	1	TON
Simazine (PRINCEP)	4	1	µg/L
Specific Conductance (E.C.)	900[2]		µmhos
Sulfate (SO_4)	250[2]	0.5	mg/L
Toluene	150	0.5	µg/L
Total 1,3-Dichloropropene	0.5	0.5	µg/L
Total Filterable Residue @ 180 C (TDS)	500[2]		mg/L
Toxaphene	3	1	µg/L
Turbidity, Laboratory	5	0.1	NTU
Uranium	20	1	pCi/L

Notes:

µmhos = micromhos; µg/L = micrograms per liter; pCi/L= picocuries per liter; mg/L = milligrams per liter; NTU = nephelometric turbidity unit; TON = threshold odor number

1. All MCLs are primary for drinking water unless noted otherwise. Primary MCLs are based on human health protection, while secondary MCLs are based on human welfare considerations (e.g., taste, odor, laundry staining).

2. Secondary MCL value shown is recommended consumer acceptance contaminant level.

Source: Regional Water Quality Control Board drinking water standards website, 2015.7

TABLE 7.2-2

STATE WATER PROJECT WATER QUALITY OBJECTIVES FOR THE CALIFORNIA AQUEDUCT

Constituent of Concern	Unit	Monthly Average	Average for any 10-year Period	Maximum
Total Dissolved Solids	ppm	440	220	
Total Hardness	ppm	180	110	
Chlorides	ppm	110	55	
Sulfates	ppm	110	20	
Boron	ppm	0.6		
Sodium Percentage	%	50	40	
Fluoride	ppm			1.5
Lead	ppm			0.1
Selenium	ppm			0.05
Hexavalent Chromium	ppm			0.05
Arsenic	ppm			0.05
Iron and Manganese together	ppm			0.3
Magnesium	ppm			125
Copper	ppm			3.0
Zinc	ppm			15
Phenol	ppm			0.001

Note:
ppm = parts per million

Source: California Department of Water Resources, Water Supply Contract Between the California Department of Water Resources and Kern County Water Agency, November 15, 1963

TABLE 7.2-3

STATE WATER PROJECT PUMP-IN CRITERIA FOR NON-PROJECT WATER IN THE CALIFORNIA AQUEDUCT

Metals, Minerals, and Others	2001 Policy Criteria Mean Concentrations, mg/L (1988 - 2001[1])	2012 Policy Criteria[2,3] Mean Concentrations, mg/L (1988 - 2011)
Aluminum	0.029	0.03
Antimony	0.005[4]	0.002
Arsenic	0.002	0.002
Barium	0.050[4]	0.05
Beryllium	0.001	0.001[4]
Bromide	0.21	0.22[2]; (0.10-0.41)[3]
Cadmium	0.004	0.003
Chromium	0.005[4]	0.004
Copper	0.005	0.004
Fluoride	0.09	0.1
Iron	0.049	0.037
Manganese	0.007	0.009
Mercury	0.0008	0.001
Nickel	0.002	0.001
Nitrate	3.5	2.9
Nitrate-Nitrite	0.6	NA
Nitrite	0.5	NA
Salinity (Specific conductance)	299-756[3,5]	NA
Selenium	0.001[4]	0.001
Silver	0.004	0.003
Sulfate	43	42
Total Organic Carbon	4	4.0[2] (2.7-7.0)[3]

TABLE 7.2-3

STATE WATER PROJECT PUMP-IN CRITERIA FOR NON-PROJECT WATER IN THE CALIFORNIA AQUEDUCT

Metals, Minerals, and Others	2001 Policy Criteria Mean Concentrations, mg/L (1988 - 2001[1])	2012 Policy Criteria[2,3] Mean Concentrations, mg/L (1988 - 2011)
Total Dissolved Solids	NA	157.3-372.9[3]
Zinc	0.009	0.007

Notes:

mg/L = milligrams per liter; NA – not applicable

1. Historical water quality conditions during 1988-2001 at O'Neill Forebay Outlet (mg/L)
2. Historical water quality conditions during 1988-2011 at O'Neill Forebay Outlet (mg/L)
3. Criteria are variable based on monthy averages for water year classifications: Wet, Near Normal (combined above and below normal), Dry and Critical.
4. These values represent reporting limits; actual values would be lower.
5. Historical salinity concentrations during 1979-2000 at O'Neill Forebay Outlet (us/cm)

Pesticides, herbicides, and synthetic organic chemicals are not detected in water samples at this location. Therefore, historical conditions are considered to be represented by less than detection levels for these compounds.

Source: California Department of Water Resources. 2001 and 2012 *Water Quality Policy and Implementation Process for Acceptance of Non-Project Water into the State Water Project*

Surface Water Sources

Major surface water sources and conveyance features in the vicinity of the KWB include the SWP's California Aqueduct, the Friant-Kern Canal, the Kern River, CVC, and the KWB Canal (see Figures 7.2-1 and 7.2-2). The three main sources of surface water banked at the KWB are the SWP's California Aqueduct, the CVP's Friant-Kern Canal, and the Kern River.

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. A main feature of the SWP is the California Aqueduct, which conveys water from the Sacramento-San Joaquin Delta (Delta) to San Luis Reservoir and O'Neill Forebay and subsequently south to Central and Southern California. The California Aqueduct provides SWP water to the KWB. In addition, recovered water from KWB banking activities is pumped into the California Aqueduct for water banking participants. The KWB Canal and the CVC transport water from the California Aqueduct to the KWB and other neighboring water banking projects. The KWB Canal and the CVC conveys recovered water to be pumped back into the California Aqueduct.

The CVP, operated by the U.S. Bureau of Reclamation (Reclamation), is one of the world's largest water storage and transport systems. The Friant-Kern Canal carries water from Millerton Lake to its terminus at the Kern River, 4 miles west of Bakersfield. The water serves Fresno, Tulare, and Kern Counties. The canal has an initial capacity of 5,000 cubic feet per second (cfs) that gradually decreases to 2,000 cfs at its terminus in the Kern River. CVP Friant Division water is provided to the KWB via the Friant-Kern Canal and other interconnecting canals.

The Kern River is one of the primary river courses in the southern portion of the Central Valley of California. The Kern River watershed extends high into the southern Sierra Nevada and drains roughly 2,400 square miles above the City of Bakersfield. Lake Isabella, which is formed by Lake Isabella Dam, is the main storage reservoir on the Kern River and is located approximately 35 miles northeast of the City of Bakersfield. The primary purpose of the dam and reservoir is to provide flood control. Lake Isabella also provides water for irrigation in the valley, which is diverted for consumption or groundwater recharge from the Kern River via numerous conveyance and diversion canals along the river. The Kern River experiences a high degree of annual and seasonal hydrologic variability, and flows are influenced by Lake Isabella operations and diversions. During certain times of the year, the Kern River may be dry

on and near KWB Lands. During high flow times, Kern River flows are conveyed to the Aqueduct at the Kern River Intertie located in Pool 29, which is above Check 29 at milepost 241.02.

There are many canals that distribute water throughout KWB Lands. The CVC conveys water from the California Aqueduct eastward for agricultural purposes, recharge, and to Improvement District No. 4 (ID4) and westward for groundwater recharge and recovery. The CVC's intertie with the California Aqueduct is located just upstream of Check 29.

Surface Water Quality

California Aqueduct

Table 7.2-4 summarizes the average concentrations of COCs from samples collected from the Aqueduct during 1995 at three checks located upstream (Check 21) and downstream from the vicinity of KWB (Checks 29 and 41) (see Figure 7.2-2 for locations). These data are from the monthly sampling program as reported in the Department's online water quality database.[8]

Concentrations of TDS in the Aqueduct are typically variable due to variations in Delta water quality as well as changes in pump-in and pump-out activities. The Department's objective for TDS is to not exceed a monthly average of 440 milligrams/liter (mg/L) (Table 7.2-4).

In 1995, background concentrations of arsenic, chloride, dissolved chromium, dissolved organic carbon, and sulfate in the Aqueduct at all three checks were below the relevant MCLs for these constituents. No sampling analyses are available for nitrate, nitrite, or uranium.

TABLE 7.2-4

1995 WATER QUALITY IN CALIFORNIA AQUEDUCT FOR CONSTITUENTS OF CONCERN

Station	Dissolved Arsenic	Dissolved Bromide	Dissolved Chloride	Dissolved Chromium	Dissolved Organic Carbon	Dissolved Nitrate	Dissolved Sulfate	Total Dissolved Solids	Uranium
Check 21									
Avg	0.002	0.15	48	<0.005	NS	NS	69	273	NS
Min	0.001	0.08	25	<0.005	NS	NS	25	139	NS
Max	0.002	0.25	109	<0.005	NS	NS	364	722	NS
Check 29									
Avg	0.002	NS	50	<0.005	NS	NS	51	239	NS
Min	0.001	NS	25	<0.005	NS	NS	24	141	NS
Max	0.003	NS	103	<0.005	NS	NS	107	417	NS
Check 41									
Avg	0.002	0.14	46	<0.005	0.1	NS	46	226	NS
Min	0.001	0.04	15	<0.005	NS	NS	18	103	NS
Max	0.003	0.32	97	<0.005	NS	NS	98	404	NS

Notes:
Data are in milligrams per liter (mg/L)
NS = No Sample
Source: DWR (2015)

Friant-Kern Canal

Water in the Friant-Kern Canal is considered to be of high quality because the water originates as snowmelt from the Sierra Nevada; however, similar to the California Aqueduct, non-CVP project water is pumped into the Friant-Kern Canal before it reaches the CVC and its terminus at the Kern River channel. Reclamation regulates water quality within the Friant Division through the *Baseline Water Quality Report for CVP.* All wells that participate in the Friant-Kern Canal Groundwater Pump-in Program are required to meet Reclamation's water quality requirements established in Reclamation's *Policy for Accepting Non-Project Water into the Friant-Kern and Madera Canals*.[9]

The KCWA Water Purification Plant (WPP) collects samples from the Friant-Kern Canal for water quality analysis annually to fulfill CCR Title 22 sampling and annual reporting requirements.

Kern River

Surface water in the Kern River is generally good quality; concentrations of arsenic, chloride, dissolved chromium, dissolved organic carbon, and sulfate are below the relevant MCLs for these constituents.[10] The KCWA WPP collects samples from the Kern River for water quality analysis annually to fulfill CCR Title 22 sampling and annual reporting requirements.

Groundwater Source

The KFE property is part of the Kern County Subbasin of the Tulare Lake hydrologic basin which comprises the southern half of the San Joaquin Valley bounded on the west by marine layers of the Coast Ranges and the east and south the by the Sierra Nevada, Tehachapi, and San Emigdios Mountains. The basin consists of deep depositional centers separated by a basement high near KWB Lands known as the Bakersfield Arch, located generally along the Kern River. Overlying the marine sedimentary rocks in the basin is a thick sequence of continental rocks and semi-consolidated to consolidated sediments. The Tulare Formation in the Coast Ranges to the west dips eastward under the alluvium in the KWB area and interfingers with the upper portion of the Kern River Formation in the subsurface. The upper portion of these formations and the overlying alluvium constitute the KWB, the developed part of which goes to depths of 700 to 900 feet bgs.

The hydrogeology as well as the groundwater at the KWB is dominated by the Kern River Fan, a large composite alluvial fan extending across the southern San Joaquin Valley from near Bakersfield to the Elk Hills. The hydrogeology in the western part of the KWB area contains material derived from marine sedimentary rock sources representing alluvial fan development with materials eroded from the Elk Hills. Local groundwater is also influenced by the Kern River as well as recent recharge water from the KWB. This recharge water displaces and mixes with local groundwater as it shifts back and forth in the groundwater system through variable recharge and recovery (pumping) conditions.

In general, east side source area rocks and sediments yield groundwater that exhibits lower TDS (100-300 mg/L) with major cations that include calcium (Ca) and magnesium (Mg), and the major anion hydrogen carbonate (HCO_3). West side source area rocks and sediments generally yield TDS up to several 1,000 mg/L with major cations including calcium and sodium (Na) and major anions including sulfate (SO_4) and chloride (CL). Between the eastside and west side groundwater, a more variable water type is found that is influenced by infiltration of excess irrigation or recharge activities and is generally higher in anions like sodium rather than cations like calcium.

Groundwater Quality

Groundwater quality in the vicinity of the KFE property was investigated by DWR in the late 1980s and early 1990s to establish generalized water quality and identify any areas of known and potential water

quality concerns.[11,12,13.] Early groundwater quality investigations were performed for standard minerals and minor elements, volatile organics, selected pesticides, and radiological parameters.

Of the constituents sampled in wells located on the KFE property, concentrations of TDS, sulfate, chloride, arsenic, boron, barium, and alpha/uranium were detected at concentrations above respective MCLs.[14,15,16] Elevated and/or detected concentrations of nitrate, petroleum hydrocarbons, and pesticides were also observed.[17,18,19,20] Additional data from 1990 to 1995 obtained from KCWA indicate that electrical conductance, an indicator of salinity and TDS, also had a seemingly widespread exceedance of the MCL across the KFE property.[21] Sampling data also indicated isolated exceedances of primary or secondary MCLs for benzene, cadmium, iron, manganese, EDB, and toxaphene.[22]

Areas of Water Quality Concern (1995)

KFMC previously delineated areas of elevated levels of total dissolved solids (TDS), fluoride, arsenic, ethylene dibromide (EDB), nitrate as NO_3, uranium, and dibromochloropropane (DBCP) on maps using historical data from approximately 1995 (Figure 7.2-3).[23]

Figure 7.2-3 depicts areas of water quality concern for selected constituents in the KWB region. The source of this figure is the Kern Water Bank Groundwater Monitoring Report from 1991 to 1993.[43] The majority of samples were from the shallow aquifer with the exception of arsenic and fluoride. COCs are discussed in the context of MCLs. A general discussion of areas of groundwater quality concern as shown on Figure 7.2-3 is summarized below and in Appendix 7.3.

Total Dissolved Solids: TDS is made up of inorganic salts as well as a small amount of organic matter. Common inorganic salts that can be found in water include cations (calcium, magnesium, potassium, and sodium) and anions (carbonates, nitrates, bicarbonates, chlorides, fluoride, and sulfates). In 1995, on the KFE property, concentrations were generally lower than the CCR Title 22 contaminant level of 500 mg/L MCL; however, there were several small areas that had concentrations exceeding 500 mg/L in an area located just east of the Elk Hills (near Tupman) with scattered areas in the northern and eastern part of the KFE property.

Fluoride: An area exceeding 1.4 mg/L was located south to southeast of the KFE property extending east and west of Interstate 5 (I-5).

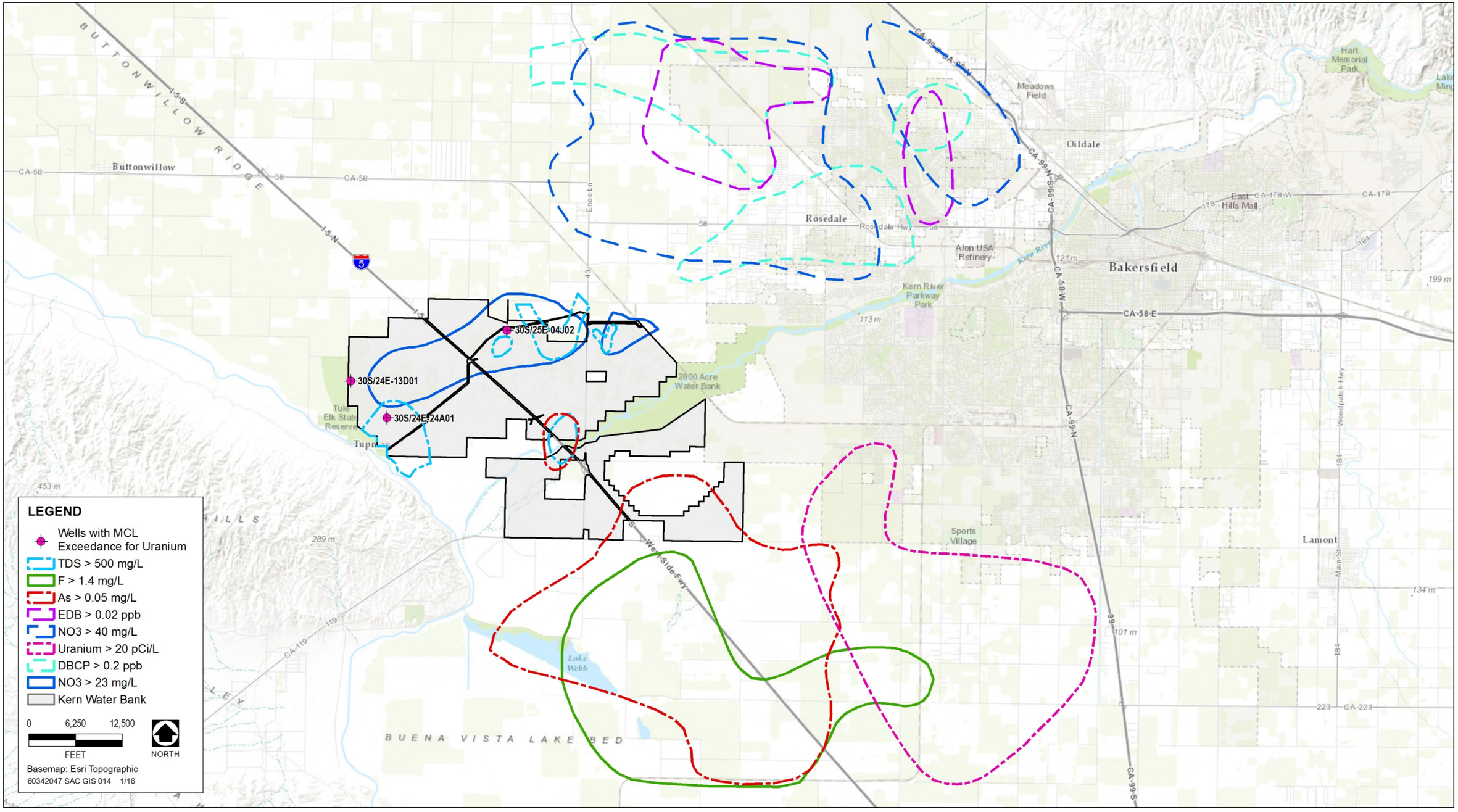
Total Arsenic: Areas exceeding 0.05 mg/L (i.e., 50 µg/L) were located along I-5 between the north and south portions of the KFE property (small area) with a larger area extending east and west of I-5 from the southern part of the KFE property southward.

EDB: 1,2-dibromo-3-chloropropane (EDB) areas of concern exceeding 0.02 µg/L were located northeast but well outside of the KFE property.

Nitrate as NO_3: Nitrate was not found above the MCL of 45 mg/L.

Uranium: Areas exceeding 20 pCi/L were located east-southeast of the KFE property.

DBCP: 1,2-Dibromo-3-chloropropane (DBCP) areas of concern exceeding 0.2 µg/L were located several miles to the northeast of the KFE property (but not within the KFE property).



Sources: DWR KFE Feasibility Study 1990 and Kern Water Bank Groundwater Monitoring Report 1991-1995[24]

Figure 7.2-3 Areas of Groundwater Quality Concern, 1995 and Prior, in the Kern Fan Area

7.2.2.2 Changes in Physical Setting from 1996 through 2014

Surface Water Quality

California Aqueduct

Table 7.2-5 summarizes the concentration range for COCs in water supplies recharged on KWB Lands from 1996 through 2014 for the three main surface water sources for KWB recharge.[25] The table also summarizes associated MCLs and drinking water standards.

TABLE 7.2-5

SUMMARY OF WATER QUALITY OF KWB SURFACE WATER SUPPLIES, 1996-2014

Water Source	Arsenic (ppb)	Bromide (ppb)	Total Chromium (ppb)	Chromium 6 (ppb)	Nitrate (ppm)	TDS (ppm)	DOC (ppm)	Sulfate (ppm)	Uranium (pCi/L)
California Aqueduct at Check 29	1-3	30-400	1-2	NS	0.4-4.2	92-269	NS	15-45	3.9-4.6
Friant-Kern Canal at KCWA WPP Pumping Plant	<2.0	<50	<2	<0.1	<0.4	20	3.2	2	0.4
Kern River at KCWA WPP Pumping Plant	3.0-4.6	64-100	<1	<0.1	<0.4	69-100	2.4-4.1	7.03-11	1.4-3.4
MCL[1]	10	NA	50	10	45	1000	NS	250	20
NL[2]	NA	1000	NA	NA	2	NS	NS	NS	NS
DLR[3]	2	NA	10	1	NA	NS	NS	NS	1

Notes:
ppm = parts per million; ppb = parts per billion; pCi/L = picocuries per liter; KCWA = Kern County Water Agency; WPP = water purification plant; NA = not applicable; NS = no standard set
1. MCL = Maximum contaminant level set by the State Water Resources Control Board Division of Drinking Water (SWRCB-DDW) as of March 3, 2015.
2. NL = Notification level set by the SWRCB-DDW as of February 4, 2015.
3. DLR = Detection limit for purposes of reporting set by the SWRCB-DDW as of March 3, 2015.
Source: Kern County Water Agency, 2015 KCWA Groundwater Quality Database

Table 7.2-6 compares COCs at upstream and downstream locations in the Aqueduct during wet and dry years. During wet years, surface water is diverted to the groundwater recharge facilities. During dry years, recovered groundwater is discharged to the Aqueduct.

Friant-Kern Canal

Water quality of the various local water supplies (i.e., SWP, CVC, Friant-Kern Canal, Kern River, and groundwater recovery) differs, so conveyance agreements, such as the CVC Operating Agreement, provide certain water quality protections. TDS or electrical conductivity (EC) is used as an indicator of salts.

The Henry C. Garnet Water Purification Plant, operated by ID4, samples water quality for the Kern River, the Friant-Kern Canal, and the SWP to fulfill CCR Title 22 sampling requirements. Table 7.2-5 summarizes the concentration range of constituents of concern (COCs) in these recharge water supplies.[26]

TABLE 7.2-6

COMPARISON OF WATER QUALITY CONSTITUENTS OF CONCERN IN THE CALIFORNIA AQUEDUCT

Station	Arsenic	Bromide	Chloride	Chromium	Total Organic Carbon	Nitrate as NO_3	Sulfate	Total Dissolved Solids
Recharge 2006; 2011								
Check 21								
Min	0.001	0.05	18	0.001	0.8	0.5	15	107
Max	0.003	0.24	82	0.002	5.7	4.4	45	290
Avg	0.001	0.11	36	01001	3.2	2.3	26	167
Check 29								
Min	0.001	0103	16	0.001	0.9	0.4	12	92
Max	0.003	0.40	80	0.002	5.7	4.2	45	269
Avg	0.002	0.11	33	0.001	3.3	2.1	24	156
Check 41								
Min	0.001	0.03	12	0.001	1.1	0.6	10	101
Max	0.003	0.22	81	0.003	5.0	4.5	47	281
Avg	0.001	0.10	33	0.001	3.3	2.3	2.5	158
Recovery 2008; 2014								
Check 21								
Min	0.001	0.19	69	0.002	2.3	0.2	33	279
Max	0.004	0.44	134	0.003	6.4	6.9	137	470
Avg	0.003	0.33	101	0.002	4.1	1.9	57	351
Check 29								
Min	0.002	0.18	41	0.001	0.6	0.4	32	231
Max	0.008	0.37	106	0.003	6.0	7.5	121	434
Avg	0.005	0.26	76	0.001	2.5	4.2	54	300
Check 41								
Min	0.003	0.18	41	0.001	0.8	101	40	261
Max	0.008	0.37	101	0.005	6.0	16.0	101	340
Avg	0.005	0.25	72	0.002	2.5	5.2	58	298

Notes:
Data in milligrams/liter (mg/L)
ND = Not detected
Source: KCWA (2015)

Kern River

Surface water quality in the Kern River, its tributaries, and streams from the Caliente Creek watershed is generally good. Concentrations of COCs in the lower Kern River were well below MCLs (see Table 7.2-5). Streams on the east side of the Tulare Lake Hydrologic Region generally exhibit excellent water quality.[27]

Groundwater Quality (1996 to 2014)

Following the transfer of the KFE property, a Kern Water Bank Groundwater Quality Monitoring Program was established in accordance with the 1995 KWB MOU and the Department's policy requirements for the introduction of non-project water into the California Aqueduct. The Program consists of sampling 57 dedicated monitoring wells and 85 recovery wells. Sampling is performed in accordance with a sampling plan and schedule established in collaboration with the KFMC and in accordance with the Department's policies for introducing non-project water into the California Aqueduct. KWB groundwater monitoring wells are sampled on an annual basis in accordance with the 1997 *Sampling Plan for Groundwater Monitoring for Kern Fan Monitoring Program*.[28] Recovery wells are sampled in accordance with the 2012 *Kern Water*

Bank Recovery Program Water Quality Monitoring Plan[29] prepared and approved by the Department and the SWP facilitation group to comply with DWR's Pump-In-Policy Tier 2 provisions. A more detailed description of the sampling program and associated schedule for sampling of specific constituents is provided in Appendix 7-1.

Groundwater quality sampling data are reported to KCWA and the KFMC for further evaluation, analysis, and determination of whether adverse impacts are likely to result from groundwater banking operations within the Kern County Subbasin, per the requirements of the 1995 KWB MOU. Water quality data are reported in Kern Fan Operations Reports that are required to be prepared by the KFMC on an annual basis. The most recent published KFMC operations report covers 2005-2006. However, groundwater data are available from KCWA through 2015.

KFMC previously delineated areas of groundwater quality concern in the Kern County Subbasin, which show elevated levels of total dissolved solids (TDS), fluoride, arsenic, ethylene dibromide (EDB), nitrate as NO_3, uranium, and dibromochloropropane (DBCP) on maps using historical data during1998-2009 (Figure 7.2-4).[6]

Figures 7.2-5 through 7.2-9 present a series of maps, one each for TDS, arsenic, nitrate as NO_3, alpha, and uranium, These five maps show wells which were sampled for the specific constituent from 1995 through 2014; one or more groundwater samples exceeding an MCL were shown with a red dot and samples below an MCL were shown with an open dot. It should be noted that wells with a red dot do not necessarily represent a persistent concentration of a given COC above an MCL (refer to time-concentration graphs for relative degree of persistence).

Figure 7.2-5 (TDS) shows the distribution of wells where one or more samples exceeded the secondary MCL of 500 mg/L during 1995 to 2015. Areas of elevated TDS are located on the west to southwest one third of the property extending from the Elk Hills eastward into the valley. A second area of elevated TDS is located in the northeastern portion of KWB Lands (30S/25E-sections 1, 11, and 12 and 30S/26E-section 6).

Figure 7.2-6 (arsenic) shows the distribution of wells where one or more samples exceeded the 10 µg/L MCL during 1995 to 2015. Arsenic has no clearly apparent pattern other than it appears to be more widespread at and east of I-5 in the deepest parts of the aquifer system during times of recovery.

Figure 7.2-7 (nitrate as NO_3) shows that only one well (shallow well 29S/25E-27N02) exceeded the NO_3 MCL of 45 mg/L. No wells sampled within KWB Lands exceeded the MCL.

Figure 7.2-8 (alpha) and Figure 7.2-9 (uranium) show the distribution of wells where one or more samples exceeded the MCL during 1995 to 2015. Alpha is distributed in a wide west-southeast to east-northeast band north of the Kern River. Uranium was not as frequently detected as alpha so the distribution is not as well-known but appears to generally follow the pattern of alpha.

Because these figures represent a broad overview of the 1995 to 2015 time period, they were used with other data sources, such as tables summarizing data sets and individual time-concentration graphs included in Appendix 7-3, to evaluate potential impacts and their significance.

Potential migration of COCs can be lateral as well as vertical with respect to groundwater flow vectors induced through recharge and recovery (pumping). This is complicated because of variable periods and magnitudes of recharge and recovery. While the general horizontal flow direction is radially outward during periods of recharge (associated with groundwater mounding), it is radially inward during periods of recovery (associated with cones of depression). Overall and based on groundwater modeling results presented in Section 7.1, Surface Water and Groundwater Hydrology, it appears that there is little overall lateral change in water quality as recharge water (typically of better quality than of existing groundwater) both displaces and mixes with existing groundwater.

Pump-in Program

As described previously, recovered KWB water is delivered to the California Aqueduct for subsequent delivery (or by exchange) to KWB participants. Water introduced into the Aqueduct is called "pump-in water." Pump-in water is produced from KWB recovery wells and introduced into turn-ins at the Aqueduct. Some surface conveyance facilities flow in either direction or, as in the case of the CVC and KWB Canal, are operated in two or more independent reaches. During periods of groundwater recovery, conveyance facilities could be carrying either water from its originally designated source or a blend of surface water and groundwater.

To protect water quality in the Aqueduct, KCWA has developed a blending model that calculates and tracks changes to water quality that result from various surface water and groundwater blending operations on a daily basis. Modeling results are also used to forecast water quality changes for pump-in proposals. Water quality COCs included in the blending models for the KCWA pump-in programs include arsenic, bromide, chromium (total and hexavalent), sulfate, nitrate, TDS, DOC, and uranium.

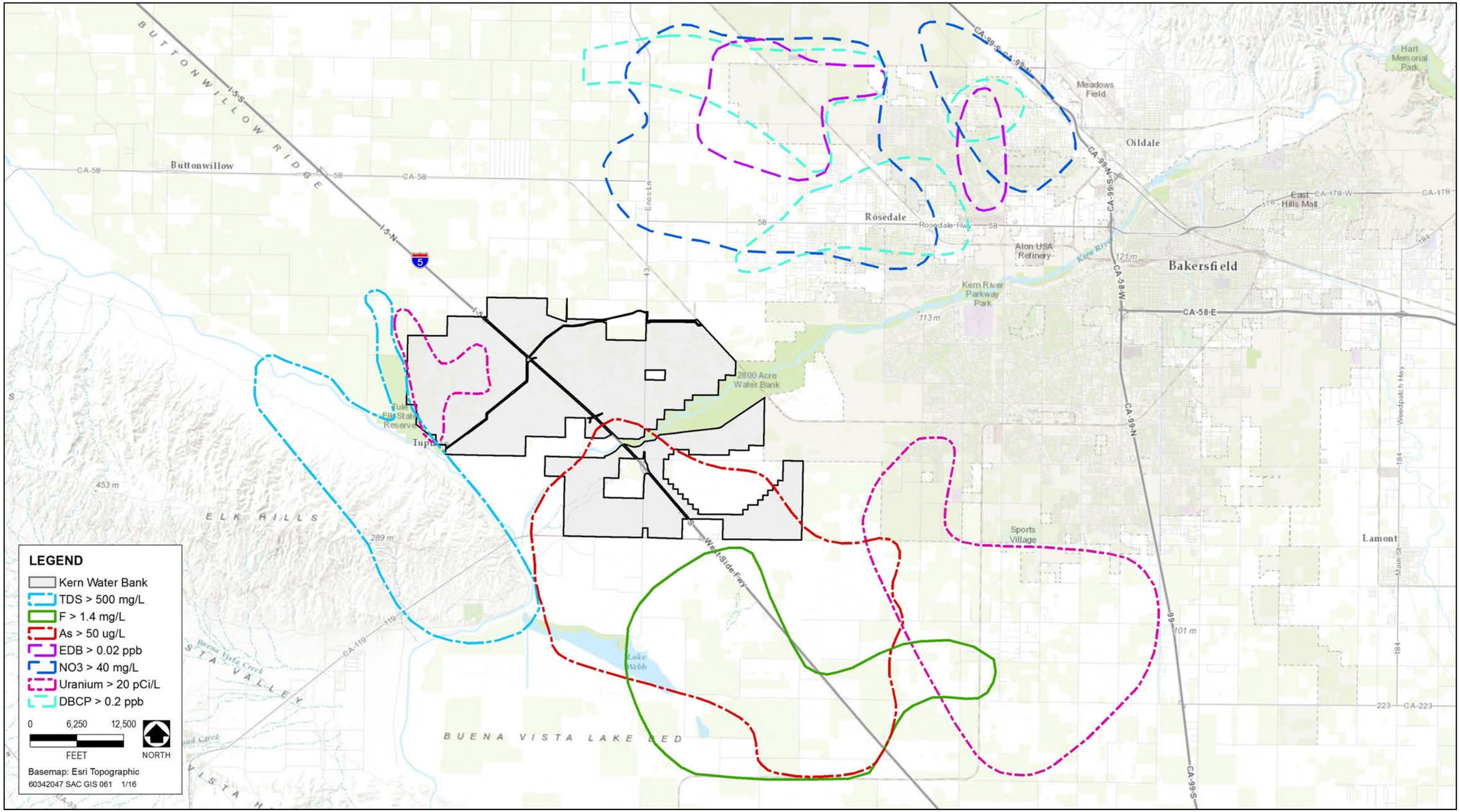
A station near Kettleman City at Check 21 of the Aqueduct is used as a background station for assessing water quality changes resulting from downstream pump-ins. Table 7.2-7 lists several districts/facilities that pump in water to the Aqueduct and the associated nearby check structures that are used for water quality sampling by the Department.

TABLE 7.2-7

CALIFORNIA AQUEDUCT PUMP-IN FACILITY LOCATIONS AND NEAREST UPSTREAM SAMPLING SITES

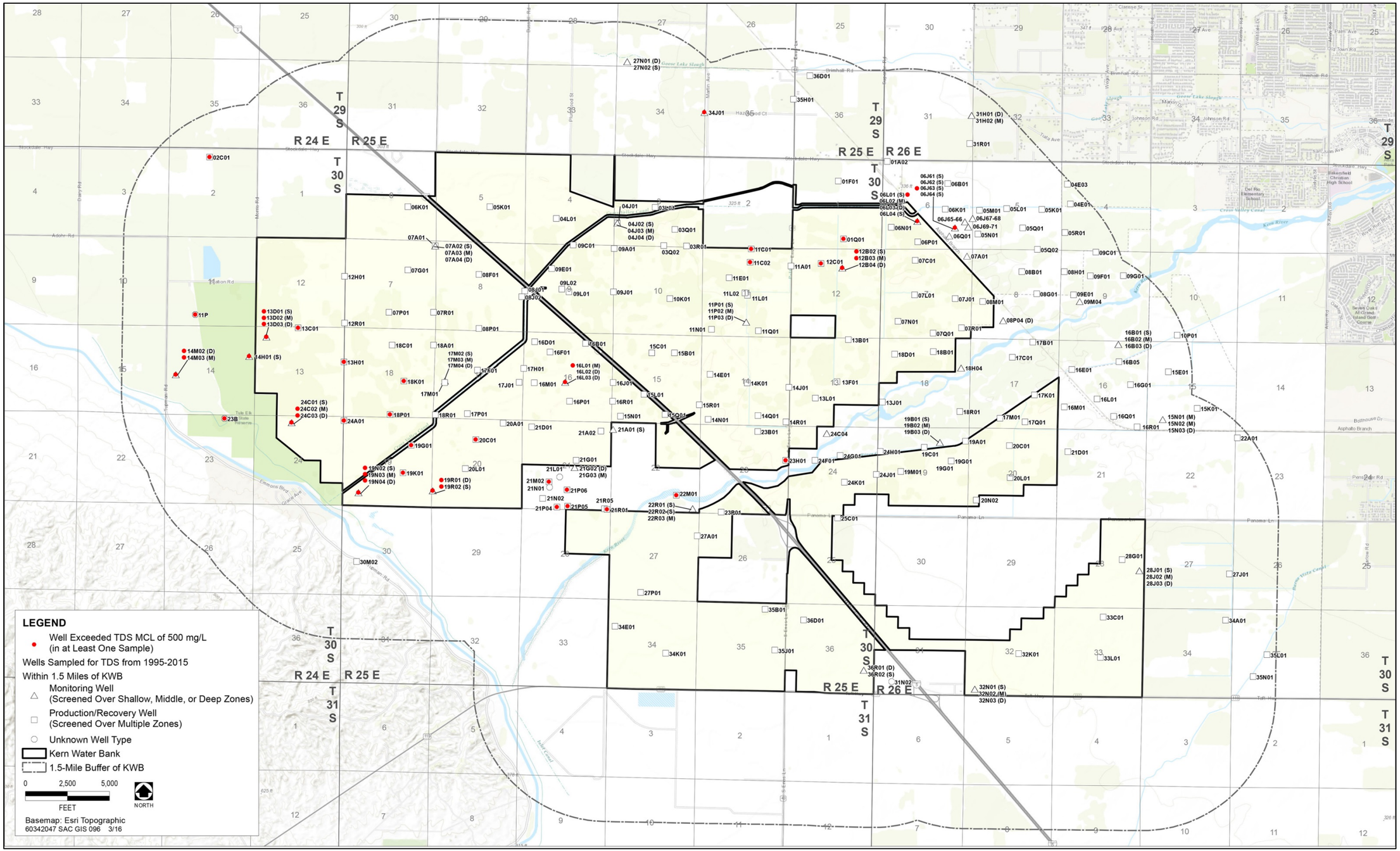
Agency/Facility Pumping In	Pump-in Facility Location		Upstream Sampling Site
Semitropic Water Storage District 3	Between Check 23 and Check 24	Milepost 206.99	Check 21 and Check 23
Semitropic Water Storage District 2	Between Check 24 and Check 25	Milepost 209.80	Check 21, Check 23, and Check 24
Cross Valley Canal	Between Check 27 and Check 28	Milepost 238.04	Check 25, Check 27, and Tupman Road
Kern Water Bank Canal	Between Check 28 and Check 29	Milepost 238.19	Check 25, Check 27, and Tupman Road
West Kern Water District	Between Check 28 and Check 29	Milepost 240.20	Cole's Levee
Wheeler Ridge–Maricopa Water Storage District	Between Check 29 and Check 40 at the Edmonston Pumping Plant	Various Mileposts	Check 29 and State Route 119
Arvin-Edison Water Storage District	Check 34 and Check 35 at the Teerink Pumping Plant	Milepost 277.30	Check 29 and State Route 119

Source: DWR 2014[30]



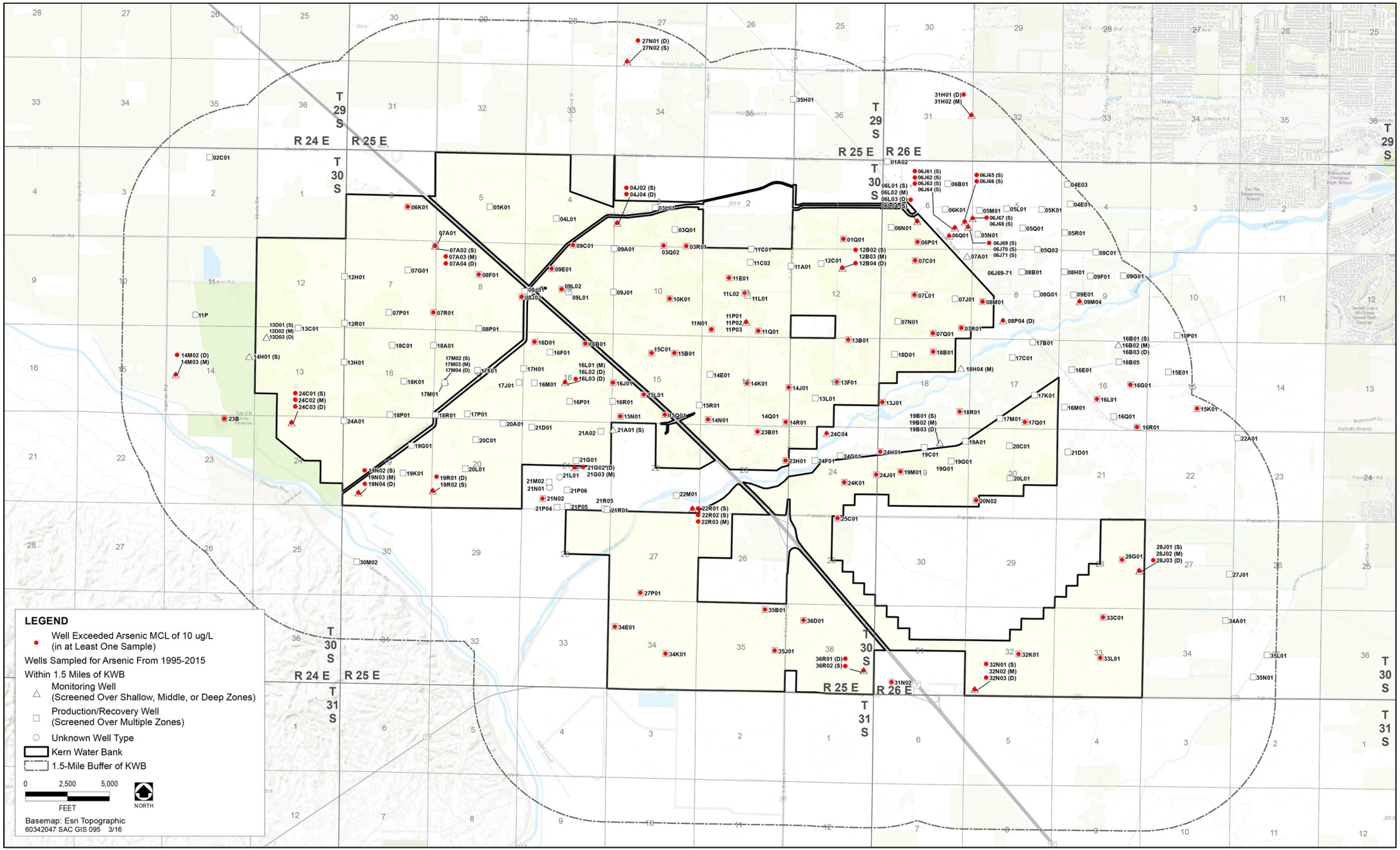
Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-4. Map Published in the Kern Fan Monitoring Committee Report as Areas of Groundwater Quality Concern, 1998 to 2006



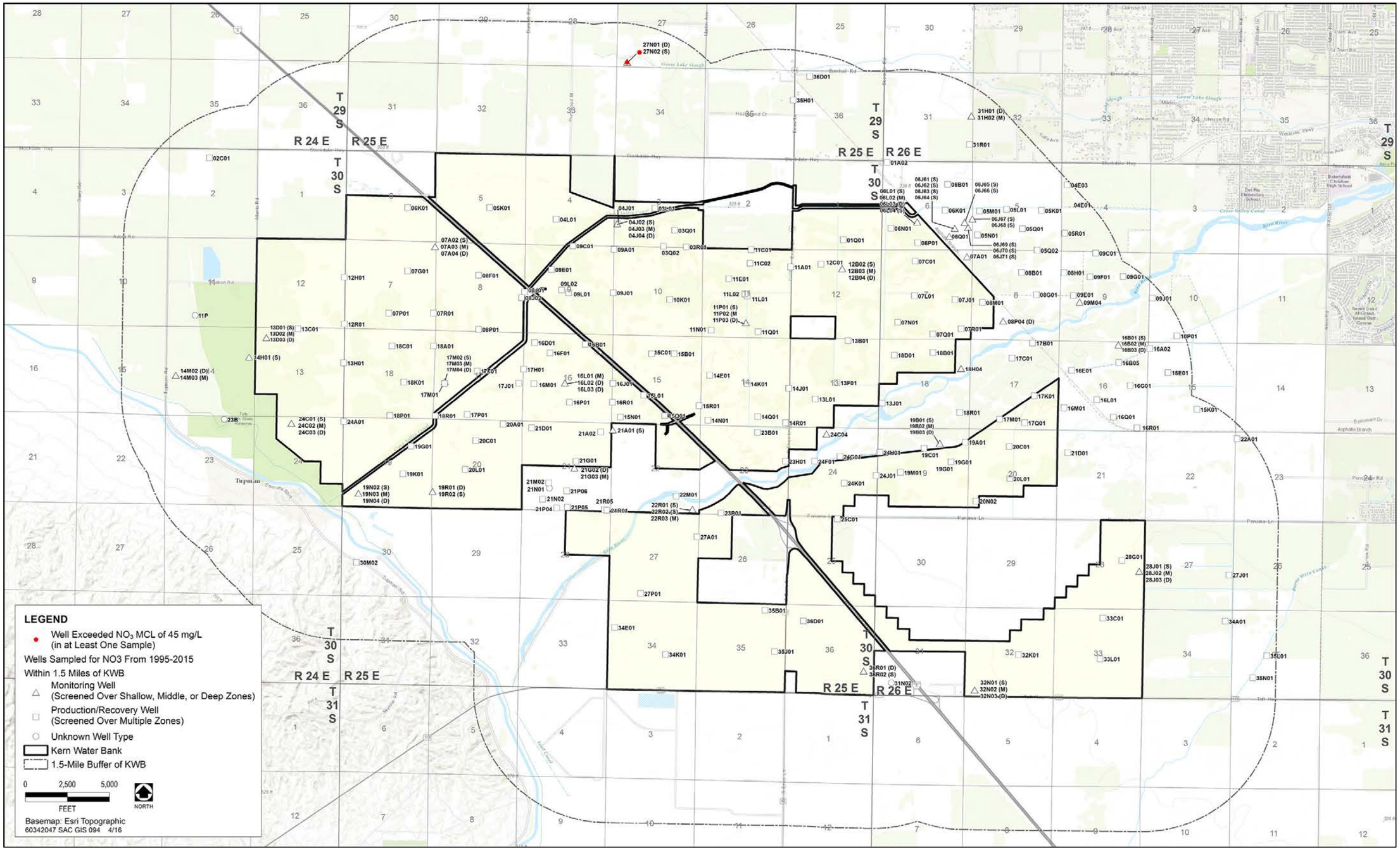
Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-5. Wells Sampled for Total Dissolved Solids, 1995 to 2015



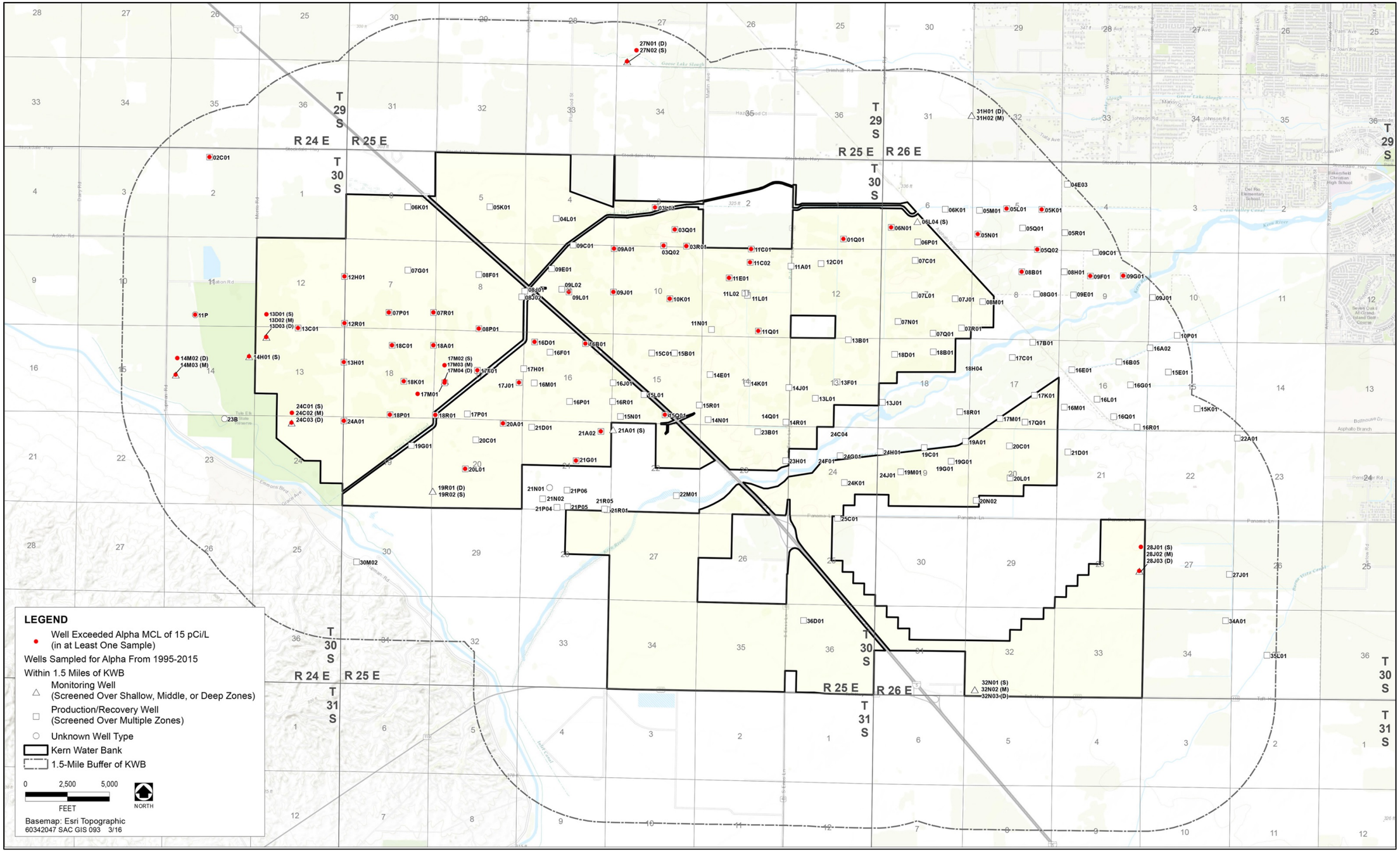
Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-6. Wells Sampled for Arsenic, 1995 to 2015



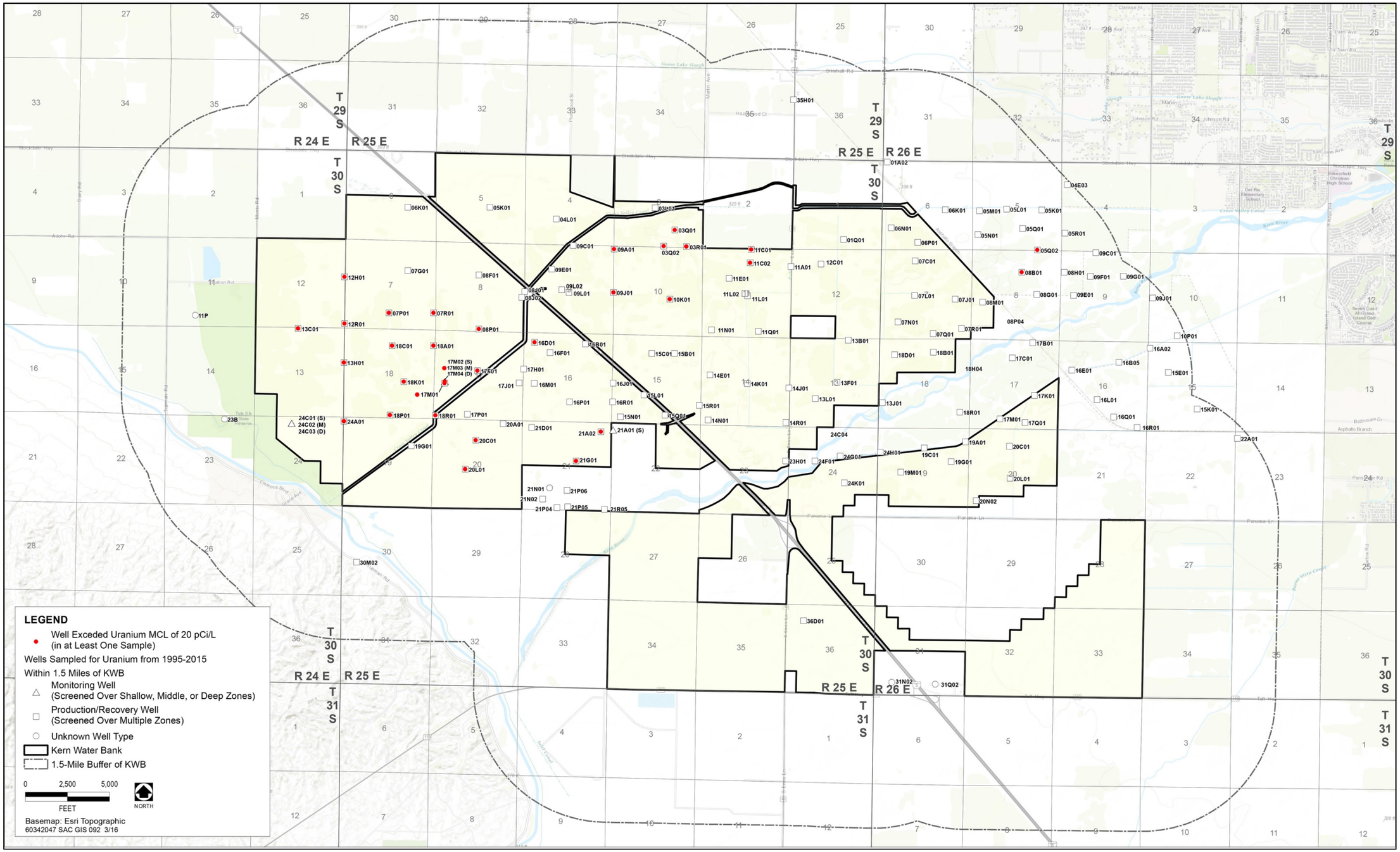
Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-7. Wells Sampled for Nitrate as NO_3, 1995 to 2015



Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-8. Wells Sampled for Alpha, 1995 to 2015



Source: 2005-2006 Kern Fan Monitoring Committee Report (KCWA 2009)

FIGURE 7.2-9. Wells Sampled for Uranium, 1995 to 2015

7.2.2.3 Regulatory Setting in 1995

1995

Three basic methods are available for managing groundwater resources in California:

- management by local agencies under authority granted in the California Water Code or other applicable state statutes,
- local government groundwater ordinances or joint-powers agreements, and
- court adjudications.

No state law requires that any of these forms of management be applied in a given basin. Management is often instituted after local agencies or landowners recognize a specific groundwater problem. The level of groundwater management in any basin or subbasin often depends on water availability and demand.

Federal Plans, Policies, Regulations, and Laws

Clean Water Act

EPA is the lead federal agency responsible for water quality management. The Clean Water Act (CWA) of 1972 (33 United States Code 1251 et seq.) is the primary federal law that governs and authorizes water quality control activities by EPA and the State of California, and regulates the discharge of pollutants into navigable waters. State water quality programs and regulations are chiefly the products of federal mandates put into effect through the CWA and managed by EPA. Various elements of the CWA address water quality, as described below.

Under federal law, EPA has published water quality regulations under Title 40 of the Code of Federal Regulations. CWA Section 303 requires states to adopt water quality standards for all surface waters of the United States. As defined by the CWA, water quality standards consist of two elements: (1) designated beneficial uses of the water body in question, and (2) criteria that protect the designated uses. Section 304(a) requires EPA to publish advisory water quality criteria that accurately reflect the latest scientific knowledge on the kind and extent of all effects on health and welfare that may be expected from the presence of pollutants in water. Where multiple uses exist, water quality standards must protect the most sensitive use. In California, EPA has designated the State Water Resources Control Board (SWRCB) and its nine regional water quality control boards (RWQCBs) with the authority to identify beneficial uses and adopt applicable water quality objectives.

Section 401 Water Quality Certification or Waiver

Under CWA Section 401(a)(1), applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects with a federal component that may affect state water quality must also comply with CWA Section 401. (Such projects include those that require federal agency approval such as issuance of permits under CWA Section 404, Sections 9 and 10 of the Rivers and Harbors Act, and licenses for hydroelectric power plants issued by the Federal Energy Regulatory Commission under the Federal Power Act.)

The CWA Section 401 water quality certification certifies that the proposed activity will not violate state water quality standards, and that the activity complies with all applicable limitations and restrictions.

The RWQCBs administer the Section 401 program with the intent of prescribing measures necessary to avoid, minimize, or mitigate adverse impacts of proposed projects on water quality. KWB Lands fall under the jurisdiction of the Central Valley RWQCB (CVRWQCB).

Section 402 Permits for Discharge to Surface Waters

SWRCB and RWQCBs regulate discharges of waste into waters of the United States through National Pollutant Discharge Elimination System (NPDES) permits, authorized under CWA Section 402, and regulate point-source (municipal and industrial) discharges of waste and pollutants into waters of the United States through WDRs authorized under the state's Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (see below).

Dischargers whose projects disturb 1 or more acres of soil are required to obtain coverage under the General Permit for Discharges of Stormwater Associated with Construction Activity, known as the Construction General Permit. The Construction General Permit requires the project proponent to develop and implement a storm water pollution prevention plan (SWPPP), which must identify best management practices for protection from stormwater runoff. In addition, the SWPPP must contain a visual monitoring program, a chemical monitoring program, and a sediment monitoring plan if the site discharges directly to a water body listed on the CWA Section 303(d) list for sediment.[31]

Section 303 List of Impaired Waters

Under CWA Section 303(d), states are required to develop lists of water bodies that would not attain water quality objectives after point-source dischargers implement required levels of treatment. Section 303(d) requires that the state develop a Total Maximum Daily Load (TMDL) for each listed pollutant. The TMDL is the amount of loading that the water body can receive and still be in compliance with water quality objectives. The TMDL also can act as a plan to reduce loading of a specific pollutant from various sources to achieve compliance with water quality objectives.

EPA either must approve a TMDL prepared by the state or, if it disapproves the state's TMDL, must issue its own. NPDES permit limits for listed pollutants must be consistent with the waste load allocation prescribed in the TMDL. It is anticipated that after the TMDL is implemented, the problems that led a given pollutant to be placed on the Section 303(d) list will be remediated.

Federal Anti-degradation Policy

The federal anti-degradation policy, established in 1968, is designed to protect existing uses and water quality and national water resources. The federal policy directs states to adopt a statewide policy that includes the following primary provisions:

- Existing instream uses and the water quality necessary to protect those uses shall be maintained and protected.
- Where existing water quality is better than necessary to support fishing and swimming conditions, that quality shall be maintained and protected unless the state finds that allowing lower water quality is necessary for important local economic or social development.
- Where high-quality waters constitute an outstanding national resource, such as waters of national and state parks, wildlife refuges, and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

The Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) of 1974 (Public Law 93-523) was established to protect the public health and quality of drinking water in the United States, whether from aboveground or underground sources. EPA is the lead agency responsible for establishment of the National Primary Drinking Water Regulations for contaminants that could cause adverse public health effects, and for overseeing all states, localities, and water suppliers who implement these standards. The SDWA applies to every public water system in the United States, but does not apply to private wells or bottled water.

All surface waters require some form of treatment to meet drinking water standards. The degree of treatment needed depends on the quality of the raw water. The highest quality raw surface waters need only to be disinfected before being served to consumers. More typically, raw water is treated in a conventional water treatment plant that includes sedimentation, filtration, and disinfection processes. Although it is technically possible to treat virtually any raw water so that it will meet drinking water standards, it is usually not practical to do so. Municipal water suppliers prefer raw-water sources of high quality because their use minimizes risks to public health and the cost and complexity of treatment needed to meet SDWA drinking water standards.

The SDWA directed EPA to set national standards for drinking water quality, and required EPA to set MCLs for a wide variety of potential drinking water pollutants. The owners and operators of public water systems are required to comply with primary (health-related) MCLs and encouraged to comply with secondary (nuisance- or aesthetics-related) MCLs.

Federal drinking water standards for are set for various microorganisms; turbidity; disinfectants (chlorine, chloramine, and chlorine dioxide) and disinfection byproducts (bromate, chlorite, haloacetic acids, and trihalomethanes); inorganic chemicals (antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, copper, cyanide, fluoride, lead, mercury, nitrate, nitrite, selenium, and thallium), and more than 53 organic chemicals that include benzene, dioxin (2,3,7,8-TCDD), polychlorinated biphenyls (i.e., PCBs), styrene, toluene, vinyl chloride, and several pesticides. Standards also have been issued for synthetic volatile organic compounds and radionuclides (alpha particles, beta particles, photon emitters, radium, and uranium). EPA also identifies and lists unregulated contaminants on the "Contaminant Candidate List," and periodically reviews and decides whether to regulate listed contaminants. MCLs and the process for setting these standards are reviewed triennially.

EPA delegated to the California Department of Public Health (CDPH) the responsibility for administering California's drinking water program, making CDPH accountable to EPA for program implementation and for adopting standards and regulations that are at least as stringent as those developed by EPA. On July 1, 2014, the Drinking Water Program moved from CDPH to the SWRCB, Division of Drinking Water (DDW). The applicable state primary and secondary MCLs are set forth in CCR Title 22, Division 4, Chapter 15, Article 4 (see "California Code of Regulations Title 22" below for further discussion).

National Toxics Rule

EPA promulgated the National Toxics Rule (NTR) in 1992 to establish water quality criteria for 12 states and two territories, including California, that had not complied fully with CWA Section 303(c)(2)(B) (57 *Federal Register* [FR] 60848, December 22, 1992). When a state adopts and EPA approves water quality criteria that meet the requirements of CWA Section 303, EPA issues a rule amending the NTR to withdraw the federal criteria for that state. If the state's criteria are not less stringent than the federal criteria, EPA withdraws its criteria without notice. However, if a state adopts criteria that are less stringent than the federal criteria, but EPA decides that the criteria fully meet the requirements of the CWA, EPA will provide an opportunity for public comment before withdrawing the federal criteria.

State Plans, Policies, Regulations, and Laws

Agencies with Jurisdiction over Water Quality

SWRCB has broad authority over water-quality control issues for the state. Responsible for developing statewide water quality policy, SWRCB exercises the powers delegated to the state by the federal government under the CWA. Other state agencies with jurisdiction over water quality regulation in California include the SWRCB-DDW (formerly CDPH for drinking water regulations), the California Department of Pesticide Regulation, the California Department of Fish and Wildlife, and the California Office of Environmental Health Hazard Assessment.

Regional authority for planning, permitting, and enforcement is delegated by the SWRCB to the nine RWQCBs. The CVRWQCB is responsible for the regional area in which the KWB and Kern Fan Element are located.

The SWRCB Water Rights Division has primary regulatory authority over water supplies. The Water Rights Division issues permits for water rights that specify amounts, conditions, and construction timetables for diversion and storage facilities. Water rights decisions implement the objectives adopted in the water quality control plans (see "Porter-Cologne Water Quality Control Act") and reflect water availability, recognize prior water rights and flows needed to preserve instream uses (such as water quality), and determine whether the diversion of water is in the public interest.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act of 1969 is California's statutory authority for protecting water quality. It was enacted to preserve, enhance, and restore the quality of the state's water resources. Under the Porter-Cologne Act, the state must adopt water quality policies, plans, and objectives that protect the state's waters for the use and enjoyment of the people. The act sets forth the obligations of the SWRCB and the RWQCBs to adopt and periodically update water quality control plans (basin plans). Basin plans are the regional water quality control plans required by the California Water Code (Section 13240), the CWA, and the Porter-Cologne Act in which beneficial uses, water quality objectives, and implementation programs are established for each of the nine regions in California. The Porter-Cologne Act defines water quality objectives as "…the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area" (Water Code Section 13050[h]). In addition to defining objectives and water quality standards adopted by the RWQCBs, the basin plans include California's policies for water quality control and have the force and effect of regulation.

The act requires waste dischargers to notify the RWQCBs of their activities through the filing of reports of waste discharge (RWD) and authorizes the SWRCB and the RWQCBs to issue and enforce waste discharge requirements (i.e., WDRs), NPDES permits, Section 401 water quality certifications, or other approvals. The RWQCBs also have authority to issue waivers to RWDs and/or WDRs for broad categories of "low threat" discharge activities that have minimal potential for adverse water quality effects when implemented according to prescribed terms and conditions.

Projects that may discharge wastes to land or water are required to conform to water quality objectives, policies, and procedures of the applicable basin plans. A change in water quality is allowed only if the change is consistent with the maximum beneficial use of the waters of the state, would not unreasonably affect present or anticipated beneficial uses, and would not result in water quality lower than that specified in the basin plan. The Porter-Cologne Act defines waters of the state as "any surface water or ground water, including saline waters, within the boundaries of the state." Some waters that qualify as waters of the state, such as certain isolated wetlands and groundwater, do not necessarily

qualify as waters of the United States. This includes surface waters that are not tributary to navigable waters of the United States.

Water Quality Control Plan (Basin Plan) for the Tulare Lake Basin

The Kern County Groundwater Subbasin is located within the Tulare Lake Hydrologic Region. Pursuant to the Porter-Cologne Act, the CVRWQCB prepares and updates the *Water Quality Control Plan (Basin Plan) for the Tulare Lake Basin*.[32] The Tulare Lake Basin Plan describes the officially designated beneficial uses for specific surface water and groundwater resources, the enforceable water quality objectives necessary to protect those beneficial uses, and a program of implementation needed to achieve objectives (Water Code Section 13050[j]).

State and federal laws mandate the protection of designated beneficial uses of water bodies. State law defines “beneficial uses” as “domestic, municipal, agricultural and industrial water supply; power generation; recreation; aesthetic enjoyment; navigation; aquaculture; and preservation and enhancement of habitat for fish, wildlife, and other aquatic resources or preserves” (Water Code Section 13050[f]). Additional protected beneficial uses included in the Tulare Lake Basin Plan include groundwater recharge and freshwater replenishment. Kern County, and specifically KWB Lands, are located within the jurisdiction of the CVRWQCB (Region 5) and are subject to compliance with the Tulare Lake Basin Plan. Basin plans adopted by the RWQCBs are implemented primarily through the NPDES permitting system and WDRs are issued to regulate waste discharges so that water quality objectives are met. Basin plans provide the technical basis for determining WDRs and authorize the RWQCBs to take regulatory enforcement actions if necessary.

The Tulare Lake Basin Plan includes numerical and narrative water quality objectives for physical and chemical water quality constituents:

- For inland surface waters:
  - Numerical objectives are set for temperature, dissolved oxygen, turbidity, pH, toxicity, radioactivity, TDS, EC, bacterial content, various specific ions, trace metals, and synthetic organic compounds.
  - Narrative objectives are set for parameters such as suspended solids, sediment, biostimulatory substances (e.g., nitrogen and phosphorus), oil and grease, color, taste, odor, and aquatic toxicity.
- For groundwater:
  - Numerical objectives are set for toxicity, radioactivity, TDS, EC, bacterial content, and various specific ions, trace metals, pesticides, and organic compounds.
  - Narrative objectives are set for parameters such as taste and odor.

Narrative objectives are often precursors to numerical objectives. At a minimum, water designated for municipal and domestic water supply shall not contain concentrations of chemical constituents greater than the MCLs specified in the provisions of CCR Title 22, which are incorporated into the Tulare Lake Basin Plan and discussed below.

The Tulare Lake Basin Plan establishes a limit for the allowable maximum average annual EC increase in groundwater for the various hydrographic units. The Kern River, Poso, and Westside South hydrographic units are located within Kern County. The KWB operates within the nexus of the three hydrographic units. The Kern River Unit is allowed up to 5 µmhos per centimeter (µmhos/cm) per year, the Westside South Unit is allowed 1 µmhos/cm per year, and the Poso Unit is allowed up to 6 µmhos/cm per year.

California Code of Regulations Title 22

CDPH has been responsible for the domestic water quality and monitoring requirements listed in CCR Title 22, Division 4, Chapter 15 (Article 16, Section 64449), which define drinking water standards. Drinking water MCLs directly apply to water supply systems “at the tap” (e.g., at the point of use by consumers in their homes or offices). California MCLs, both primary and secondary, directly apply to groundwater and surface water resources when they are specifically referenced as water quality objectives in the basin plan. In such cases, MCLs become limits enforced by the SWRCB and RWQCBs. When fully protective of health, MCLs also may be used to interpret narrative water quality objectives in the basin plan that prohibit toxicity to humans in water designated as a source of drinking water (MUN).

CCR Title 22 became effective January 3, 2001. Monitoring for hexavalent chromium was to have been completed by December 31, 2002; and for other chemicals, by December 31, 2003.

California State Non-degradation Policy

In 1968, as required under the federal anti-degradation policy described above, the SWRCB adopted a non-degradation policy aimed at maintaining the high quality of waters in California. The non-degradation policy states that the disposal of wastes into state waters shall be regulated to achieve the highest water quality consistent with maximum benefit to the people of the state and to promote the peace, health, safety, and welfare of the people of the state. Any discharges associated with KWB activities would be required to comply with this policy.

The non-degradation policy provides as follows:

- Where the existing quality of water is better than required under existing water quality control plans, such quality would be maintained until it has been demonstrated that any change would be consistent with maximum benefit to the people of the state and would not unreasonably affect present and anticipated beneficial uses of such water.
- Any activity which produces waste or increases the volume or concentration of waste and which discharges to existing high-quality waters would be required to meet WDRs, which would ensure (1) pollution or nuisance would not occur and (2) the highest water quality consistent with the maximum benefit to the people of the state would be maintained.

California Well Standards

Department Bulletin 74-81, *Water Well Standards: State of California*, and Bulletin 74-90, *California Well Standards*, together establish standards for constructing, altering, maintaining, and destroying water supply wells and monitoring wells, such as the KWB’s production and monitoring wells. Bulletin 74-90 revises some but not all portions of Bulletin 74-81; therefore, the bulletins must be considered together before any wells are constructed, modified, or destroyed.

California Division of Oil, Gas and Geothermal Resources

The California Division of Oil, Gas and Geothermal Resources (DOGGR) regulates production of oil and gas, as well as geothermal resources, in the state of California. DOGGR oversees the drilling, operation, maintenance, and plugging and abandonment of onshore and offshore oil, gas, and geothermal wells, to protect life, health, property, and natural resources; underground and surface waters suitable for irrigation or domestic use; and oil, gas, and geothermal reservoirs. Responsibilities of DOGGR are identified in CCR Title 14, Division 2, Chapter 4, and include well design and construction standards, surface production equipment and pipeline requirements, and well abandonment procedures and guidelines.

Underground Injection Control Program

In California, wells that inject fluids associated with oil and natural gas production operations (Class II injection wells) also are regulated by DOGGR under its Underground Injection Control (UIC) Program. The main features of the UIC Program include permitting, inspection, enforcement, mechanical integrity testing, plugging and abandonment oversight, data management, and public outreach. 14 CCR §1724.6 requires that DOGGR approve "any subsurface injection or disposal project," including all UIC Class II wells. 14 CCR §§1724.7 and 1724.8 lists the data an injection well operator must submit to DOGGR to obtain approval for cyclic steam projects. 14 CCR §1724.10 lists the filing, notification, operating, and testing requirements for underground injection projects.

The injection plan must ensure that injection fluids will be confined to the intended zone or zones of injection (14 CCR §1724.7(c)(3)). To confirm that injection fluid is confined to the approved zone or zones, and will not leak to other formations or zones during injection, mechanical integrity testing must be performed on each injection well when the project begins and periodically thereafter (14 CCR §1724.10(j)). When abandoning a well, injection well operators are also required to use every effort and endeavor to protect underground or surface water suitable for irrigation or domestic purposes from the infiltration of detrimental substances (Public Resources Code §3228 [see also related: 14 CCR §1722.4; 14 CCR §1723.1[b]; 14 CCR §1723.2; 14 CCR §1724.10[h]; 14 CCR §1724.10[f]). DOGGR directly regulates the exploration and production of oil and gas in Kern County for conformance with California's conservation laws. Pursuant to CCR, Title 14, Division 2, Chapter 4, Section 1722 (k), DOGGR establishes Field Rules which supplement more broadly applicable statutory and regulatory requirements regarding well operations in order to protect California's water resources and health and safety. Field Rules have been adopted for most zones and fields in Kern County and are available online.

Senate Bill 1281 – Disclosure of Oil and Gas Water Use and Disposal

Senate Bill 1281 (SB 1281), effective January 2015, amended Sections 3226.3 and 3227 of the Public Resources Code to require that: (1) DOGGR provide the SWRCB with an annual "inventory of all unlined oil and gas field sumps"; and (2) well operators provide DOGGR with quarterly information regarding the source and disposition of water produced by or used in oil and gas production in addition to existing obligations to report gas and oil production and produced water information on a monthly basis.

Regional and Local Plans, Policies, Regulations, and Ordinances

1995 Kern Water Bank Memorandum of Understanding

On October 26, 1995, a MOU was reached between the KWB participants and the Adjoining Entities regarding KWB operation and monitoring of the KWB Groundwater Banking Program (see Appendix 7-5a). The KWB participants consist of Dudley Ridge and Tejon-Castac Water Districts, KCWA, Semitropic and Wheeler Ridge–Maricopa Water Storage Districts, and Westside Mutual Water Company, collectively known as the KWBA. The Adjoining Entities consist of the Buena Vista and Rosedale–Rio Bravo Water Storage Districts and the Kern Delta, Henry Miller, and West Kern Water Districts.

Consistent with the Project Description (see end of Appendix 7-5a), KWB participants will make a good faith effort to meet the following objectives, which may or may not be met:

1) The Parties should operate their projects in such manner as to maintain and, when possible, enhance the quality of groundwater within the Project Site and the Kern Fan Area.

2) If supplies of acceptable recharge water exceed recharge capacity, all other things being equal, recharge priority should be given to the purest or best quality water.

3) Each project within the Kern Fan Area should be operated with the objective that the average concentration of total dissolved salts in the recovered water will exceed the average concentration of total dissolved salts in the recharged water, at a minimum, by a percentage equal to or greater than the percentage of surface recharge losses. The average shall be calculated from the start of each Project.

4) To maintain or improve groundwater quality, recovery operations should extract poorer quality groundwater where practicable. Blending may be used to increase extraction of lesser quality groundwater unless doing so will exacerbate problems by generating unfavorable movement of lesser quality groundwater. It is recognized that the extent to which blending can help to resolve groundwater quality problems is limited by regulatory agency rules regarding discharges into conveyance systems used for municipal supplies, which may be changed from time to time.

5) All groundwater pumpers should attempt to control the migration of poor quality water. Extensive monitoring will be used to identify the migration of poor quality water and give advance notice of developing problems. Problem areas may be dealt with by actions including, but not limited to:

    a) limiting or terminating extractions that tend to draw lesser quality water toward or into the usable water areas;

    b) increasing extractions in areas that might generate a beneficial, reverse gradient;

    c) increasing recharge within the usable water area to promote favorable groundwater gradients.

6) It is intended that all recovery of recharged water be subject to the so-called “golden rule.” In the context of a banking project, the “golden rule” means that, unless acceptable mitigation is provided, the banker may not operate so as to create conditions that are worse than would have prevailed absent the project giving due recognition to the benefits that may result from the project…

7) The Project should be developed and operated so as to prevent, eliminate or mitigate significant adverse impacts. Thus, the Project shall incorporate mitigation measures as necessary. Mitigation measures to prevent significant adverse impacts from occurring include but are not limited to the following: (i) spread out recovery area; (ii) provide buffer areas between recovery wells and neighboring overlying users; (iii) limit the monthly, seasonal, and/or annual recovery rate; (iv) provide adequate well spacing; (vi) adjust pumping rates or terminate pumping to reduce impacts, if necessary; (vii) impose time restrictions between recharge and extraction to allow for downward percolation of water to the aquifer; and (viii) provide recharge of water that would otherwise not recharge the Kern Fan Basin. Mitigation measures that compensate for unavoidable adverse impacts include but are not limited to the following: (i) with the consent of the affected overlying user, lower the pump bowls or deepen wells as necessary to restore groundwater extraction capability to such overlying user; (ii) with the consent of the affected overlying user, provide alternative water supplies to such overlying user; and (iii) with the consent of the affected overlying user, provide financial compensation to such overlying user.

The MOU's recitals define "significant adverse impacts" as those impacts to "water levels, water quality or land subsidence within the boundaries of Adjoining Entities, or otherwise interfere with the existing and ongoing programs of Adjoining Entities."

The following "Minimum Operating Criteria" numbered objectives in the 1995 KWB MOU apply to water quality:

1) The Monitoring Committee shall be notified prior to the recharge of potentially unacceptable water, such as "produced water" from oilfield operations, reclaimed water, or the like. The Monitoring Committee shall review the proposed recharge and make recommendations respecting the same as it deems appropriate. Where approval by the RWQCB is required, the issuance of such approval by said Board shall satisfy this requirement.

2) Recharge may not occur in, on or near contaminated areas, nor may anyone spread in, on or near an adjoining area if the effect will be to mound water near enough to the contaminated area that the contaminants will be picked up and carried into the uncontaminated groundwater supply. When contaminated areas are identified within or adjacent to the Project, the KWBA and the Project Participants shall also:

    a) Participate with other groundwater pumpers to investigate the source of contamination

    b) Work with appropriate authorities to ensure that the entity or individual, if any, responsible for the contamination meets its responsibilities to remove the contamination and thereby return the Project site to its full recharge and storage capacity;

    c) Operate the project in cooperation with other groundwater pumpers to attempt to eliminate the migration of contaminated water toward or into usable water quality areas.

14) The Kern Fan Element Groundwater Model, with input from the Project Participants and Adjoining Entities, and utilizing data from a comprehensive groundwater monitoring program, may be used by the Monitoring Committee as appropriate to estimate groundwater impacts of the project.

<u>Other Local Ordinances</u>

A method of managing groundwater in California is through adoption of ordinances by local governments such as cities or counties. Thirty counties have adopted groundwater ordinances. The authority of counties to regulate groundwater has been challenged. In 1995, however, the California Supreme Court declined to review an appeal of a lower court decision, *Baldwin v. County of Tehama* (1994), which holds that state law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers.

Local ordinances passed during the 1990s significantly increased the potential role of local governments in groundwater management. The intent of most ordinances has been to hold project proponents accountable for impacts that may result from proposed export projects. Because most of these ordinances have been adopted fairly recently, their effect on local and regional groundwater management planning efforts is not yet fully known.

7.2.2.4 Changes in Regulatory Setting between 1996 and 2014

State Plans, Policies, Regulations, and Laws

California Safe Drinking Water Act

On July 1, 2014, the Drinking Water Program was transferred from CDPH to the SWRCB-DDW, which adopts drinking water standards as part of the Drinking Water Program pursuant to the California SDWA. These standards directly apply to public drinking water systems and to water delivered to customers. Under the California SDWA, untreated public drinking water from groundwater and surface water sources (systems serving 15 or more connections or more than 25 people per day) is monitored regularly for CCR Title 22 constituents.

MCLs are components of the drinking water standards adopted by the SWRCB-DDW/CDPH. Primary MCLs are based on human health protection, while secondary MCLs are based on human welfare considerations (e.g., taste, odor, laundry staining). EPA also adopts MCLs under the federal SDWA. Some California MCLs are more stringent than EPA MCLs, but are required to be at least stringent as those adopted by EPA.

Under the California SDWA, the MCL for arsenic was reduced from 50 µg/L to 10 µg/L in 2008.

Water Quality Control Plan for the Tulare Lake Basin

The CVRWQCB updated the *Water Quality Control Plan (Basin Plan) for the Tulare Lake Basin*. The current version was adopted on March 27, 2014 and went into effect on January 26, 2015. Amendment to the Basin Plan included incorporation of SWRCB policies that are pertinent to the Basin Plan.

California NPDES General Construction General Permit

The SWRCB's NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, 2009-0009-DWQ (Construction General Permit) is a general NPDES permit authorizing statewide stormwater discharges associated with construction activities that disturb 1 or more acres and that meet the terms and conditions defined in the permit.[33] With regard to Permitted Activities, the Construction General Permit covers the following:

- Any construction activity resulting in a land disturbance of 1 acre or greater;
- Construction activity resulting in land surface disturbances of less than 1 acre if the construction activity is part of a larger common plan of development;
- Construction activity related to residential, commercial, or industrial development on lands currently used for agriculture;
- Construction activity associated with linear underground or overhead projects such as pipelines or electric utilities; and
- Discharges of sediment from construction activities associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities.

The Construction General Permit does not cover discharges composed entirely of flows which are from conveyances (e.g., pipes or ditches used for collecting and conveying storm water runoff) and which do not come in contact with any raw material, intermediate products, finished product, byproduct, or waste products located on the operations. The Clean Water Act (33 USC § 1342(l)(2) exempts these activities from NPDES permitting. Generally, the Construction General Permit would not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

For projects that do require coverage under the Construction General Permit, project applicants are required to prepare and submit Permit Registration Documents (PRDs) that include a Notice of Intent (NOI) to comply with the general permit, a site map, and the appropriate fees prior to construction. To reduce the risk of adverse effects to water quality, the project applicants much also prepare the following documents:

- A risk assessment consisting of two components: (1) project sediment risk—the relative amount of sediment that can be discharged, given the project and location details—and (2) receiving water risk—the risk sediment discharges pose to the receiving waters.
- A SWPPP, which includes a list of Best Management Practices (BMPs) addressing and designed to reduce, among other things, sources of sediment associated with construction and construction site erosion and the potential for discharge of pollutants after construction is completed.
- A monitoring and reporting program to demonstrate compliance with the Construction General Permit's requirements.
- Post-construction on-site water balance calculations.

Beginning September 2, 2012, project applicants will be required to implement long-term maintenance plans to achieve applicable water balance requirements and implement BMPs to reduce post-construction pollutant runoff.

Discharges with Low Threat to Water Quality

The SWRCB's Water Quality Order 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality (SWRCB, 2003[34]) addresses potential discharges of low water quality–threat wastewater. Discharges that may be covered include hydrotest water, well development water, boring waste discharge, and monitoring well purge water discharge. In accordance with this permit, all dischargers must comply with all applicable provisions in the water quality control plan governing that region (i.e., the Tulare Lake Basin Plan), including any prohibitions and water quality objectives for both surface water and groundwater. In addition, the discharge of waste may not cause the spread of groundwater contamination. Discharges must be made to land owned or controlled by the discharger, unless the discharger has a written lease or agreement with the landowner. An NOI must be filed with the regional board (in this case the CVRWQCB) prior to any wastewater discharge to land that would have low water quality–threat discharges. Compliance with permit terms, including any monitoring, and filing a notice of termination upon completion of the activity are also required.

The CVRWQCB allows the discharge to surface waters of certain categories of clean or relatively pollutant-free wastewater posing little or no threat to water quality. The CVRWQCB Order No. R5-2008-0081, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters (CVRWQCB, 2008)[35] covers discharges of waste to waters of the state provided they do not contain significant quantities of pollutants and either (a) the discharge is 4 months or less in duration or (b) the average dry weather discharge does not exceed 0.25 million gallons per day. All pollutants must be properly treated prior to discharge to ensure continuous compliance with applicable water quality requirements. Similar to the SWRCB's general permit for low-threat discharges to land, an NOI must be filed with the regional board (in this case the CVRWQCB) and substantive and other procedural requirements apply.

Groundwater Legislation

The California Legislature recognized the need for groundwater data when making sound local management decisions. In 1999, the Legislature approved funding for and directed the Department to update the inventory of groundwater basins from Bulletin 118 (1975), *California's Ground Water*, and Bulletin 118-80 (1980), *Ground Water Basins in California*. AB 599 (2001) subsequently required the SWRCB to establish a comprehensive monitoring program to assess groundwater quality in each groundwater basin in the state and increase coordination among agencies that collect information about groundwater contamination. Senate Bill (SB) 1938, enacted in 2002, added new requirements for local agency groundwater management plans to be eligible for public funds for groundwater projects.

California Toxics Rule and State Implementation Plan

The California Toxic Rule (CTR) (65 FR 31682, May 18, 2000) was issued in response to the requirements of the NTR. The CTR set numeric water quality criteria for approximately 130 priority pollutants, trace metals, and organic compounds. The CTR criteria are regulatory criteria adopted for inland surface waters, enclosed bays, and estuaries in California that are subject to CWA Section 303(c). The NTR and CTR include criteria for the protection of aquatic life and human health. Human health criteria (water- and organism-based) apply to all waters within a "Municipal and Domestic Supply" beneficial use designation, as indicated in the basin plan water quality objectives for toxic pollutants.

The *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*, also known as the State Implementation Plan (SIP), was adopted by the SWRCB in 2000. The SIP establishes provisions for translating CTR and NTR criteria and basin plan water quality objectives for toxic pollutants into NPDES permit effluent limits, effluent compliance determinations, monitoring, and provisions for controlling chronic (long-term) toxicity. In addition, the SIP initiates the development of site-specific water quality objectives and the granting of exceptions for effluent compliance. The goal of the SIP is to establish a standardized approach for the permitting of discharges of toxic effluents to inland surface waters, enclosed bays, and estuaries in a consistent fashion throughout the state.

Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act of 2014 (SGMA) was enacted on September 16, 2014. The SGMA provides a framework for sustainable management of groundwater supplies, and it strengthens local control and management of groundwater basins throughout the state with little state intervention. The Legislature declares that "excessive groundwater extraction can cause overdraft, failed wells, deteriorated water quality, environmental damage, and irreversible land subsidence that damages infrastructure and diminishes the capacity of aquifers to store water for the future."[36] The SGMA lists the following undesirable results caused by groundwater conditions and affecting water quality:

- significant and unreasonable seawater intrusion;
- degraded water quality, including the migration of COC plumes; and
- depletions of interconnected surface water that have significant impacts on beneficial uses of the surface water.

Regional and Local Plans, Policies, Regulations, and Ordinances

1997 Monterey Initial Study and Addendum

The 1997 Monterey IS and Addendum analyzed potential environmental impacts associated with implementation of the KWB HCP/NCCP (see Appendix 7-6a). This document stated that the quality of water used for recharge was very good and not expected to increase TDS and organic constituent concentrations in the local groundwater. The 1997 Monterey IS and Addendum also noted that the quality of water for recharge would be expected to vary and would require monitoring to avoid degradation of local water quality and exacerbation of negative salt balance in the region. Areas of soil contamination from prior oil and agricultural operations (noted to occur at/or near some recharge areas) were to be avoided to prevent mobilization and degradation of groundwater quality. Remediation of any contamination was to be coordinated by the RWQCB (or other local regulatory agencies) tasked with oversight of remedial investigations and cleanup. Respective to groundwater quality, the 1997 Monterey IS and Addendum includes the following mitigation measures required for implementation by KWBA:

- Mitigation Measure C-1 – Implementation of MOU. Key aspects of the 1995 KWB MOU are summarized above (also see Appendix 7-5a).

- Mitigation Measure C-2 – Hydrocarbon Contamination Monitoring – whereby the KWBA would continue to monitor the remediation of the current and any future hydrocarbon contamination working with local regulatory agencies (such as the RWQCB) to ensure investigations and remedial activities are implemented to ensure protection of groundwater quality.

Tulare Lake Basin Portion of Kern County Integrated Regional Water Management Plan

KCWA's Kern County Integrated Regional Water Management Plan (Kern IRWMP) was developed in collaboration with water suppliers, community and government representatives, environmental groups, businesses, and a variety of other interested parties (Kennedy Jenks Consultants, 2011).[37]

A goal of the Kern IRWMP is to improve overall water quality. The Kern IRWMP outlines the following specific measureable objectives related to water quality:

- Monitor and/or manage headwaters/areas of origin, natural streams, and recharge areas to prevent or mitigate contamination.
- Identify and preserve prime recharge areas in the Kern Fan area and other areas.
- Improve water quality for disadvantaged communities and the watershed throughout the planning horizon.
- Continue to provide drinking water that meets or exceeds water quality standards; support efforts to attain appropriate standards throughout the planning horizon.
- Maximize the use of lesser quality water for appropriate uses (landscaping, certain agricultural crops, "aesthetic" projects) throughout the planning horizon.

Kern County General Plan

Portions of KWB Lands west of Enos Lane are governed by the *Kern County General Plan*. The general plan was adopted by the Kern County Board of Supervisors on June 15, 2004, and was last amended on September 22, 2009. The *Kern County General Plan* identifies policies that provide long-range guidance to county officials who make decisions affecting growth and resources in unincorporated Kern County, excluding the unincorporated portion of the county within the metropolitan

Bakersfield planning area. The general plan helps ensure that day-to-day planning and land use decisions conform to the long-range program.

An overarching goal of the *Kern County General Plan* is to ensure that environmental resources are protected and adequate infrastructure is developed. The plan specifically emphasizes ensuring adequate water supplies and acceptable quality for future growth.[38] The plan is reviewed and updated periodically as the community's goals and requirements evolve.

The following water quality–related goals and policies from the Land Use, Open Space, and Conservation Element of the *Kern County General Plan* are applicable to KWB activities:

Public Facilities and Services Goal 5: Ensure that adequate supplies of quality (appropriate for intended use) water are available to residential, industrial, and agricultural users within Kern County.

- **Public Facilities and Services Policy 2:** The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur within or adjacent to areas with adequate public service and facility capacity.
  a. Ensure that water quality standards are met for existing users and future development.
  b. Ensure that adequate storage, treatment, and transmission facilities are constructed concurrently with planned growth.

Resource Goal 3: Ensure the development of resource areas minimize effects on neighboring resource lands.

- **Resource Policy 10:** To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:
  (b) Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers.
  (c) Support the development of groundwater management plans.

<u>Metropolitan Bakersfield General Plan (Unincorporated Planning Area)</u>

Portions of KWB Lands east of Enos Lane would be governed by the *Metropolitan Bakersfield General Plan (Unincorporated Planning Area)*. This general plan is a separate but interrelated planning program for Kern County. The boundaries of the planning area were mutually agreed upon by the City of Bakersfield and Kern County as part of the joint adoption of the *Metropolitan Bakersfield General Plan* and represent the area where planning and land use decisions could affect both the City of Bakersfield and Kern County.[39] The general plan was adopted by the Kern County Board of Supervisors on December 3, 2002 and was last amended on December 11, 2007.

The following goals and policies related to water quality from the Conservation Element of the *Metropolitan Bakersfield General Plan (Unincorporated Planning Area)* are applicable to KWB activities:

Water Resources Goal 4: Continue cooperative planning for and implementation of programs and projects which will resolve water resource deficiencies and water quality problems.

- **Water Resources Policy 5:** Work towards resolving the problem of groundwater resource deficiencies in the upland portions of the planning area.
- **Water Resources Policy 6:** Protect planning area groundwater resources from further quality degradation.

- **Water Resources Policy 7:** Provide substitute or supplemental water resources to areas already impacted by groundwater quality degradation by supporting facilities construction for surface water diversions.

Water Resources Goal 6: Maintain effective cooperative planning programs for water resource conservation and utilization in the planning area by involving all responsible water agencies in the planning process.

- **Water Resources Policy 9:** Encourage and implement water conservation measures and programs.

7.2.3 IMPACTS AND MITIGATION MEASURES

7.2-1 KWB construction and maintenance activities could potentially change groundwater quality.

1996 – 2014

KWB facilities currently include approximately 7,200 acres of recharge ponds, 85 recovery wells, a network of monitoring wells, 36 miles of pipeline, and the 6-mile-long KWB Canal. The ponds consist of low earthen berms that pond water to depths of a few feet. The recovery wells average about 750 feet deep and produce as much as 5,000 gallons per minute of water. They are distributed throughout the KWB Lands and are spaced approximately one-third mile apart. Small diameter (15- to 36-inch-diameter) PVC pipelines transport water recovered from wells to existing canals or, in some cases, to large diameter (>36-inch-diameter) pipelines. Approximately 31 miles of small-diameter and 5 miles of large-diameter pipeline have been constructed.

Construction of KWB infrastructure could adversely affect surface or groundwater water quality if construction spills or other pollutants were introduced into surface waters or the groundwater system. KWB construction and well installation activities were subject to general construction and grading permits following local, state, and federal regulations. This includes an NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activities. BMPs were guided by county and state regulations including CVRWQCB authorization and permit requirements. Water well requirements include Article 14.08 of the Kern County Ordinance Code (specifically Article III Well Standards). Department Bulletins 74-81 and 74-90 provide specific State-issued minimum standards for well construction and well destruction, noting that the Department is not a regulatory agency. Construction of wells followed permits and policy's under the Kern County Environmental Health Services Water Program (Water Well Permits Policy Manual). Grading and stormwater protection permits were obtained, monitored, and approved as appropriate. Construction of KWB facilities during this time period are not known to have caused any substantial adverse impacts on groundwater water quality.

All infrastructure requires maintenance, including the numerous production wells and monitoring wells on KWB Lands. The production wells require periodic rehabilitation to maintain or improve well efficiency. Rehabilitation necessary to maintain the yield of production wells generally consists of two components: (1) the addition of chemicals to breakdown slime or iron bacteria mass or encrustation that reduce the size of the well perforations; and (2) mechanical cleaning with a brush, surge block, or water under high pressure (this includes well redevelopment).

Chemicals added to the wells include several acids, hydrogen peroxide, and specially developed polymers chosen to react with the bacteria, slime, or encrusting minerals. Chemical addition techniques have been developed to ensure that the chemicals do not add contaminants to groundwater, and that they are neutralized or diluted by water pumped into the well and subsequently into the groundwater

through well perforations.[40] The mechanical cleaning adds no contaminants to groundwater because the movement of groundwater or clean surface water is used to dislodge particles.

Construction BMPs are required by local regulatory and state regulatory agencies. This includes permitting, monitoring, reporting, inspections (with approval) and reporting on the work, as appropriate. All work would be required to be completed within the regulatory framework. Waste containment and disposal would be required to be in accordance within state and federal regulatory guidelines, including retention of records (including those associated with waste manifests). Maintenance of KWB facilities during this time period are not known to have caused any substantial adverse impacts on groundwater water quality.

Therefore, construction- and maintenance-related impacts from 1996 to 2014 on groundwater quality were ***less than significant.***

Mitigation Measures

None required.

2015 – 2035

Near-term future KWB activities include construction of approximately 190 acres of recharge ponds and three wells under the ongoing Integrated Regional Water Management (IRWM) program. Longer-term future construction of approximately 862 acres of additional recharge ponds and associated facilities is anticipated as part of full build-out. In addition to the new recharge ponds wells and associated facilities, other potential ground-disturbing activities could include: fencing, constructing replacement recovery wells, installing and replacing pipeline, and installing weir boxes. Maintenance of existing and new basins, wells, and ancillary facilities would also take place. The IRWM program ponds have been sited. The locations of additional ponds are approximate but will be consistent with KWB HCP/NCCP requirements; final locations and areas will be determined as these facilities are designed.

These activities would be subject to construction contract BMPs, CVRWQCB authorization and permit requirements regarding construction under NPDES permits, and Article 14.08 of the Kern County Ordinance Code (specifically Article III Well Standards). Department Bulletins 74-81 and 74-90 provide specific State-issued minimum standards for well construction and well destruction, while the local city and county provide enforcement. Water well permits would be regulated by the Kern County Environmental Health Services (KCEHS) Water Program (See Section 7.0.4.1.6) under which new wells and well deepening, reconstruction, and destruction would be subject to permits requiring compliance. Drilling operations would follow grading permits (if needed) and well permit regulations in accordance to general conditions stipulated in KCEHS water well permit applications.

Ongoing future facility maintenance and well rehabilitation or construction would occur as it has in the past for the 1996 through 2014 period. Although many KWB activities are regulated as described above, all infrastructure requires construction and maintenance, including the numerous production wells and monitoring wells on KWB Lands. Rehabilitation necessary to maintain the yield of production wells generally consists of the addition of chemicals to break down slime or iron bacteria mass or encrustation that reduce the size of the well perforations. Furthermore, unexpected chemical or other spills and overall construction activities near surface and groundwater sources have the potential to adversely affect groundwater quality. Therefore, impacts from KWB construction and maintenance activities from 2015 to 2035 on groundwater quality would be ***potentially significant***.

Mitigation Measures

Mitigation Measure 7.2-1 would reduce impacts of KWB activities with regard to potential changes to groundwater quality to less than significant. Furthermore, KWBA is subject to legal requirements regarding activities related to well drilling in section c) below (see Section 7.0.4.1.6). Therefore, impacts from KWB construction and maintenance activities from 2015 to 2035 on groundwater quality would be ***less than significant, with mitigation***.

7.2-1 *KWBA will implement the following measures:*

a) *Comply with Mitigation Measure 7.11-1(a).*

b) *Comply with Mitigation Measure 7.8-1(a).*

c) *Comply with Kern County Environmental Health Program under which new wells and well deepening, reconstruction, and destruction would be subject to permits requiring compliance. (see Section 7.0.4.1.6).*

7.2-2 KWB operations could mobilize contamination in soils or the unsaturated zones associated with hazardous waste sites or oil and gas production operations and potentially degrade groundwater quality.

1996 – 2014

As discussed in Section 7.11, Hazards and Hazardous Materials, there were several hazardous material sites located on or adjacent to KWB Lands between 1996 and 2014 that were remediated for pesticide and/or petroleum hydrocarbon contamination, or were still under investigation to determine the extent of release of contamination. Of these, there were two hazardous materials sites where a release to soils with the potential to impact groundwater or groundwater contamination was identified. These sites are shown on Figure 7.2-10. A summary of the hazardous material sites and corresponding observation points are presented in Table 7.2-8.

During KWB recharge and recovery operations, there was a potential for recharge water to come into contact with soil contamination causing it to leach or further disperse in soils or the underlying aquifer. Mobilization of soil contaminants could also occur by spreading recharge water on areas with soil contamination or through saturation of soils as a result of mounding and fluctuations of the groundwater table. Wetting and drying of the unsaturated zone that occurs as a result of recharge and recovery cycles can also cause geochemical oxidation and reduction reactions that could contribute to mobilization of constituents from soils to groundwater.

The process of leaching of soil contamination to groundwater is complex and dependent on several variables including how long the contamination was present, solubility of contamination in water, composition of soil, and the chemistry of recharge water in relationship to underlying groundwater.

Historic operations at the KWB during recharge periods of 1995-1998, 2005-2006, and 2011, in addition to recharge operations at other neighboring groundwater banks, resulted in periodic high groundwater elevations within KWB and surrounding areas. To evaluate potential mobilization of soil contamination or the migration of groundwater contamination as a result of high water level fluctuations, the minimum depth to water was simulated at 3 observation points corresponding to the hazardous waste sites using hydrologic model scenarios described in Section 7.1, Surface Water and Groundwater Hydrology. The frequency and duration of high water levels were then evaluated with respect to the nature and depth of residual soil and/or groundwater contamination.

Table 7.2-9 summarizes the number of months from 1996 to 2014 where the minimum simulated water level was less than 50, 25, or 0 ft bgs. (Hydrographs for each observation point are presented in Appendix 7-3 as Figures 7.3-31 to 7.3-33.)

Uhler Fire Training Facility Site (Observation Point 1)

From 1979 to 1990, a 6-acre property operated as an oil industry firefighting training facility. Petroleum contamination in soils and groundwater was first identified in 1996 and chlorinated solvents (TCE and PCE), arsenic, chromium, and lead were first identified in groundwater in 2006 above MCL concentrations. In 2011, approximately 10,000 tons of impacted soil was removed to approximately 18–35 ft bgs. In February 2012, CVRWQCB concluded that removal and remediation of impacted soil was complete. Groundwater monitoring in two wells continued following soil removal; however, it was limited because monitoring wells, which were screened between 20-60 ft bgs and 130-150 ft bgs, periodically went dry. In 2012, all constituents in shallow groundwater except for TRPH ranging 700 to 900 mg/L and TPH as diesel ranging from 190 to 205 mg/L were below applicable MCLs. According to recent regulatory correspondence, groundwater recharge and extraction activities conducted by KWBA are being closely monitored as part of the ongoing groundwater monitoring program for this site.[41]

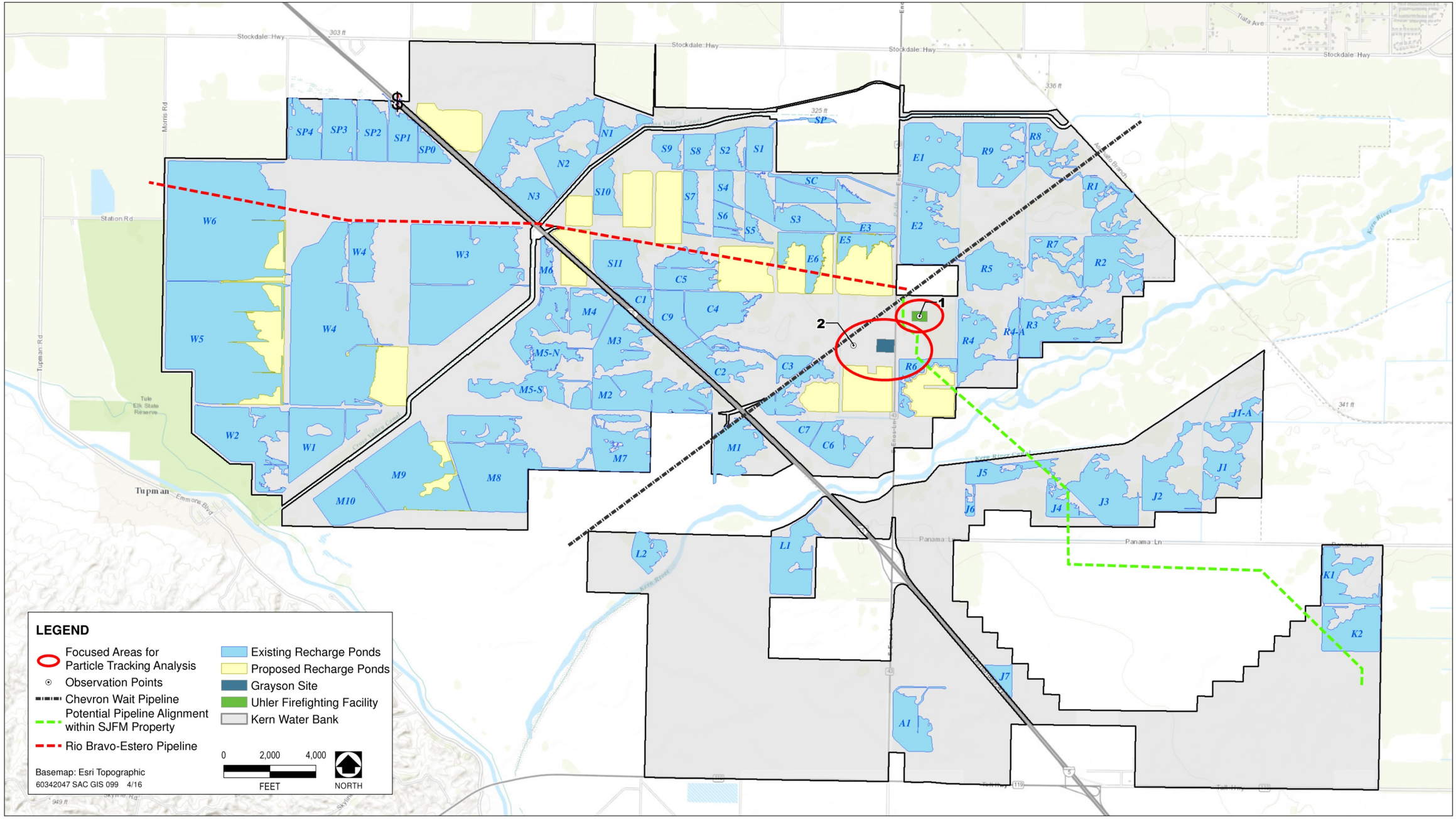
KWB along with neighboring groundwater banking recharge operations contributed to a rise in groundwater levels resulting in water potentially contacting contaminated soil between 1996 and 2014. The source of contamination was thought to have been removed in 2011.

Nearby wells were sampled for BTEX, PCE, and TCE (30S/25E-14K01, -11Q01, -13F01, -13L01 and -14J01) at various times from 2001 to 2012 with no detections except for ethyl-benzene at 1.9 µg/L in a 2002 sample from well 30S/25E-11Q01. There were no detections in subsequent 2005 and 2014 samples. Methyl tert-butyl ether (MTBE) analyses were also run in samples from -13F01, -13L01, and -14J01 and was only detected in a 2003 sample from -14J01 at 8.6 µg/L with no detections in subsequent 2006 and 2012 samples.

Particle tracking generated by the DWR KWB Model under the APO scenario shows that groundwater contaminants in the vicinity of the Uhler Fire Training Site would have remained within KWB Lands (see Appendix 7-3).

Grayson Site (Observation Point 2)

The site contains three concrete lined wastewater basins and possibly one unlined sump that were reportedly used for oil and wastewater storage. Cease and Desist and Cleanup and Abatement Orders (CAOs) were issued by the CVRWQCB regarding the disposal basins (called Ponds 1 through 4 in the CAO). This site remains in active case status with the CVRWQCB as a CAO (No. R5-2015-0730) requiring demonstration that the discharge to the ponds can comply with the applicable laws, policies, and regulations or the discharge will have to cease by December 31, 2016. Work outlined in the CAO may include a hydrogeological site characterization to assess the effects of the discharge of oil field wastes on underlying groundwater. The CAO states that if the discharger demonstrates that the wastes discharged to the ponds cannot affect the quality of the underlying groundwater, the Assistant Executive Officer may rescind by signed letter all or part of the requirements the groundwater investigation and groundwater monitoring portions of the CAO. A Work Plan for Proper Basin Closure, dated January 26, 2016, was submitted to CVRWQCB for three of the basins (noting that the fourth area was never used). The Work Plan included plans for breaking up and removal of the liner, excavation of any visual contamination, stockpiling and sampling and analysis of excavated stockpiled soil, composite sampling the floor of the impounds after excavation, and backfilling the impounds after CVRWQCB approval. The Work Plan contained no information about a hydrogeologic investigation or a groundwater monitoring and reporting program. The current status of Work Plan approval and implementation is not known.



Source: Sanberg 2015 and AECOM 2015

FIGURE 7.2-10. Location of Observation Points at Areas of Potential Contamination

TABLE 7.2-8

SUMMARY OF HAZARDOUS MATERIAL SITES WITH RESIDUAL SOIL OR GROUNDWATER CONTAMINATION, 1996-2014

Site Name	Observation Points	Constituents of Potential Concern[1]	Depth to Potential Contamination
Uhler Firefighting Training Facility (Being Monitored) CVRWQCB – Removal and Remediation of Impacted Soil Complete – February 2012	1	Tetrachloroethylene (PCE), trichloroethylene (TCE), arsenic, chromium, lead, crude oil, benzene, toluene, ethylbenzene, and xylenes	Residual TPH soil contamination less than 100 mg/kg at 35 ft bgs. Samples taken in 2012 showed TPH above MCL. Shallow groundwater monitoring will continue as per RWQCB recommendations and/or when water level in the area allow.
Grayson Site – Under CVRWQCB CAO – Workplan for Basin Closure submitted January 26, 2016	2	Petroleum and oil field wastewater constituents, nitrates, and solvents	Unknown; surface discharge of oilfield wastewater into 3 concrete-lined ponds.

Notes:
ft bgs = feet below ground surface; mg/kg = milligrams per kilogram; TPH = Total Petroleum Hydrocarbons
1. Wastewater produced from oil fields may contain elevated concentrations of general minerals (especially total dissolved solids and chloride), metals (i.e., arsenic), trace elements (i.e., boron, strontium, thallium, lithium, etc.), petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs, i.e., benzene, toluene, ethylbenzene, and xylenes [BTEX]), and radionuclides (i.e., uranium)

TABLE 7.2-9

FREQUENCY OF MONTHLY OCCURRENCE OF MODEL-GENERATED MINIMUM DEPTH TO WATER AT OBSERVATION POINTS

	1	2
APO WITH KWB[1]		
DTW < 50 ft	58	58
DTW < 25 ft	20	22
Flooding (DTW < 0 ft)	2	2
AFO-EC WITH KWB[2]		
DTW < 50 ft	0	0
DTW < 25 ft	0	0
Flooding (DTW < 0 ft)	0	0
AFO-EC WITHOUT KWB[2]		
DTW < 50 ft	0	0
DTW < 25 ft	0	0
Flooding (DTW < 0 ft)	0	0
AFO-BC WITH KWB[2]		
DTW < 50 ft	20	25
DTW < 25 ft	5	6
Flooding (DTW < 0 ft)	0	0
AFO-BC WITHOUT KWB[2]		
DTW < 50 ft	0	0

TABLE 7.2-9

FREQUENCY OF MONTHLY OCCURRENCE OF MODEL-GENERATED MINIMUM DEPTH TO WATER AT OBSERVATION POINTS

	1	2
DTW < 25 ft	0	0
Flooding (DTW < 0 ft)	0	0

Notes:
APO = Analysis of Past Operations, AFO-EC = Analysis of Future Operations - Existing Conditions; AFO-BC = Analysis of Future Operations – Buildout Conditions; KWB = Kern Water Bank; DTW = depth to groundwater
1 Frequency of monthly occurrence from January 1996 to December 2014 (228 months)
2 Frequency of monthly occurrence from January 2015 to December 2035 (252 months)
Source: Section 7.1, Surface Water and Groundwater Hydrology

Water quality data from nearby wells did not show petroleum hydrocarbons, VOCs, or SVOCs within detection limits.

Groundwater is generally greater than 50 ft bgs; however, simulated groundwater reached flooding conditions (water levels at ground surface) for 2 months in 1996. Water levels have been consistently below 75 ft bgs since late-2011 (see Appendix 7-3, Figure 7.3-9).

The extent of soil and groundwater contamination from site activities is presently unknown. Because the site is adjacent to a KWB recharge pond (R6 on Figure 7.2-10), potential soil and groundwater contamination, if present, could have been mobilized if groundwater reached potential contamination zones. However, particle tracking generated by the DWR KWB Model for the APO scenario shows that groundwater contaminants in the vicinity of the Grayson Site, if present, would have remained within KWB Lands. KWB recovery wells capture groundwater in the vicinity of the Grayson Site, and analytical testing from the recovery wells has not shown detectable levels of petroleum compounds or chemicals associated with hazardous waste.

Conclusion

Particle tracking generated by the DWR KWB Model shows that groundwater contaminants in the vicinity of the two sites (Uhler Firefighting Facility and Grayson Site) would have remained within KWB boundaries. Particle tracking results are included in Appendix 7-3 in Figure 7.3-6 A&B (APO with and without the KWB). Particle paths (and movement of potential COCs) would be minimal and limited to about a mile from any of the two sites during past KWB operations.

As summarized in the analysis above, KWB operations under the Analysis of Past Operations (APO) scenario using the DWR KWB Model contributed to the rise in the groundwater table potentially resulting in groundwater coming in contact with contaminants between 1996 and 2014. This may have resulted in groundwater degradation at the Uhler Fire Training Facility site (soil remediation considered complete by CVRWQCB but groundwater monitoring needed to be continued) and the Grayson Site (currently under a CVRWQCB CAO) with work in progress. However, particle tracking model results indicated that any potential contaminants from these sites would have traveled about 0.25 mile with KWB recharge and recovery and about 0.5 mile without KWB recharge and recovery operations since 1996. Furthermore, water quality data available between 1996 and 2014 do not show evidence that KWB recharge and recovery operations have mobilized potential contamination in soils or the unsaturated zones associated these sites potentially degrading groundwater quality.

Therefore, the impact of KWB operations during 1996 to 2014 in relation to these sites on groundwater quality was ***less than significant*.**

Mitigation Measures

None required.

2015 – 2035

Future KWB recharge and recovery operations would be similar to 1996 to 2014 activities; however, recharge and recovery operations would be increased with the addition of planned recharge ponds, recovery wells, and ancillary facilities. Impacts of KWB recharge operations on groundwater quality associated with hazardous material sites during future recharge operations during the periods of 2016–2019, 2026–2027, and 2032 (using the DWR KWB Model under Analysis of Future Operations – Existing Conditions and Buildout Conditions [AFO-EC and AFO-BC, respectively] are similar to 1995–1998, 2005–2006, and 2011 hydrologic conditions, respectively. Potential impacts were evaluated by analyzing the minimum water levels at the two observation points (see Table 7.2-9) using the DWR KWB Model. (Hydrographs presenting AFO-EC and AFO-BC water levels with and without KWB operations for each observation point are presented in Appendix 7-3, Figures 7.3-10 and 7.3-11, respectively.

Under the AFO-EC scenario, groundwater levels would rise during recharge periods; however, due to substantial lowering of the water table from the multi-year drought, groundwater levels may not recover to historic water levels. Consequently, groundwater levels could be lower than 1996-2014 conditions.

Recharge operations under the AFO-BC scenario would result in higher groundwater elevations than under the AFO-EC scenario. The AFO-BC scenario includes approximately 1,052 acres of planned recharge ponds (190 acres as part of the IRWM project and 862 acres as part of full build-out), which would result in recharge and recovery of more water.

Hazardous materials sites are subject to Kern County Environmental Health Services Division requirements and CVRWQCB requirements for the protection of water quality. The Kern County Environmental Health Services Division administers programs to ensure that hazardous materials are handled and managed in ways that are safe and protective of workers and the environment. These programs include: Hazardous Materials Business Plans, Hazardous Waste Generator / Tiered Treatment, underground and above-ground petroleum storage tanks, and the California Office of Emergency Services' Accidental Release Prevention Program. The CVRWQCB is responsible for state water quality. This includes oversight and working with potentially responsible parties for soil and groundwater cleanup.

Uhler Firefighting Training Facility (Observation Point 1)

The Uhler Firefighting Training Facility has an ongoing groundwater monitoring program under the oversight of the RWQCB which is being routinely reviewed by KWBA.

Under AFO-EC operations, an evaluation of the depth to water at observation point 1 indicates that water levels are not anticipated to rise above 50 ft bgs between 2015 and 2035 with or without KWB operations. Particle tracking analysis from the DWR KWB Model shows that contaminants, if present, would remain within KWB Lands and that groundwater particles (and movement of potential COCs) would be minimal and limited to about 0.25 mile (with KWB) and to about 0.5 mile (without KWB) from the Uhler site during future KWB operations (see Appendix 7-3 Figure 7.3-7A&B AFO-EC with and without KWB).

Under AFO-BC with KWB operations, groundwater levels are projected to be approximately 18 ft bgs for minimal periods of time. Table 7.2-9 indicates that groundwater levels under the AFO-BC would only rise above 50 feet bgs during 20 months and above 25 feet bgs during 5 months of the 252-month period (January 2015 to December 2035). Under the AFO-BC without KWB operations, groundwater was never simulated to rise above 50 feet bgs. Similar to AFO-EC, AFO-BC particle tracking analysis indicates that contaminants, if present, would remain within KWB Lands and groundwater particles (and movement of potential COCs) would be minimal and limited to about 0.25 mile (with KWB) and 0.5 mile (without KWB) from the Uhler site during future KWB operations (see Appendix 7-3 Figure 7.3-8A&B AFO-BC with and without KWB).

Grayson Site (Observation Point 2)

Under the AFO-EC with or without the KWB scenario, DWR KWB Model results for depth to water analysis at observation point 2 indicate that water levels are not anticipated to rise above 50 ft bgs (see Table 7.2-9). The presence or extent of potential soil and groundwater contamination will remain unknown until work under the existing CAO is implemented; however, groundwater contamination has not been found in water sampling from nearby wells.

Under the AFO-BC with the KWB scenario, DWR KWB Model results indicate that groundwater levels at observation point 2 is predominantly below a depth of about 50 ft bgs. However, modeled water levels are anticipated to rise above 50 feet bgs during 25 and above 25 feet bgs during 6 of 252 simulated months during the AFO-BC with KWB simulation only. The shallowest water level is simulated to be approximately 13 ft bgs. Groundwater levels are not expected to rise above 50 feet bgs for the AFO-BC without the KWB scenario.

There is an existing KWB recharge pond located adjacent to the southeast of the basins identified in the CAO, and several proposed ponds would be located approximately 1,000 feet or more from the site.

Under both the AFO-EC and AFO-BC scenarios with and without the KWB, particle tracking generated by the DWR KWB Model shows that groundwater flow in the vicinity of the Grayson Site remains within KWB Lands (see Appendix 7-3); Figures 7.3-7A&B (AFO-EC) and 7.3-8A&B (AFO-BC) show that groundwater particles (and movement of potential COCs, if present) would be minimal and limited to about 0.25 mile (with KWB) and to about 0.5 mile (without KWB) during future KWB operations.

Conclusion

As summarized above, KWB operations under AFO-EC and AFO-BC (with the KWB) conditions, would only result in groundwater levels that could rise above 50 ft and 25 ft bgs for limited periods of time with the potential to mobilize some COCs. For AFO-EC and AFO-BC without the KWB groundwater levels are not expected to rise above 50 feet bgs. Particle tracking results indicate that groundwater particles (and COCs, if present and mobilized) would remain within a mile of the two sites of concern (the Uhler Firefighting Training Facility (OP 1), and the Grayson Site (OP 2). Both sites are under CVRWQCB oversight with remediation of impacted soil considered complete (February 2012) and groundwater monitoring continuing at the Uhler Firefighting Training Facility and work just starting to be implemented under a CAO (issued August 15, 2015) at the Grayson Site respective to soil and groundwater contamination associated with three onsite oil field production wastewater holding ponds.

Therefore, the impact of KWB operations from 2015 to 2035 in relation to the two sites on groundwater quality would be ***potentially significant*** until such time that the CVRWQCB indicates that groundwater under the Uhler Firefighting Training area is not impacted and that soil and/or groundwater under the Grayson Site is not impacted.

Mitigation Measures

Mitigation Measure 7.2-2 would reduce impacts of KWB activities with regard to mobilization of contamination in soils or the unsaturated zones associated with hazardous waste sites or oil and gas production operations to less than significant. KWBA is obligated to carry out the measures relating to its actions in subsections b), c) and d) below (Section 7.0.4.3.2, 2016 KWBA Resolution). Therefore, the impact of KWB activities from 2015 to 2035 with regard to exposing workers or the public to previously unidentified hazards or hazardous materials would be ***less than significant, with mitigation***.

7.2-2 *KWBA will implement the following measures:*

a) *Comply with Mitigation Measure 7.11-3.*

b) *Hazardous waste sites would be subject to the county public health department and/or the CVRWQCB oversight with the responsible parties (see Section 7.0.4.1.7). KWBA will cooperate with the regulatory agency(s) during the process and provide pertinent groundwater elevations and water quality data the regulatory agencies may request.*

c) *On an annual basis, KWBA shall report the status of shallow groundwater level monitoring activities and water quality analysis in areas of contamination to the Kern Fan Monitoring Committee.*

d) *KWBA will continue to monitor and evaluate the nature and extent of any current and future contamination and remediation within KWB Lands as follows:*

(i) For all evaluation and monitoring activities performed by third parties on KWB Lands, KWBA shall obtain reports and sampling data as soon as they become available. Monitoring and evaluation shall continue until verification by third party documentation, regulatory correspondence, and/or laboratory analysis is obtained that indicates soil or groundwater contamination has been remedied and no longer provides a threat to groundwater quality.

(ii) On an annual basis, KWBA shall report the status of contamination for each issue and provide water quality data monitoring activities, where available, to the Kern Fan Monitoring Committee. Any newly discovered contamination shall be reported to the Kern Fan Monitoring Committee immediately.

7.2-3 The operation of oil and gas production wells within and surrounding KWB Lands could potentially degrade the quality of KWB water supplies.

1996 – 2014

KWB Lands are situated across four active oil and gas fields: Coles Levee, North; Strand Oil Field; Ten Section Oil Field; and Canal Oil Field. As shown in Table 7.11-2 in Section 7.11, Hazards and Hazardous Materials, there are 31 active, 11 idle, and 152 abandoned oil and gas wells on KWB.

While these oilfield wells are situated on KWB, they are not operated or associated with KWB operations or with KWBA. The wells are operated by third parties holding mineral rights or leases. KWB is located in an area of active oil and gas production and well stimulation activities although stimulation activities are not being done on wells within the KWB boundaries.

Oil and gas production and well stimulation activities are regulated by the Division of Oil, Gas & Geothermal Resources (DOGGR).(See Section 7.0.4.1.8) The DOGGR regulatory program emphasizes sound engineering practices that protect the environment, prevent pollution, and ensure

public safety. All California oil and gas wells, enhanced-recovery wells, and water-disposal wells are permitted, drilled, operated, maintained, plugged and abandoned under requirements and procedures administered by DOGGR. Other agencies like the CVRWQCB and the State and County Fire Marshal provide oversight for specific activities within their jurisdiction. The responsibilities of DOGGR are identified in CCR Title 14, division 2, Chapter 4, and include well design and construction standards, surface production equipment and pipeline requirements, and well abandonment procedures and guidelines.

Well stimulation activities are not known to have occurred in oilfield wells located on KWB Lands between 1996 and 2014. Two stimulation wells were identified at locations outside of KWB, near its southwest corner. Sampling of the nearest groundwater recovery wells is required as part of compliance for well stimulation activities. Central Resources, Inc. will sample existing KWB recovery well 19R-1 and West Kern Water District wells 28E-04 and 2-02 as part of the monitoring program.

Two wells are located on KWB Lands that inject oil field brines at depths ranging from 2,360 to 3,870 feet bgs. Injection wells are subject to regulation by the DOGGR Class II Underground Injection Control (UIC) program, which enforces the requirement of the federal Safe Drinking Water Act. There are no reports of leaks from these wells.

There is a single wastewater injection well not located on KWB Lands (well WD 2-31 – located in T30S/R26E – Section 31) that showed casing leakage at a depth between 812 feet to 817 feet during a pressure test in 2010. The leakage was corrected following testing in 2010. It is unknown how long the leak was present. The casing leak was located in the deeper zone of the freshwater aquifer below what is considered to be the main producing zone and screened intervals of most recovery wells. The nearest KWBA monitoring well in the deep aquifer, well 30S/26E-32N03, indicated relatively stable concentrations of TDS from 1996 through 2014. WD 2-31 has been routinely pressure tested and there is no indication of distinct changes in groundwater quality in the vicinity of the injection well; groundwater quality degradation associated with the injection well leak is considered to be less than significant. Annual mechanical integrity tests are performed to confirm that oil field brines have not contaminated overlying freshwater aquifers.

As shown in Table 7.11-3 in Section 7.11, Hazards and Hazardous Materials, several former oil wells or dry holes are located within existing recharge ponds. These wells are identified by DOGGR as plugged and abandoned. A review of available reports for wells shown on the table indicates that they were plugged and abandoned in accordance with regulated practices and in a manner that would preclude vertical movement along the well casing between the deeper oil-producing zone and the upper fresh water aquifer.

Older wells not properly plugged or abandoned by today's standards may lack plugs at the base of the freshwater aquifer or near the ground surface. Improperly plugged abandoned wells could serve as conduits for the vertical movement of oil brines or petroleum constituents or surface pollutants into the freshwater aquifer. According to DOGGR files, only one well had no abandonment record. This well is not located near KWB facilities. Sampling of monitoring and recovery wells on and around KWB Lands has not shown the presence of constituents associated with petroleum contamination.

Therefore, the impacts of the operation of oil and gas production wells within and surrounding KWB Lands on the quality of KWB water supplies during 1996 through 2014 were ***less than significant.***

2015 – 2035

Near-term future KWB activities include construction of approximately 190 acres of recharge ponds and three wells under the ongoing IRWM program (Kern Water Bank Recharge and Recovery Project). Longer-term future construction of approximately 862 acres of additional recharge ponds and

associated facilities is anticipated as part of full build-out. Maintenance of existing and new basins, wells, and ancillary facilities would also take place. The IRWM program ponds have been sited. Locations of additional ponds are approximate but will be consistent with the KWB HCP/NCCP requirements; final locations and areas will be determined as these facilities are designed.

Future KWB recharge and recovery operations would be similar to 1996 through 2014 activities; however, recharge and recovery operations would be increased slightly with the addition of new facilities. Third party oil and gas production, wastewater injection, and well stimulation activities within and surrounding KWB Lands are expected to continue in 2015 through 2035 in the same manner as during 1996 through 2014.

As shown in Figure 7.11-2 in Section 7.11, Hazards and Hazardous Materials, future recharge ponds are proposed in areas of plugged and abandoned oil production wells. Typical construction of oil wells includes an upper casing and cement seal from ground surface to a depth of approximately 500 feet. Groundwater level changes during recharge or recovery from KWB operations have maximum depths of approximately 250 feet. Changing water levels from KWB activities would not significantly impact active or abandoned oil wells.

Construction of recharge ponds may potentially damage the near surface portion or the top of plugged or abandoned wells and well casing failures during oil and gas production, wastewater injection, and/or well stimulation could cause a release of petroleum constituents, oil field brines, and/or well stimulation fluid into the freshwater aquifer, which may substantially degrade groundwater quality.

Therefore, the impacts of the operation of oil and gas production wells within and surrounding KWB Lands on the quality of KWB water supplies during 2015 to 2035 could be ***potentially significant***.

Mitigation Measures

Mitigation Measure 7.2-3 would reduce impacts of KWB activities within oil and gas operational areas within KWB Lands to less than significant. KWBA is obligated to carry out the measures relating to its actions in subsections a) and b) (Section 7.0.4.3.2, 2016 KWBA Resolution) and subject to legal requirements in subsection c) (section 7.0.4.1.7) below. Therefore, the impact of the operation of oil and gas production wells within and surrounding KWB Lands on the quality of KWB water supplies in the future would be ***less than significant, with mitigation***.

7.2-3 *KWBA will implement the following measures:*

a) *Prior to construction, identify all plugged and abandoned wells through agency contacts. This includes identification of abandoned wells through the DOGGR website, field verification of an abandoned well prior to construction, notifying DOGGR of intent to construct a recharge pond adjacent to or over an abandoned well.*

b) *Modify excavation and grading activities to ensure the near surface seals and wellhead remain undamaged.*

c) *If the top of an abandoned well or wellhead is damaged during pond construction, appropriate authorities (i.e., DOGGR, CVRWQCB, and/or Kern County Environmental Health) will be notified as to the nature and extent of the damage along with plans to repair the damage, as needed and in accordance with existing regulations.*

7.2-4 KWB recharge and recovery operations could potentially change water quality in the underlying aquifer as a result of lateral and vertical migration of low quality water within and outside the limits of the KWB.

During periods of recharge, groundwater levels rise and groundwater flow is outward from the KWB recharge mounds. During periods of recovery, water levels are depressed and groundwater flows inward. Recharge and recovery water level effects dissipate with distance. These effects are dynamic and variable depending on duration, volume, and location of recharge and/or recovery operations. At times, only recharge or recovery is occurring. At other times, both occur in the same year and the effects overlap each other. Groundwater levels in response to recharge and recovery can fluctuate from near land surface to depths of more than 300 feet below land surface.

Groundwater levels rose when KWB recharge operations were predominant (e.g., 1995-2000) and declined during periods when KWB groundwater recovery was dominant (e.g., 2001, 2007-2010). Near the end of the 2007-2010 recovery period, groundwater levels dropped below historical low levels in most areas. In some wells, groundwater levels decreased as much as 90 feet below the previous year's historical low level. During periods of active recharge, groundwater flow is primarily southeast to northwest beneath the northern portion and northwest to southeast beneath the southern portion of the KWB.

Water levels provide the driving force for groundwater flow and migration of dissolved constituents. When groundwater levels are high, flow direction is outward from the KWB. When water levels are low, groundwater flows radially inward toward the KWB.

Analysis Approach

Four methods were used to assess potential groundwater lateral and vertical migration of low-quality water: 1) reviewing Areas of Groundwater Quality Concern maps prepared by the KFMC and those prepared for this REIR, 2) developing and reviewing time versus concentration graphs to determine if individual dissolved constituent change over time and if they change with respect to other constituents nearby or within the same well, 3) comparing the concentration graphs with groundwater hydrographs, and 4) conducting particle tracking modeling to assess whether changes in chemical concentrations in a well correlate with past and modeled trends in surrounding wells. Each of the four methods were used to analyze lateral migration. Vertical migration was assessed by comparing time concentrations of various COCs for three identified depth zones (shallow, middle, and deep).

<u>Areas of Groundwater Quality Concern Maps</u>

Two sets of maps summarize water quality for KWB and surrounding areas. The first set of maps prepared by KFMC and titled, *Areas of Groundwater Quality Concern,* present data for 1995 (see Figure 7.2-3) and 1998-2009 (see Figure 7.2-4) for selected COCs: TDS, fluoride, arsenic, EDB, nitrate, uranium, and DBCP. The maps are regional in scale and extend from Highway 99 in the east to Elk Hills in the west. The second set of maps prepared for this REIR show wells sampled from 1995 through 2015 for TDS, arsenic, nitrate as NO_3, alpha, and uranium where one or more well samples exceeded the MCLs (see Figures 7.2-5 through 7.2-9). These COCs were selected based on a preliminary review of water quality data.

In the sampling program conducted by KFMC and KWBA, two types of wells are sampled: groundwater bank recovery wells and monitoring wells located across KWB and extending several miles beyond KWB Lands. Monitoring wells typically include three depth zones: shallow, middle, and deep. Water quality test results are summarized on maps for wells which exceeded the MCLs for the five COCs.

The maps described above were used to determine whether there are areas with low-quality water for one or more COCs and for which groundwater migration could impact either the recovery program or offsite areas.

Time-Concentration Graphs/Hydrographs

Individual well time/concentration graphs for TDS, arsenic, nitrate, alpha, and uranium from wells where one or more samples since 1995 were found to exceed the MCL are included at the end of Appendix 7-3. These graphs are listed in order of township, range and section; see Figures 7.2-5, 7.2-6, and 7.2-7 for TDS, arsenic, and nitrate as NO_3 respectively, and Figures 7.2-8 and 7.2-9 for alpha and uranium, respectively. Time/concentration graphs were also developed for a select set of wells located along the perimeter of KWB Lands as introduced in Appendix 7.3, Section 7.3-4. These wells are shown on Figure 7.3-1. This data set includes groupings of wells set on one time/concentration graph for:

- Arsenic - Figures 7.3-3A (Shallow Zone 0-50 µg/L); 7.3-3B (Shallow Zone 50-400 ug/L), 7.3-3C (Deep Zone 0-80 µg/L); 7.3-3B (Deep Zone 80-200 ug/L)
- NO_3 – Figures 7.3-4A (Shallow Zone), 7.3-4B (Middle Zone), and 7.3-4C (Deep Zone)
- TDS – Figure 7.3-5A (Shallow Zone), 7.3-5B (Middle Zone), and 7.3-5C (Deep Zone)

These are followed by combined alpha and uranium plots for single select wells from that data set.

Hydrographs for the wells included on Figure 7.3-1 are included on Figures 7.3-2-1 to 7.3-2-14. In addition, hydrographs from select wells used for KWB water level monitoring were generated for wells and areas within and adjacent to the KWB. These wells are identified in Appendix 7-3, Figure 7.3-12, with hydrographs shown on Figures 7.3-13 to 7.3-40.

Evaluation of Select Wells

Well cluster 30S/24E-13D is located in the western portion of KWB. Well 30S/24E-13D01 (shallow well – screen interval 150-250 ft bgs), -13D02 (middle well – screen interval 320-360 ft bgs), and -13D03 (deep – screen interval 520-650 ft bgs) – Hydrograph Figure 7.3-15 for the 13D hydrograph). These select wells had MCLS exceeded for certain COCs and show the following trends:

- In 13D01 TDS and NO_3 concentration trends generally followed one another (rising and falling together) indicating changes in water quality with a generally rising concentration trend until 2006 and then a generally decreasing trend with the exception of a rise in arsenic in a late-2012 sample. TDS values ranged from approximately 500 mg/L in late 1996, increasing to approximately 1,300 mg/L in 2006, and declining to approximately 550 mg/L in 2013. NO_3 followed a similar pattern starting at 2 mg/L in 1996, rising to 26 mg/L in 2006, and declining to approximately 8 and 17 mg/L in late 2011 and late 2012.
- In 13-D02, TDS and NO_3 concentrations followed similar trends (TDS range of 340 mg/L to a high of 800 mg/L in 2006 and 2009 with a decline to 500 mg/L in 2014; NO_3 below detection in late 1996 to a peak of 8 mg/L in 2009, with a follow-on decline).
- In 13-D03, TDS followed less pronounced changes in concentration over time. TDS ranged from a low of 360 mg/L to a high of 550 mg/L, with overall concentrations that tended to be more stable than those in the shallow and middle zones. NO_3 concentrations tended to be low (near the detection limit) and more stable than that in the shallow and middle zones.
- Arsenic (only detected in the shallow and deep zones) stayed at relatively low concentrations in both wells and did not appear to be affected by changing water levels.
- Alpha in the shallow zone well appears to follow the same concentration peak pattern as that for TDS and NO_3.
- Changing trends in concentration of TDS and nitrate suggest that water quality in the -13D cluster, in the shallow and middle zones, may be responding to a change due to mixing of recharge and recovery water.

During recharge operations, groundwater levels rise, causing a downward and laterally outward movement of groundwater. Mixing of recharge water and groundwater occurs along the interface between the two. Recovery operations result in pumping water from the deeper part of the aquifer and a further mixing of water. This mixing results in changes in concentrations of COCs over time. Mixing is variable and dependent on location of effective recharge, volume and duration of recharge, and the location, pumping rate, volume, and duration of recovery operations. Beyond natural lateral and vertical groundwater movements, both flow components would be enhanced during recharge and recovery operations, further distributing a mix of natural and recharge water across KWB Lands.

Well 30S/26E-32N01 is located in the southern portion of KWB. In Appendix 7-3, Figures 7.3-3B, 7.3-4A, and 7.3-5A show concentrations for arsenic, nitrate, and TDS, respectively, at well 30S/26E-32N01. This is also shown as a separate well in the arsenic/nitrate/TDS 30S/26E time/concentration graphs at the end of Appendix 7-3. Arsenic is shown to have two distinct peaks, one in 1998, and the other in 2005, while the TDS and nitrate time-concentration graphs show no change for those time periods. The two periods of elevated arsenic concentration do not correspond with groundwater level changes shown on the hydrographs. It can be inferred that the changes in arsenic concentration in that well are not due to lateral groundwater migration but to some other effect.

Well cluster 30S/25E-12B is located in the northern portion of KWB. Appendix 7-3 Figures 7.3-2-3 through 7.3-2-14 show the response of groundwater levels to recharge and recovery cycles. There are three identified major recharge and recovery cycles shown on the figures. Recharge cycles are identified by higher groundwater levels and recovery cycles are identified by periods of low groundwater levels. The three cycles were compared to the time-concentration graphs to assess potential correlation between changing groundwater levels and changing chemical concentrations. For well cluster 30S/25E-12B02 (shallow), 03 (middle), and 04 (deep), the hydrograph is shown in Figure 7.3-2-5 which indicates three major peaks in the water level (one in 1998, the second in late-2007 and early-2008, and the third in 2011/2012. Time/concentration graphs for this cluster are included in Appendix 7.3 Township 30S/Range 25E. these select wells had MCLs exceeded for certain COCs and show the following trends:

- For - 12B02 (shallow well), while there is a TDS peak in the 1997-1998 timeframe, there is no indication of concentration increases in 2007/2008 or in 2011/2012 although there is a slight rise in TDS starting in 2010. TDS concentrations appear to continually decline after 1997 which may be an indication that recharge and recovery operations are either diluting the existing TDS or removing TDS over time. Note that the 1997 high for TDS was 5,200 mg/L stabilizing around the MCL of 500 mg/L.
- 12B02 NO_3 concentrations slightly increased from 1997 to 2008 ranging from 20 mg/L to 32 mg/L. After 2008, there has been a steady decline dropping to approximately 10 mg/L.
- 12B02 Arsenic concentrations declined from a high of 41 ug/L in 1996 to low concentrations (with a few non-detects).
- For - 12B03 (middle zone), elevated TDS and nitrate concentrations are not seen in the prior to 1998. After that, there was a slow increase in TDS and NO_3 with a peak in the 1998/1999 period, a short decline after that, and a rise again in 2012, roughly corresponding to the 2011/2012 rise in water levels.
- For - 12B04 (deep well), no concentration trends are apparent that may be in response to increasing or decreasing water levels during recharge and recovery. Concentrations for TDS and nitrate in this well remain relatively stable with a very slow rise starting in 2005. TDS has ranged around 120 mg/L while NO_3 has ranged below 5 mg/L. Arsenic has had two peak concentration periods, of 38 ug/L in 1999 and of 39 ug/L in late 2003. Only the 1998 water level rise appears to correlate to the elevated 1998 arsenic concentration. Elevated water levels in 2007/2008 and 2011/2012 do not appear to have an effect on arsenic concentrations. Arsenic

concentrations appear to have been on a steady decline in this well since 2004 with no apparent relation to changes in groundwater levels.

Particle Tracking

Particle tracking was conducted using the DWR KWB Model to assess the potential distance a particle of groundwater may travel from the KWB boundary under various operating conditions. This could be used to assess potential COC movement beyond the boundary of KWB Lands. The scenarios evaluated were:

- APO – Analysis of past operations (1995 through 2014) with and without KWB recharge/recovery operations.
- AFO-EC – Analysis of future operations under existing conditions (2015 through 2035) with and without KWB recharge/recovery
- AFO-BC – Analysis of future operations under full project build out (2015 through 2035) with and without KWB recharge/recovery

Figure 7.2-11 shows APO results and Figures 7.2-12 and Figure 7.2-13 show AFO-EC and AFO-BC results, respectively. Figure 7.2-11 shows the migratory path of water particles from 1995 through 2014 for the APO "With KWB Operations." An example from Figure 7.2-11 is the set of particles placed on the western property line that trace the path of groundwater from the property line outward in a northwesterly direction during periods of recharge and follow a return path to the bank during periods of recovery.

Particle tracking was used to assess whether groundwater from areas of poor quality water could migrate and affect offsite pumping wells.

The movement of water particles were simulated using the MODPATH particle tracking model and incorporating flow and velocity vectors of the DWR KWB Model. For the APO evaluation, Figure 7.2-11 illustrates migration zones (with and without KWB Operations) of water molecules located at the KWB boundary at the start of the simulation period. Each particle path starts at a box at the KWB boundary. The line extending from the box is the particle path-line with the endpoint being the farthest extent of travel noting that during the migration period particles can move outwards in response to recharge and inwards in response to recovery. The figure illustrates that without KWB operations, movement of water particles are influenced by the operations of neighboring water banks, but travel shorter distances away from KWB boundaries when compared to that with KWB operations. Figure 7.2-11 shows that water particles move in the direction of groundwater gradient with little lateral movement. For example, a particle at the northwest corner of KWB boundary would move in a northwest direction. Figure 7.2-11 shows that a water molecule at the start of the simulation period would not migrate beyond 1.5 mile of the KWB boundary.

Similar to the APO, particle tracking scenarios for the AFO-EC and AFO-BC are shown on Figures 7.2-12A&B and 7.2-13A&B. All three particle tracking simulations show similar results over each simulation period.

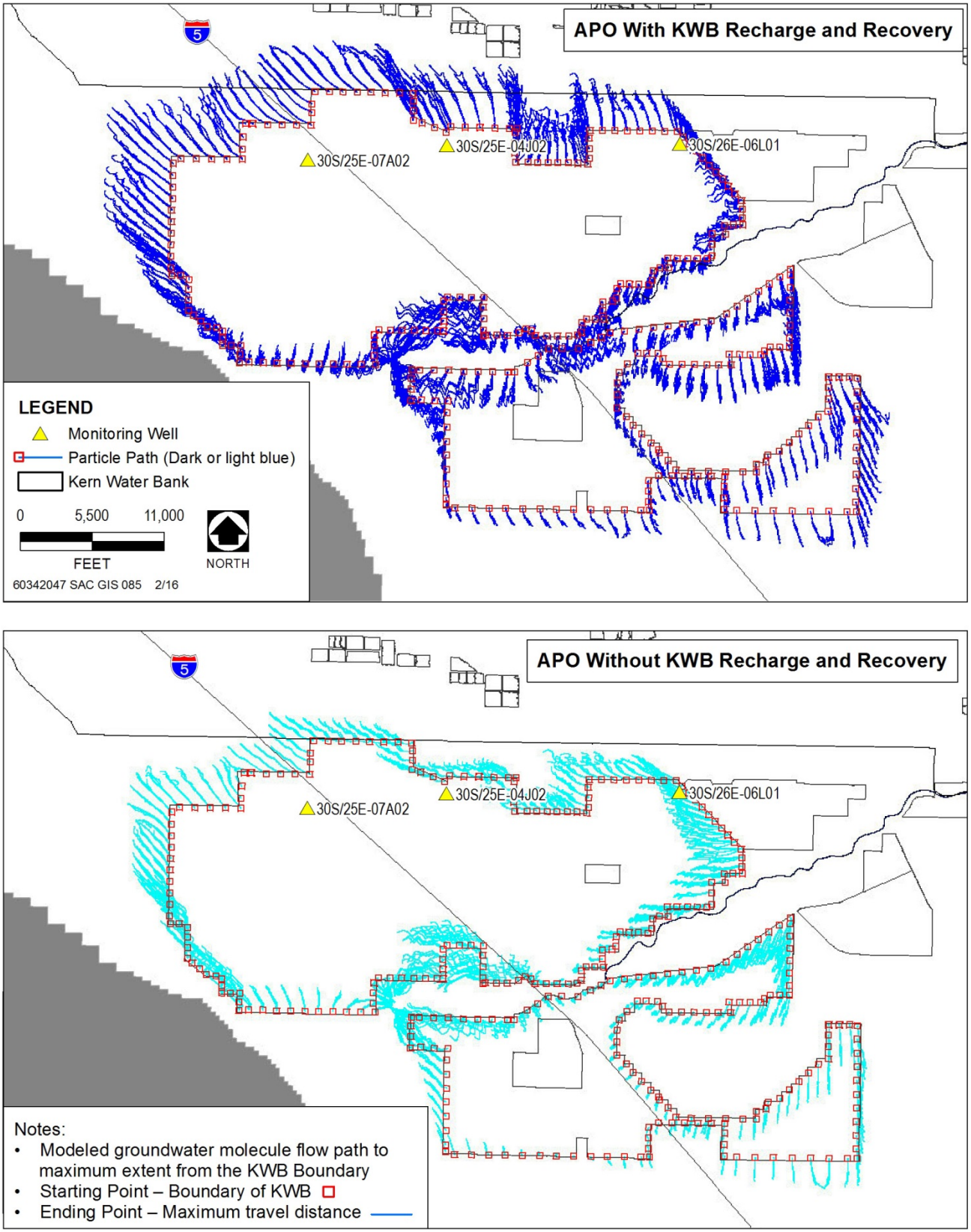


FIGURE 7.2-11. APO Particle Tracking Results with and without KWB Operations, 1995-2014

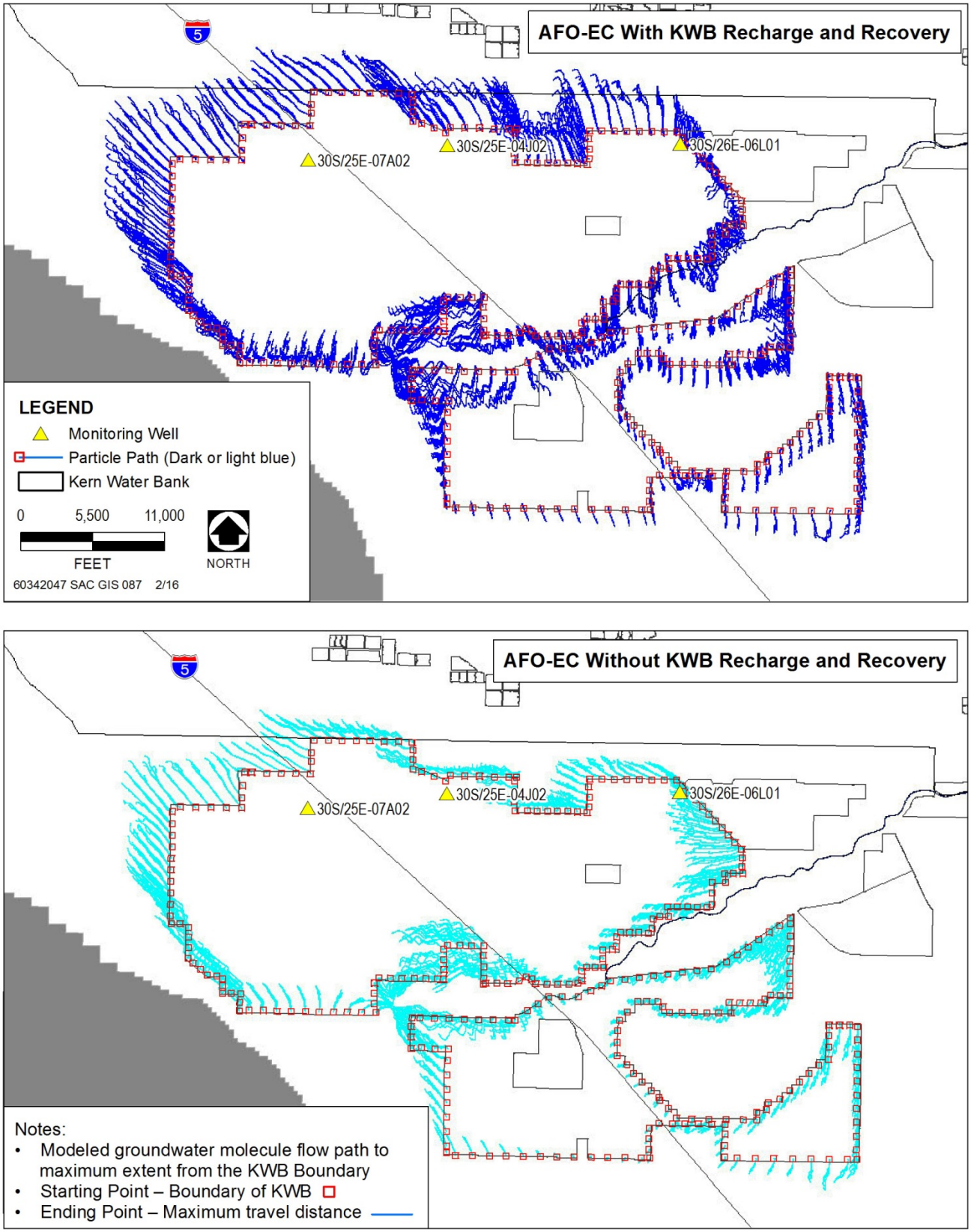


FIGURE 7.2-12. AFO-EC Particle Tracking Results with and without KWB Operations, 2015-2035

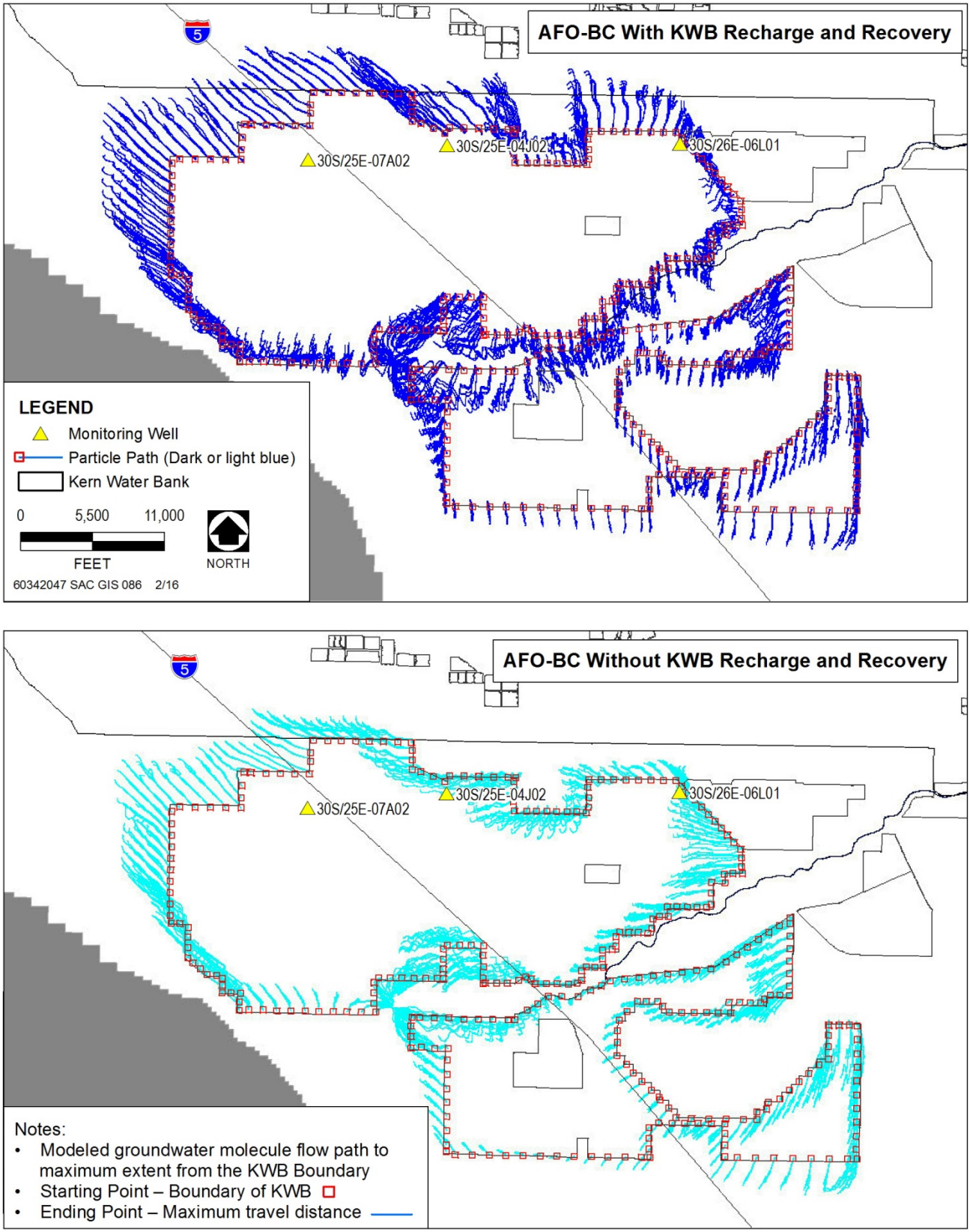


FIGURE 7.2-13. AFO-BC Particle Tracking Results with and without KWB Operations, 2015-2035

1995 – 2014

Areas of Groundwater Quality Concern Maps

Figures 7.2-3 and -4 identified three COCs present on or bordering KWB Lands: TDS, uranium, and arsenic. Figures 7.2-5 through 7.2-9 show well data relative to MCLs from 1995 through 2014 for TDS, arsenic, nitrate as NO_3, alpha, and uranium, respectively. These figures show wells with one or more occurrences where a sample exceeded its MCL for selected COCs. The figures should be used in conjunction with Appendix 7-3 time/concentration graphs to determine both concentration values and trends.

Figure 7.2-5 shows that areas of elevated TDS are located on the west to southwest one third of KWB Lands extending from the Elk Hills eastward into the valley. A second area of elevated TDS is located in the northeastern portion of KWB Lands.

Figure 7.2-6 suggests that arsenic has no clearly apparent pattern other than it appears to be more widespread at and east of I-5 in the deepest parts of the aquifer system during times of recovery.

Figure 7.2-7 shows that nitrate as NO_3 was not detected above the MCL in wells within KWB Lands.

Figure 7.2-8 (alpha) and Figure 7.2-9 (uranium) suggest that alpha is distributed in a wide west-southeast to east-northeast band north of the Kern River, and uranium was not as frequently detected as alpha so the distribution is not as well-known but appears to follow the pattern of alpha.

Hydrographs and Time/Concentration Graphs

Figure 7.3-12 in Appendix 7.3 is a map showing location of wells in the KWB area that are used for Kern Fan monitoring. The hydrographs (Figures 7.3-13 to 40) from these wells show changes in water level over time and can be used in identification of water level trends. These wells were selected to give an overview of historic water level trends for use with time/concentration graphs.

Time/concentration graphs have been prepared for TDS, arsenic, nitrate, alpha, and uranium for wells where one or more samples were found to exceed a respective well MCL as shown on Figures 7.2-5 through 7.2-9. The time concentration graphs are included in Appendix 7-3. In Appendix 7-3, the time/concentration graphs are divided by township and range from T29S/R24E, T29S/R25E, T29S/R26E, T30S/R24E, T30S/R25E, and T20S/R26E. Similarly combined graphs for alpha and uranium per well follow by township and range. The five chemical constituents are part of the group identified by the KFMC as COCs. The wells were selected based on availability of data and distribution of the wells both on KWB Lands and surrounding areas. Information from the time-concentration graphs supplements that shown on the “Areas of Groundwater Concern” map (Figure 7.2-4) above.

Time-concentration graphs were used to identify trends or changes in concentration over time that could be associated with groundwater migration. A trend might be identified if all COCs show a consistent pattern; that is, water level changes over time (hydrographs) and time-concentration graphs for the same well correlate.

The area of concern for TDS identified on Figure 7.2-3 and Figure 7.2-4 extends along the west side of KWB Lands adjacent to the Elk Hills. Figure 7.2-5 shows that elevated concentrations of TDS are widespread along the west side of the basin (and the west side of KWB Lands). A second area of elevated concentrations can be seen in Figure 7.2-6 and is located in the northeastern portion of KWB Lands. With the exception of well 30S/R25E-12B, all other wells in this area had stable concentrations of TDS near the MCL.

Figure 7.2-4 has identified a large area of elevated arsenic concentrations located south of KWB Lands and encroaching onto the southern portion of KWB Lands. Figure 7.2-8 shows wells with arsenic concentrations above the MCL. It can be seen that arsenic is widely distributed across the area but has no clear pattern other than it appears to be more widespread at and east of I-5 in the deepest parts of the aquifer system during times of recovery.

Time-series concentration graphs shown in Appendix 7-3, Figures 7.3-4A, B, C, and D, present arsenic concentrations from 1995 to 2014 for the shallow and deep zones. Arsenic is widely scattered throughout the area. There are few wells where the time-concentration graph either show an upward or downward trend.

In general, arsenic fluctuations are more pronounced with more MCL exceedances in deep zone wells. In particular, arsenic was considerably above the MCL in deep zone wells 30S/25E-36R01, 30S/26E-28J03, 30S/25E-22R03, and 30S/26E-32N03. These wells are all located in areas of concern for arsenic as identified on Figure 7.2-4.

Nitrate was below the MCL on KWB Lands and surrounding areas.

Figures 7.2-3 and 7.2-4 identified a large area southeast of KWB Lands with areas where uranium concentrations and a second smaller area on the western portion of KWB Lands and surrounding areas exceeding the MCL. Figure 7.2-9 identifies wells with uranium concentrations above the MCL. Alpha is related to uranium and a map identifying wells with alpha concentrations above the MCL is presented as Figure 7.2-8. It can be seen from Figures 7.2-8 and -9 that areas of elevated uranium and alpha extend across KWB Lands to areas to the northeast and east.

Uranium is generally widespread throughout the area with a few well locations on the west side of KWB Lands showing somewhat higher levels. For the most part, there are no trends in concentration. A few well locations showed a possible uptrend but these wells are mixed in with other wells with stable concentrations.

In most cases, hydrographs in the KWB area show relatively large water level fluctuations from 1995 through 2014, while COC concentrations remained relatively stable and did not correspond with the much larger changes in water level.

Particle Tracking

At the end of the three cycles of recharge and recovery, particle tracking for the APO shows that the “With KWB Operations” groundwater on the northern part of KWB Lands flows to the north and northwest, groundwater to the south flows southerly, and groundwater on the west side of KWB Lands flows northwest. The difference in distance a particle of water would have moved for the “With KWB Operations” compared to the “Without KWB Operations” can be seen on Figure 7.2-11. In general, particles move a somewhat greater distance for the “With KWB Operations” than for “Without KWB Operations.” The additional distance ranges up to about 1,500 feet.

Conclusion

Overall water quality within the various aquifer zones in the KWB is relatively unchanging. There are a few exceptions to this described above. Localized movement of COCs is limited laterally and in a few cases exhibits vertical mixing but overall trends are stable.

Therefore, changes in groundwater quality in the underlying aquifer as a result of lateral and vertical migration of poor quality from KWB operations from 1995 through 2014 were **less than significant.**

Mitigation Measures

None required.

2015 – 2035

Particle tracking analysis was performed for both the AFO-EC and AFO-BC for the "With" and "Without" KWB operations (Figures 7.2-12 and 7.2-13). There is a similar pattern of particle movement shown by the four graphs; the biggest difference between the "With" and "Without" KWB operations is that groundwater would migrate to the north and northwest as much as 1,500 feet in the "With" operations scenario. As recharge and recovery operations continue, groundwater migrates outward during times of recharge and inward during times of recovery. This would result in a mixing of groundwater in the KWB and surrounding area. Water used for recharge in KWB is from three surface water sources: SWP water in the California Aqueduct, Friant-Kern Canal water, and Kern River water. These surface water sources are of a higher quality than the existing groundwater present in KWB.

Similar responses to KWB operations are expected in the future and overall water quality within the various aquifer zones in the KWB changes would be similar as in the past.

Consequently, changes in groundwater quality in the underlying aquifer as a result of lateral and vertical migration of poor quality from KWB operations during 2015 through 2035 would be **less than significant.**

Mitigation Measures

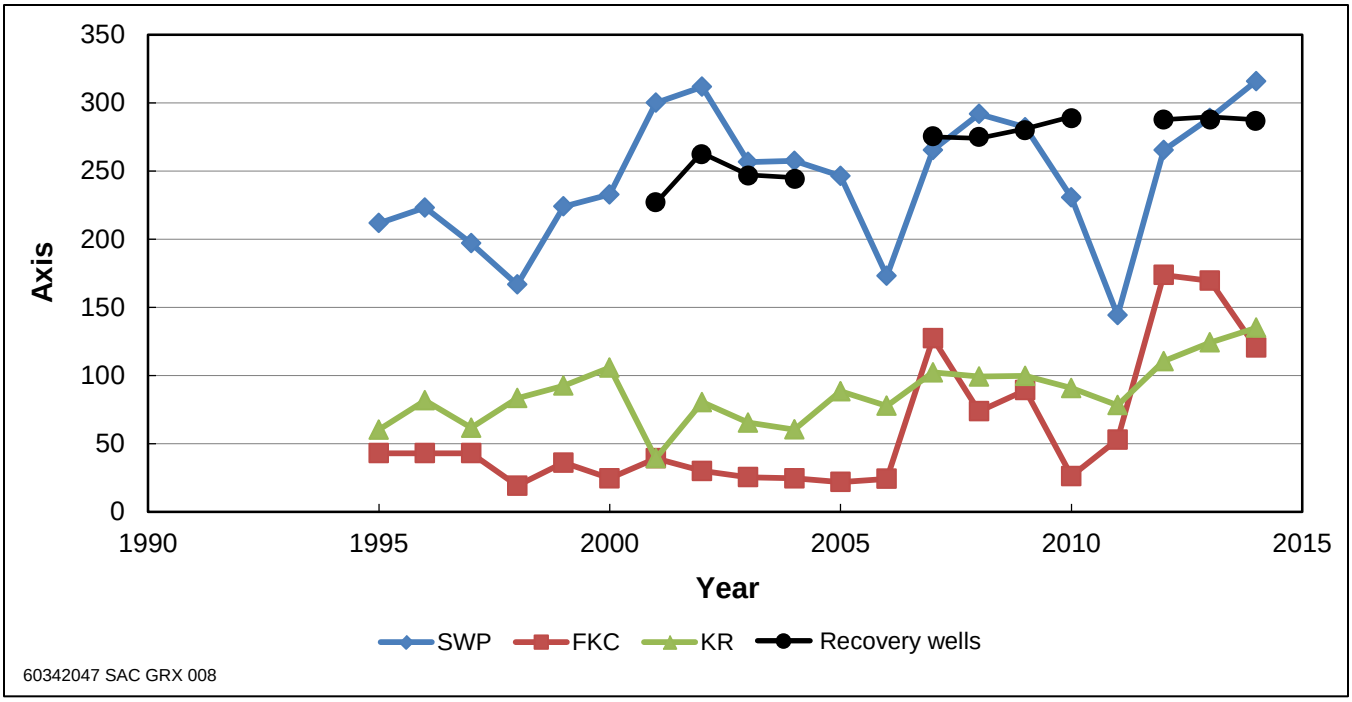
None required.

7.2-5 Kern Water Bank operations could potentially degrade water quality in the underlying aquifer as a result of an accumulation of salts during recharge activities.

1995 – 2014

TDS concentrations in imported and local water supplies used for KWB recharge operations can vary year to year and among sources. Water delivered to the KWB has TDS concentrations that vary by source (Figure 7.2-14). Concentration ranges from 144 to 314 mg/L with an average of 240 mg/L for SWP supplies; 12 to 174 mg/L with an average of 25 mg/L increasing to about 90 mg/L through 2014 for Friant-Kern Canal supplies; and 50 to 135 mg/L with an average of 80 mg/L for Kern River supplies.[7] The variation in TDS concentrations in a given year is primarily a result of the amount of precipitation, and volumes of agricultural return flows, stormwater runoff, and municipal discharges. During recharge periods in above normal and wet water years, the average TDS concentrations tend to be lower because there is more water within the system that dilutes the effects of salt loading from various sources. Figure 7.2-14 also includes TDS values for blended groundwater recovered from the KWB. Average annual TDS concentrations range from 227 mg/L to 289 mg/L. This water is pumped into the California Aqueduct.

Table 7.2-10 summarizes TDS in KWB recharge water from 1995 to 2014. The total amount of salt in the recharge water varies annually from a low of 920 tons to a high of 114,000 tons. The variation is due to the amount of water recharged and the proportion of salts from the different water sources.



Source: AECOM 2016

Figure 7.2-14 TDS Concentrations in Recharge Water Sources and Recovery Groundwater, 1995-2014

Groundwater beneath the KWB has variable TDS concentrations with higher concentrations noted along the west and southwest portions of the bank. Therefore, TDS concentrations of water recovered depend on the location of the wells used during KWB recovery operations. Table 7.2-11 summarizes salt recovered during KWB recovery operations from 1995 to 2014.

Table 7.2-12 provides a salt balance from KWB recharge and recovery operations, and indicates that approximately 430,874 tons of salts were imported (added) with the recharge water and approximately 519,562 tons of salt were exported (removed) between 1995 and 2014. KWB recovery operations have removed 21% more salt than what was introduced during recharge operations (Table 7.2-12). Figure 7.2-15 shows the cumulative salt balance associated with KWB operations through 2014.

The 1995 KWB MOU includes water quality protection measures that assist with balancing salt concentrations within the hydrologic basin. These measures include giving recharge priority to the best quality water available; removing more salts than are recharged, at a minimum, by a percentage equal to or greater than the percentage of surface recharge losses (6%); controlling the migration of poor-quality water; and extracting poorer quality groundwater where practicable (and where blending with excellent quality water from elsewhere on KWB Lands results in the water quality objectives of downstream users being met).

Table 7.2-6 shows that California Aqueduct water upstream of the KWB (Check 21) is higher in TDS concentration than water below the KWB (Check 29). Check 29 is located downstream of KWB Canal on the California Aqueduct. The difference in upstream and downstream Aqueduct water quality is due in part to KWB operations. Water pumped into the California Aqueduct from KWB recovery and blending operations has a lower concentration of TDS than water present in the California Aqueduct, improving water quality in the California Aqueduct and to downstream users. This higher quality water is delivered both downstream in the basin and outside of the basin.

TABLE 7.2-10

SUMMARY OF TOTAL DISSOLVED SOLIDS IN KERN WATER BANK RECHARGE WATER SUPPLIES, 1995-2014

Year	Gross Recharge (AF)	Net Recharge (AF)	Salt Added (tons)	Gross (mg/L)	Net (mg/L)	Net (tons/AF)
1995	222,260	208,924	28,092	93	99	0.13
1996	173,875	163,443	33,216	141	150	0.2
1997	112,262	105,526	20,582	135	144	0.2
1998	302,715	284,552	37,604	91	97	0.13
1999	36,753	34,548	9,270	186	197	0.27
2000	27,579	25,924	5,769	154	164	0.22
2001	10,030	9,428	3,817	280	298	0.4
2002	13,439	12,633	5,120	280	298	0.41
2003	40,374	37,952	17,895	326	347	0.47
2004	18,065	16,981	6,436	262	279	0.38
2005	387,557	364,304	114,436	217	231	0.31
2006	283,233	266,239	51,346	133	142	0.19
2007	16,728	15,724	7,675	338	359	0.49
2008	0	0	0	0	0	0
2009	0	0	0	0	0	0
2010	33,131	31,143	12,344	274	292	0.4
2011	476,501	447,911	76,352	118	125	0.17
2012	9,010	8,469	920	75	80	0.11
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
TOTAL	2,163,512	2,033,701	430,874	147*	156*	0.21

Notes:

AF= acre-feet; mg/L = milligrams per liter

No recharge occurred during 2008, 2009, 2013, and 2014

Net recharge volume in acre-feet is 6% less than gross recharge volume due to evaporative losses.

*The total gross and net in mg/L only represents the aggregate total not an average concentration of gross and net salt imported.

Source: Data from KCWA 2013[42]; KWBA 2015X[43] ;KCWA 2015x1[44]; KCWA 2015x2[45] compiled by AECOM in 2015

TABLE 7.2-11

SUMMARY OF TOTAL DISSOLVED SOLIDS EXPORTED WITH KERN WATER BANK RECOVERED WATER SUPPLIES, 1995-2014

Year	Gross Recovery (AF)[1]	Salt Recovered (tons)	Gross Salt Exported (mg/L)	Net Salt Exported (mg/L)	Net (tons/AF)
1995	0	0	0	0	0
1996	0	0	0	0	0
1997	0	0	0	0	0
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	0	0	0	0	0
2001	88,695	27,403	227	170	0.31
2002	26,974	9,637	263	197	0.36
2003	45,122	15,155	247	185	0.34
2004	49,289	16,332	244	183	0.33
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	230,686	86,564	276	207	0.38

TABLE 7.2-11

SUMMARY OF TOTAL DISSOLVED SOLIDS EXPORTED WITH KERN WATER BANK RECOVERED WATER SUPPLIES, 1995-2014

Year	Gross Recovery (AF)[1]	Salt Recovered (tons)	Gross Salt Exported (mg/L)	Net Salt Exported (mg/L)	Net (tons/AF)
2008	233,703	87,243	275	206	0.37
2009	162,461	62,311	282	212	0.38
2010	50,969	20,029	289	217	0.39
2011	0	0	0	0	0
2012	110,830	43,321	288	216	0.39
2013	197,171	77,270	288	216	0.39
2014	189,695	73,987	287	215	0.39
TOTAL	1,385,595	519,252	276*	207*	0.37

Notes:

AF= acre-feet; mg/L = milligrams per liter

No recovery occurred during 1995 – 2000, 2005, 2006, and 2011

Net salt exported from the hydrological basin is assumed to be 75% of salt extracted.

*The total gross and net does not represent an average from 2001 to 2014, but only the aggregate total of gross recovery and salt recovered.

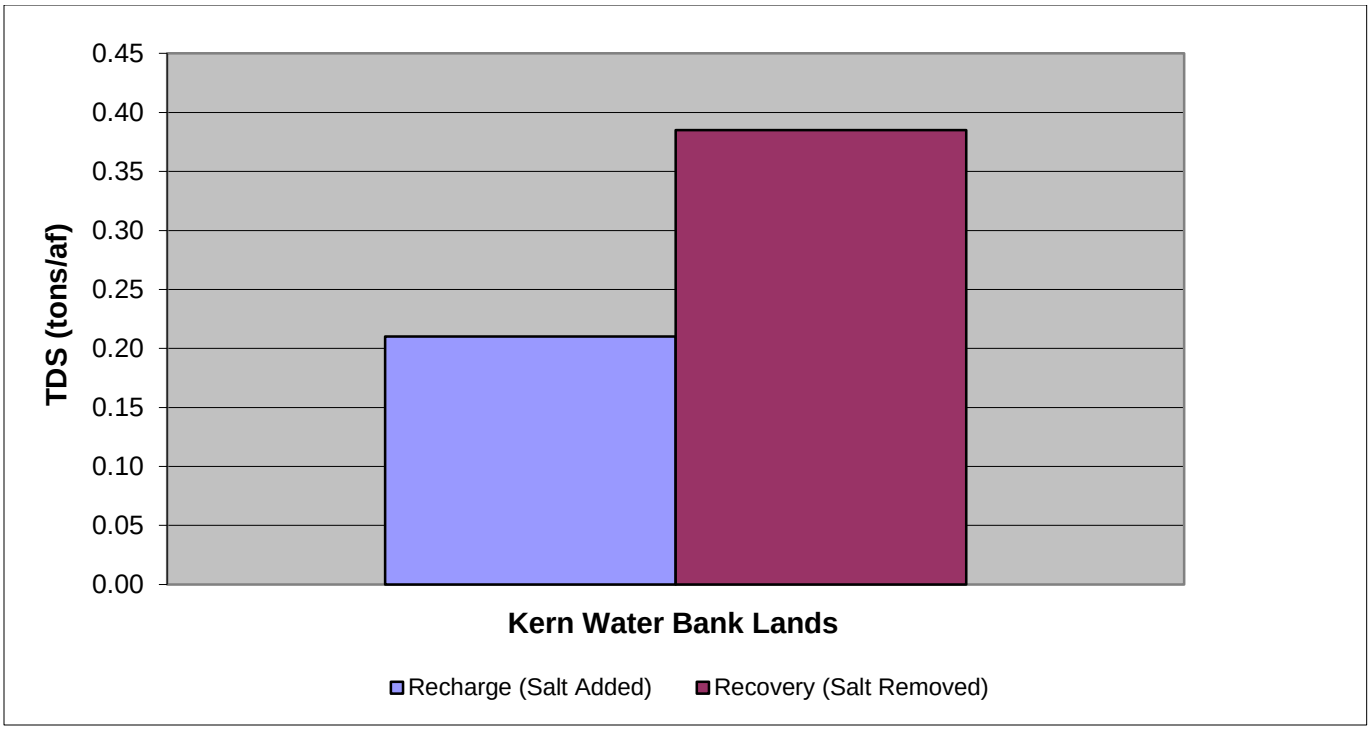
Source: Data from KCWA 2013[46]; KWBA 2015X[47] ;KCWA 2015x1[48]; KCWA 2015x2[49] compiled by AECOM in 2015

TABLE 7.2-12

ANNUAL SALT BALANCE ASSOCIATED WITH KERN WATER BANK OPERATIONS, 1995-2014

Year	Salt Added (see Table 7.2-10) (tons)	Salt Removed (see Table 7.2-11) (tons)	Net Salt Remaining (tons)
1995	28,092	0	28,092
1996	33,216	0	61,308
1997	20,582	0	81,890
1998	37,604	0	119,494
1999	9,270	0	128,764
2000	5,769	0	134,533
2001	3,817	27,403	110,947
2002	5,120	9,637	106,430
2003	17,895	15,155	109,170
2004	6,436	16,332	99,274
2005	114,436	0	213,710
2006	51,346	0	265,056
2007	7,675	86,564	186,167
2008	0	87,243	98,924
2009	0	62,311	36,612
2010	12,344	20,029	28,928
2011	76,352	0	105,280
2012	920	43,321	62,879
2013	0	77,270	-14,391
2014	0	73,987	-88,378
TOTAL	**430,874**	**519,252**	**-88,378**
Percentage of Net Salt Recovered during KWB Operations			**21%**

Source: Data from KCWA 2013[50]; KWBA 2015[51]; KCWA 2015[52]; KCWA 2015[53] compiled by AECOM in 2015



Source: AECOM 2016

FIGURE 7.2-15. Salt Balance Associated with KWB Operations, 1995-2014

Figure 7.2-15 shows that more salt is being removed from the aquifer below the KWB than is being recharged. The difference between the salt recharge and recovery volume in tons/acre foot indicate a lowering of salt content in the aquifer below KWB. This indicates that California Aqueduct water quality and groundwater quality beneath KWB have both been improved by operations of KWB with respect to TDS.

Therefore, impacts on water quality from accumulation of salts during KWB recharge activities from 1995 to 2014 were ***less than significant***.

Mitigation Measures

None required.

2015 – 2035

Similar responses to KWB operations are expected in the future and accumulation of salts during KWB recharge activities would be similar as in the past.

Therefore, impacts on water quality from accumulation of salts during KWB recharge activities from 2015 to 2035 would be ***less than significant***.

Mitigation Measures

None required.

7.2-6 KWB construction, development, and maintenance could potentially change water quality in the Kern River.

1996 – 2014

KWB facilities currently include approximately 7,200 acres of recharge ponds, 85 recovery wells, a network of monitoring wells, 36 miles of pipeline, and the 6-mile-long KWB Canal. The ponds consist of low earthen berms that pond water to depths of a few feet. The ponded water infiltrates the alluvial fan for recharge into the aquifer. Water flows between the ponds in small channels; KWBA operators control the flow with small weir boxes. The recovery wells average about 750 feet deep and produce as much as 5,000 gallons per minute of water. They are distributed throughout the KWB Lands and are spaced approximately one-third mile apart. Small diameter (15- to 36-inch-diameter) PVC pipelines transport water recovered from wells to existing canals or, in some cases, to large diameter (>36-inch-diameter) pipelines. Approximately 31 miles of small-diameter and 5 miles of large-diameter pipeline have been constructed.

Construction of these KWB facilities could have adversely affected surface water quality if spills or other pollutants were introduced into surface waters during rain events and runoff. Construction activities were conducted in compliance with regulatory requirements such as the NPDES General Construction Permit in effect at the time. Project-specific SWPPPs were developed and construction-related BMPs were implemented to minimize and avoid adverse effects from construction activities. Erosion control measures were implemented consistent with the KWB HCP/NCCP Vegetation Management Plan, which included seeding newly constructed berms and canal banks upon completion of final grade and broadcasting or straw-blowing clean straw or native grass hay over the newly seeded areas.

As discussed in Impact 7.11-1A in Section 7.11, Hazards and Hazardous Materials, construction contracts included specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as fuels. Title 8 of the CCR also addressed the use of hazardous products in the work environment, which would apply to construction contractors. The potential for inadvertent spills of materials, which could affect nearby surface water bodies or groundwater, was managed through construction site BMPs. Construction of KWB facilities from 1996 through 2014 are not known to have caused any substantial adverse impacts on surface water quality.

Therefore, impacts to surface water quality in the Kern River from KWB activities during 1996 to 2014 were ***less than significant***.

<u>Mitigation Measures</u>

None required.

2015 – 2035

Near-term future KWB activities include construction of approximately 190 acres of recharge ponds and three wells under the ongoing IRWM program (Kern Water Bank Recharge and Recovery Project). Longer-term future construction of approximately 862 acres of additional recharge ponds and associated facilities is anticipated as part of full build-out. Maintenance of existing and new basins, wells, and ancillary facilities would also take place. The IRWM program ponds have been sited. The locations of additional ponds are approximate but will be consistent with the KWB HCP/NCCP requirements; final locations and areas will be determined as these facilities are designed.

Construction of the ponds would require excavation, grading, and re-contouring of the soils at the recharge pond sites. During these activities, soils could become exposed to high winds or heavy precipitation causing a substantial increase in sedimentation in storm water run-off and loss of topsoil. In addition, construction activities would require the use of hazardous materials including but not limited

to petroleum products (i.e., oil, gasoline, and diesel fuels) and automotive fluids (i.e., antifreeze and hydraulic fluids). Inadvertent spills or leaks of such pollutants could affect the quality of runoff water from the construction sites. Construction activities would comply with the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Permit), as well as the KWB HCP/NCCP Vegetation Management Plan erosion control measures and applicable hazardous materials management laws and regulations. KWBA or its contractors would be required to prepare and submit a SWPPP that would identify pollutant sources that may affect the quality of storm water discharge and identify BMPs, such as erosion control and pollution prevention measures, to be used during construction. The project SWPPP would include BMPs to minimize the impacts of construction activities to water quality. With development of the SWPPP and implementation of BMPs, the potential for the discharge of pollutants and sediment to affect the water quality of runoff from construction sites would be minimized.

Construction activities may require discharges with a low threat to water quality or are low volume discharges with minimal pollutant concentrations. These discharges may be discharged to land under the Statewide "General Waste Discharge Requirements for Discharges to Land with Low Threat to Water Quality," Order No. 2003 003 DWQ or discharged to surface waters under the CVRWQCB's General Permit Order No. R5 2008 081, "Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters".[54] These permits specify discharge duration and volume limitations, set forth effluent limitations, require compliance with water quality objectives listed in the Tulare Lake Basin Plan, and establish specific requirements for a monitoring and reporting program. In accordance with the requirements of either of these permits, KWBA would be required to implement control measures to meet water quality standards specified for discharged water, conduct the appropriate sampling to demonstrate permit compliance, and regulate flow rates to prevent erosion or downstream flooding in the receiving water.

During construction and maintenance activities spills of equipment fuel, lubrication oil, and hydraulic oil could occur. Petroleum hydrocarbon products and other construction-related materials, as well as any hazardous materials, would be stored, handled, and used, although in relatively small quantities, during construction and maintenance. The potential release of hazardous materials to the environment as a result of construction or maintenance activities could also result in the degradation of water bodies, affecting water quality. Section 7.11, Hazards and Hazardous Materials, presents an analysis of the potential release of hazardous materials during construction and maintenance.

Compliance with applicable regulatory requirements, including those of the NPDES General Construction Permit, which requires preparation of a project-specific SWPPP and implementation of BMPs, the potential for pollutants and sediment to adversely affect the water quality of adjacent water bodies, such as the Kern River would be minimized.

Therefore, impacts to surface water quality in the Kern River from KWB activities during 2015 to 2035 could be ***potentially significant***.

<u>Mitigation Measures</u>

Mitigation Measure 7.2-6 would reduce potential impacts to surface water quality in the Kern River from KWB activities to less than significant. Therefore, the impact of KWB activities from 2015 to 2035 with regard to surface water quality in the Kern River from KWB activities would be ***less than significant, with mitigation***.

7.2-6 *KWBA will implement Mitigation Measures 7.2-1, 7.2-2, 7.2-3, 7.8-1(a) and (b), and 7.11-2.*

7.2-7 Continued use and operations of the KWB could potentially adversely impact water quality in surface water conveyance facilities and associated water supplies for downstream users.

1996 – 2014

Table 7-4 in Section 7.1.2 shows Kern River diversions for the 17-year period were 474,100 acre-feet (AF). Significant diversions (> 1,000 AF) occur during wet or above average years (six diversions from 1996 to 2014). Diversion of this water from the Kern River during high flows would not change the quality of water, only reduce the flow.

Water produced from KWB recovery and blending operations are subject to compliance with the Pump-in Policies for the SWP, KWB Canal, and CVC. These policies are designed to protect downstream water users. Each pump-in plan is reviewed by downstream water users and a Facilitation Committee. To determine if KWB operations comply with the Pump-in Policies, a blending model has been developed. The model is used to estimate water quality for a given set of flows and extraction wells.

In addition to the blending model, water quality monitoring is conducted by DWR and participating agencies in the California Aqueduct, canals, and recovery wells to verify conditions in the field are reasonably represented by the model and that the receiving waters are meeting applicable water quality objectives.

Recharge activities would have improved underlying groundwater quality through blending of high quality surface water. Pump-in water quality requirements ensured that water introduced into the CVC and California Aqueduct met KCWA and Department requirements.

To evaluate potential for changes in water quality in the California Aqueduct as a result of KWB operations, monitoring data collected by DWR were summarized for three locations on the Aqueduct and then compared for years representative of recharge (typical wet years 2006 and 2011) and recovery (typical dry years 2008 and 2014). Water quality at Check 25 (Check 21 may also be used if Semitropic Water Storage District is not pumping in) represents upstream conditions prior to the influence of KWB operations. Water quality at Check 29 represents conditions partially affected by pump-in of water from the KWB. Water quality at Check 29can also represent conditions in the Aqueduct downstream of KWB Lands (see Table 7.2-6). Review of monitoring program data indicate MCLs were met in the California Aqueduct at the selected monitoring locations. To indicate if the KWB operations were increasing COCs such that they exceeded the MCLs, a comparison of upstream (Check 21) and downstream (Check 41) water quality was performed. The monitoring data for years with high recharge (2006 and 2011) and with high recovery (2008 and 2014) were analyzed separately to indicate the effects of the different operations on water quality (Table 7.2-6).

During recovery years, concentrations of some constituents increased at downstream locations compared to upstream locations. For example, average and maximum arsenic and nitrate concentrations increased at Check 41. In addition, some parameter concentrations decreased at the downstream locations (e.g., bromide, chloride, and TDS), indicating a potential benefit from KWB operations on water quality in the California Aqueduct.

Therefore, the effects of KWB operations during 1996 to 2014 on water quality in the surface water conveyance facilities and associated water supplies for downstream users were ***less than significant***.

Mitigation Measures

None required.

2015 – 2035

Near-term future KWB activities include construction of approximately 190 acres of recharge ponds and three wells under the ongoing IRWM program (Kern Water Bank Recharge and Recovery Project). Longer-term future construction of approximately 862 acres of additional recharge ponds and associated facilities is anticipated as part of full build-out.

KWBA has also applied for a water right to divert unappropriated water from the Kern River, which is the estimated maximum quantity that KWBA can physically divert and recharge at the KWB in the wettest years (KWB Conservation and Storage Project). The quantity of water available for diversion to the KWB would depend on annual and seasonal hydrologic and climatologic conditions. Appropriation of water under this application would also supplement and permit water historically diverted from the Kern River to the KWB in above-normal or wet water years.

These future projects may result in additional water diverted, recharged, and recovered at KWB, although primarily during wetter years. Water diversions from the Kern River under future operations, however, would be similar in quantity and timing as current operations, although some additional water may be available in the wettest of years, when water quality is generally improved. As discussed above for 1995-2014, future diversions from the Kern River are not anticipated to reduce water quality in the Kern River downstream from the point of diversion.

During recovery operations, groundwater would be introduced into the CVC and the California Aqueduct and would be subject to the pump-in water quality requirements by KCWA and the Department. Recovered groundwater pumped into the CVC and California Aqueduct would be monitored. It is the intent to meet Pump-in Policy water quality objectives.

KWBA, with assistance from KFMC, would continue to monitor water quality at production wells and continue blending efforts to ensure that MCLs, pump-in criteria, and SWP water quality objectives (WQOs) are not exceeded.

Potential Impacts from future operations to water quality in the Kern River, California Aqueduct, and local conveyance systems would be similar to historical activities described above for 1996-2014, given the continuation of the current pump-in policies and water quality monitoring program.

Therefore, the effects of KWB operations during 2015 to 2035 on water quality in the surface water conveyance facilities and associated water supplies for downstream users local conveyance facilities and water supplies would be **less than significant**.

Mitigation Measures

None required.

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