2 PLAN AREA

This KRGSA GSP covers about 361 square miles (230,818 acres) within the outer KRGSA boundaries (also referred to herein as the KRGSA Plan Area or Plan Area) as shown on **Figure 2-1**. As mentioned previously, the Plan Area includes most of the Bakersfield City Limits and is traversed by portions of Highway 99 and Interstate 5. The northwestern boundary is along 7th Standard Road; the Plan Area extends to the south almost to Copus Road. The communities of Arvin and Lamont are located along the southeastern boundary. The Plan Area contains most of the Kern River from the area where it reaches the valley floor near the Beardsley Canal Diversion weir (about four miles downstream from 1st Point) to the 2nd Point measuring station near I-5 (**Figure 2-1**).

The Plan Area is slightly larger than the size of the KRGSA because it includes small areas within the outer boundary that were excluded from the KRGSA but are now included in the GSP; these lands include the Greenfield CWD GSA and portions of Kern County that are located within the outer KRGSA boundary as described in Section 1 (see **Figure 1-2**). Greenfield CWD and Kern County are cooperating with the KRGSA to develop one GSP for the entire area within the outer KRGSA boundary. Some small areas within the larger boundary remain in other GSAs and are not included in the KRGSA Plan Area (e.g., see small areas along Highway 58 in the northwestern portion of the KRGSA that are part of the Kern Groundwater Authority GSA and therefore excluded from the KRGSA Plan Area).

As an exclusive GSA, the KRGSA exclusively manages groundwater within the KRGSA boundaries. For areas in the Plan Area that are excluded from the KRGSA, groundwater management will be coordinated with GSAs associated with those lands, including Greenfield CWD, the KGA GSA, and others.

2.1 DESCRIPTION OF THE PLAN AREA

The Plan Area is in the Kern County Subbasin (DWR Basin No. 5-022.14), located in the southern San Joaquin Valley Groundwater Basin (5-022) and the southern portion of the DWR-defined Tulare Lake Hydrologic Region. Covering about 2,834 square miles, the Kern County Subbasin (Subbasin) is the largest groundwater subbasin in California, extending from the Tehachapi and San Emigdio Mountains in the south to the northern Kern County line (**Figure 1-1**). The Subbasin is bounded by the Sierra Nevada on the east and the Coast Ranges (Temblor Range) on the west.

As indicated on **Figure 1-1**, the KRGSA Plan Area comprises approximately 12.7 percent of the Subbasin. Adjacent groundwater subbasins of the larger San Joaquin Valley Basin (DWR Basin No. 5-022) include:

- Kettleman Plain (5-022.17)
- Tulare Lake (5-022.12)
- Tule (5-022.13)
- White Wolf (5-022.18)

Figure 1-3 shows the boundaries of the 11 GSAs in the Kern County Subbasin, including the KRGSA. Additional GSAs include:

- Buena Vista Water Storage District GSA
- Cawelo GSA
- Greenfield County Water District
- Henry Miller Water District GSA
- Kern Groundwater Authority (KGA) GSA
- McFarland GSA
- Olcese Water District GSA
- Pioneer GSA
- Semitropic Water Storage District GSA
- West Kern Water District GSA

No adjudicated areas exist in the Kern County Subbasin and no Alternative Plans as defined by SGMA have been submitted.

2.2 AGENCIES AND JURISDICTIONAL BOUNDARIES

Numerous agencies and entities with jurisdictional boundaries in the KRGSA Plan Area share responsibilities for water management and land use. As the sole municipality in the KRGSA, the City of Bakersfield has significant water management and land use responsibilities within the KRGSA Plan Area. In some areas, city limits extend beyond the KRGSA boundary; jurisdictional boundaries of the City within the KRGSA are shown on **Figure 2-2**. Land use and water management in this area is described in the Metropolitan Bakersfield General Plan and, in particular, the Kern River Element; these documents are summarized in **Section 2.6.1**, and **2.6.2**, respectively.

As described previously and illustrated on **Figure 1-1**, the Kern County Subbasin and the KRGSA are located within west central Kern County. Through the Kern County Planning & Community Development Department, Kern County has jurisdiction for land use planning in unincorporated areas of the County. The County also has responsibility for well permitting through its Department of Public Health. The Kern County General Plan and well permitting activities are discussed in **Section 2.6.3** and **2.6.4**, respectively.

2.2.1 Jurisdictional Boundaries of Federal and State Lands in KRGSA

The web-based DWR Water Management Planning Tool provides jurisdictional boundaries for other agencies and entities with water management and/or land use responsibilities, including state and federal lands. Jurisdictional boundaries of federal and state lands in the KRGSA Plan Area are shown on **Figure 2-2**. Federal lands include a small area owned by the Bureau of Land Management in the northeastern uplands of the Plan Area, south of the Kern River (about 1,000 feet south of Hart Park). Other scattered areas of federal lands are also indicated in the southern portion of **Figure 2-2**, with areas mapped both inside and outside of the KRGSA by the DWR Water Management Planning Tool.

State lands include several ecological reserves administered by the California Department of Fish & Wildlife (CDFW) to protect the endangered Bakersfield Cactus (*Opuntia treleasei*). Five of these reserves are in northeastern KRGSA, specifically in the upland Kern bluff area south of the Kern River (**Figure 2-2**).

In addition to the CDFW lands, the DWR Water Management Planning Tool also identifies lands designated as California Protected Areas (CPA); the state provides these lands in the CPA database (CPAD). These lands are owned in fee and protected for open space purposes by other public agencies and non-profit organizations. As shown on **Figure 2-2**, CPAD lands in the KRGSA are located primarily in the northeaster uplands south of the Kern River and on the northern KRGSA boundary.

No other state or federal agencies are known to administer land in the KRGSA Plan Area, such as military installations, United States Forest Service lands or other federal lands not on **Figure 2-2**, or state parks. No tribal lands are documented in the DWR Water Management Planning Tool or are known to exist in the KRGSA Plan Area.

2.2.2 Water and Irrigation District Boundaries

In addition to member agencies within the KRGSA, numerous water and irrigation districts surround, and in some cases overlap with, the KRGSA. Jurisdictional boundaries of those districts are shown on **Figure 2-3**. Most of these agencies provide primarily agricultural water within their respective service areas. Some of the district boundaries on **Figure 2-3**, such as Kern Water Bank and the Pioneer Project, involve agencies that operate large-scale groundwater banking projects.

The Subbasin also includes portions of the Kern County Water Agency (KCWA) service area, an agency created in 1961 by a special act of the California State legislature to serve as the local contracting entity for the State Water Project (SWP). The agency also conducts a wide variety of water management activities including water quality, flood control, canal operation and treatment plant construction and operation, and groundwater banking.

2.2.3 Water Purveyors

The Plan Area contains all or portions of numerous water purveyors, which provide water supply to residents within or adjacent to the KRGSA. Service areas of the primary water purveyors in the Plan Area are shown on **Figure 2-4**. Sources of water available in the KRGSA and activities of the KRGSA water purveyors are described in **Section 2.4.5** and throughout this GSP document.

2.3 EXISTING LAND USE

The Plan Area encompasses 361 square miles in Kern County and includes a large urban center (the Bakersfield Metropolitan area), highly developed agricultural areas, riparian ecosystems, and open space, including private lands held in public trust, such as the Panorama Vista Preserve, and municipal parks such as the Kern River Parkway.

Figure 2-5 shows general Land Use Planning Designations of the Kern County General Plan. As illustrated, the KRGSA Plan Area encompasses a broad variety of land uses including urban (e.g., commercial, parks and recreation/school, residential), industrial (also mineral and petroleum, transportation, utilities), agricultural (intensive, extensive), and open space.

A more detailed view of the land use within the City of Bakersfield is provided in the Metropolitan Bakersfield General Plan and shown on **Figure 2-6**. This figure provides details on residential, commercial, and industrial land use, as well as public facilities and open space. Agricultural areas surrounding the southern urban areas are also noted on **Figure 2-6**.

Areas designated by the California Department of Conservation, Farmland Mapping and Monitoring Program (FMMP) as Important Farmland emphasizes the importance of local agriculture on land use in the southern Plan Area. Various designations of Important Farmland categories are shown on **Figure 2-7.** The FMMP identifies lands with agricultural value on statewide maps in its Important Farmlands Inventory (IFI). IFI classifies land based upon its productive capabilities such as fertility, slope, texture, drainage, depth, salt content and availability of water for irrigation. Farmland categories are based on their suitability for agriculture as summarized below:

- **Prime Farmland.** This land has the best combination of physical and chemical characteristics for crop production. When treated and managed, its soil quality, growing season, and irrigation supply produce sustained high crop yields.
- **Unique Farmland.** This land does not meet the criteria for Prime Farmland or Farmland of Statewide Importance but has produced specific crops with high economic value.
- **Farmland of Statewide Importance.** This is land that does not qualify as Prime Farmland but has a good combination of irrigation and physical and chemical characteristics for crop production.
- **Farmland of Local Importance.** This land is either currently producing crops or has the capability to produce crops but does not meet the criteria of the categories above.
- **Grazing Land.** This is land with vegetation that is suitable for grazing livestock.

Other lands include confined animal agriculture and semi-agricultural land and rural communities.

Agricultural Preserves and agricultural lands protected under the Williamson Act also occur in the southern Plan Area as highlighted on **Figure 2-8**. These designated lands are overlain on a recent aerial photograph to show the additional agricultural land use within and surrounding the Plan Area[1]. The Williamson Act (California Land Conservation Act of 1965, Section 51200) was adopted to encourage preservation of the state's agricultural lands and to discourage its conversion to urban uses. This Act established an agricultural preserve contract procedure whereby any county or city would levy taxes on Agricultural Preserve contract land at a lower rate than its unrestricted market value using a scale based on the actual use of the land for agricultural purposes. In return, landowners guarantee that these properties would remain under agricultural production for a ten-year period. This contract is renewed automatically unless a Notice of Non-Renewal is filed by the owner. In this manner, each agricultural preserve contract (at any given date) is always operable at least nine years into the future. While contracts can be cancelled earlier than the ten-year period (with specific approvals and fees), the Williamson Act provides some stability for agricultural land use.

[1] Williamson Act lands outside of the KRGSA Plan Area are not shown.

Agricultural crop types and dairies in the KRGSA Plan Area are shown on **Figure 2-9** (2016 land use). The southern KRGSA is characterized by a variety of crops, including both perennial crops (e.g., vines and almonds) and annual crops (e.g., alfalfa, grains and field crops, cotton, and vegetables). In addition to crops, approximately 20 dairies operate in the Plan Area, contributing to the local agricultural economy. Numerous businesses and industries in the Plan Area support these agricultural activities including three food processing plants and numerous equipment, supply, and processing facilities.

2.4 WATER SOURCES AND USE

Water supply for the KRGSA Plan Area is sourced from groundwater, Kern River surface water, banked and recharged water, imported water (SWP and Federal Central Valley Project (CVP)[2]), and recycled water. A summary of these water sources and associated uses are provided below.

2.4.1 Groundwater

Groundwater is an important source of agricultural, domestic, and municipal supply, which is managed conjunctively with numerous surface water supplies in the Plan Area. The KRGSA is located in the Kern County Subbasin of the San Joaquin Valley Groundwater Basin as defined by DWR (Subbasin 5-22.14, DWR, 2006) (**Figure 1-1**). The Subbasin is the largest in the state, covering approximately 2,834 square miles (1,813,630 acres) and containing more than 40,000,000 AF of groundwater in storage (DWR, 2006; 2016).

2.4.2 Kern River

The Kern River originates northeast of Bakersfield in the Inyo and Sequoia National Forests and the Sequoia National Park at the base of Mt. Whitney. For more than 150 years, the Kern River has provided most of the natural surface water supply to the Subbasin, including water for agricultural irrigation, drinking water, and other uses. The Kern River channel enters the Plan Area from the northeast and traverses southwest across the north-central KRGSA Plan Area, to the stream gage shown as Second Point on **Figure 1-1**).

2.4.2.1 Kern River Allocation and Operation

Flows in the river consist of regulated and managed releases from Lake Isabella, approximately 25 miles upstream of the Plan Area (**Figure 1-1**). Isabella dam and Lake Isabella were constructed by the U.S. Army Corp of Engineers (USACE) in 1953 to address downstream flooding. Since that time, Isabella Dam has been operated for flood control, hydroelectric power, water supply, and conservation storage. Reservoir storage and Kern River flow management are coordinated by the Kern River Watermaster, working with the USACE, participating water districts, and the City of Bakersfield. Except for periods of

[2] Federal CVP water used within the KRGSA is Section 215 water which is a temporary supply of CVP water made available in large water supply years. The KRGSA does not contain any direct CVP contractors.

high runoff, releases from Lake Isabella are regulated through requests, or "calls" for water by the City on behalf of the Kern River Watermaster.

Distribution of water within the First Point service area of the Kern River was adjudicated in the 1900 Shaw Decree. Over the years, Kern River water has been apportioned based on entitlements determined through canal company consolidations, water rights transfers and acquisitions, court decisions, and agreements. In 1888, two permanent stream gage stations, First Point and Second Point, were established to measure flow in the Kern River on a real-time basis (**Figure 1-1**). The First Point daily discharge is used to allocate water among various Kern River interests, referred to as First Point diverters, Second Point diverters, and Lower River diverters. The Second Point of measurement is approximately 20 miles downstream and is used to check upstream water use (and entitlements) with diversion rights on the Lower River (Boyle, 1975). Second Point is shown on **Figure 1-1** and marks the western edge of the KRGSA Plan Area.

KDWD and City of Bakersfield are successors-in-interest to all First Point water rights holders. Buena Vista Water Storage District (BVWSD) is successor-in-interest to all Second Point water right holders. KCWA is successor-in-interest to all Lower River water right holders (downstream of Second Point). The City monitors, manages, and records flows and diversions in the river on behalf of the Kern River Watermaster for all water users.

A third stream gage on the Kern River is located downstream of Second Point (near Tupman) at an intertie between the river and the California Aqueduct (**Figure 1-1**). The Intertie was constructed in 1977 to convey Kern River flood waters into the aqueduct to prevent flooding of downstream lands.

2.4.2.2 Kern River Flows

Flows in the Kern River are highly variable, subject to both flooding and drought. Since 1893, natural flows at First Point have ranged from 138,740 acre-feet per year (AFY) in 2015 to 2,520,149 AFY in 1916, with a long-term mean of 711,649 AFY (Bakersfield, 2016). To provide a means of comparison between current flows and long-term average flow conditions, an annual river index is calculated and included in annual Kern River Hydrographic Reports. An index of 100 percent is representative of the long-term average flow in the river. The annual indices for a 22-year period from 1995 through 2016 are provided on **Figure 2-10.** During that time, the annual Kern River Index ranged from 19 percent (2015) to 236 percent (1998), with an average of 94 percent.

The 20-year period from 1995 through 2014 has an average index of 100 percent, indicating that this period is representative of the long-term average hydrologic conditions (**Figure 2-10**). Based in part on this average river index, the 20-year period 1995 through 2014 has been selected as a Study Period for GSP analyses. Numerous other factors were also considered for criteria in the Study Period selection including data availability, local water operations, and average precipitation. The selection of the 1995-2014 Study Period and it use in this GSP is described in more detail in **Section 3.1**.

2.4.2.3 Kern River Treatment Plants

Surface water from the Kern River is treated prior to distribution for municipal use. California Water Service Company (Cal Water) purchases Kern River water from the City of Bakersfield and treats it at the Northeast Bakersfield Water Treatment Plant (WTP) or the North Garden WTP for use within its service area (Cal Water, 2016). Additional micro-filtration treatment occurs at the North West WTP plant, located in the North Garden WTP. About one-half of the water treated in the North West WTP is supplied to the City of Bakersfield under contract with Cal Water.

2.4.2.4 Banked and Recharged Water

KRGSA members actively recharge and bank surface water supplies, including Kern River supplies and imported water supplies, for later extraction and use. Spreading, banking and recharge of surface water supplies occurs within dedicated water banking areas, such as the City of Bakersfield's (COB) 2800 Acre recharge facility, and through managed and regulated recharge in conveyance facilities, such as unlined canals and the Kern River channel, and through other dedicated recharge and recovery efforts and projects. Recovered recharged and banked water supplies constitutes a significant source of supply for the KRGSA members, particularly in connection with the City's domestic water supply.

2.4.3 Imported Water

Imported surface water is also an important source of supply in both the Subbasin and the KRGSA Plan Area. Water is available from the State Water Project (SWP), which distributes flows from northern California through a series of aqueducts, reservoirs, and pump stations, including the California Aqueduct shown on **Figure 1-1**. SWP water is conveyed from the California Aqueduct into the KRGSA Plan Area via the Cross Valley Canal (CVC). SWP water has been available to the Subbasin through KCWA, a state-water contractor since 1968. The Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation, has provided water supply to CVP contractors in the Subbasin since 1951 with the completion of the Friant-Kern Canal. While no direct CVP contractors are in the KRGSA Plan Area, CVP water is available for purchase in wet years (Section 215 water) and has been purchased by KRGSA member agencies when available.

The Henry C. Garnett Water Purification Plant (HCGWPP), owned and operated by ID4, primarily treats imported water for municipal use. SWP water is conveyed directly to the plant as needed. When excess SWP water is available, ID4 recharges it – both inside and outside of the KRGSA Plan Area – for subsequent recovery and treatment at the HCGWPP. ID4 also diverts Kern River water and CVP water to the plant through exchanges. Water from the HCGWPP is distributed to Cal Water, City of Bakersfield, ENCSD, and NORMWD.

2.4.4 Recycled Water

The City of Bakersfield treats municipal wastewater for a variety of reuses in the Plan Area. Tertiary treated wastewater is recycled to irrigate parkland and sports fields within the KRGSA Plan Area

that would have otherwise used potable water (about 733 AFY in 2015). Recycled water use is projected to increase to about 2,240 AFY by 2020 (Stetson, 2017). Secondary treated effluent is used for crop irrigation both inside and outside KRGSA boundaries (about 10,000 AFY in 2015), and de-nitrified secondary treated wastewater is used to recharge groundwater via unlined ponds (7,936 AFY in 2015) (Stetson, 2017).

In addition to the City of Bakersfield, other agencies collect and/or treat wastewater within the Plan Area including ENCSD, Kern County (through Kern Sanitation Authority and Kern County Service Area No. 71), North of the River (NOR) Sanitary District, and Lamont Public Utilities (LPUD). ENCSD sends their effluent to the City of Bakersfield for treatment at its WWTP No.2. The Kern Sanitation Authority operates a treatment plant for wastewater flows in unincorporated east Bakersfield. Plant effluent is used to irrigate 1,100 acres of adjacent farmland; 100 percent of the effluent process at the plant is reused. Effluent from the NOR Sanitary District and LPUD is also used for irrigation of fodder and fiber crops (non-human consumption).

Wastewater outside of the sewer service areas are primarily handled through onsite wastewater treatment systems (e.g., residential septic systems). For new development in unincorporated areas within the northern Plan Area, an OWTS is only allowed for parcels not within close proximity to a sewer trunk line of the City of Bakersfield or NOR Sanitary District. Onsite septic systems occur primarily within the southern and southeastern Plan Area outside of the city limits. In the south, most of the OWTSs are located north of Bear Mountain Blvd.

Table 2-1 summarizes information on the wastewater treatment plants, wastewater use, and recycling in the Plan Area.

Table 2-1: Wastewater Treatment and Recycling within KRGSA Plan Area

Facility	WWTP Capacity/ Average Flow	Service Area	Treatment Facilities and Wastewater Use
City of Bakersfield WWTP #2	25 mgd/ 13.9 mgd	East of Highway 99	Primary and secondary treatment; storage ponds, clarifiers, solids processing facilities, trickling filters, digesters, and methane recovery and cogeneration facilities. ENCSD and Kern Sanitation Authority also discharges to WWTP #2
City of Bakersfield WWTP #3	32 mgd / 17.6 mgd	West of Highway 99	Primary, secondary and tertiary treatment; storage ponds, clarifiers, solids processing facilities, activated sludge, digesters, and methane recovery and cogeneration facilities. Tertiary treated water (1,120 AFY currently) irrigates adjacent State Farm Sports Village. Secondary treated denitrified water (6,645 AFY currently) recharges groundwater in unlined ponds. About 18,000 AF of recycled water is exported for irrigation at Green Acres Farm (west of I-5). Kern Sanitation Authority also discharges to WWTP #3
Kern Sanitation Authority (KSA)	7 mgd/ 4 mgd	East Bakersfield	Wastewater treatment facilities include a screening unit, two primary clarifiers, an anaerobic digester, two trickling filters, two secondary clarifiers, and recirculation pumps.
North of River Sanitary District No. 1 (NORSD-1)	7.5 mgd / 5 mgd	North-northwest KRGSA. Oildale area north of the Kern River and west of Hwy 99.	Treatment facilities include screens, a lift station, a vortex grit removal system, addition of coagulant (Ferric Chloride) and Polymer, a primary clarifier, a plastic media trickling filter, a secondary clarifier, primary and secondary sludge digesters, 14 unlined sludge drying beds, and storage ponds (capacity 1,488 AF). The effluent is used to irrigate various crops for nonhuman consumption. Also treats some CSA-71 wastewater.
Kern County Service Area 71 (CSA-71)		Northwest KRGSA; north of the Kern River.	A centralized dry sewer system for developed area (7 square miles) and on-site septic systems. Most of the area has been developed with dry sewer systems. The dry sewers are connected to main trunk line sewers to transport the waste to a City of Bakersfield WWTP.
Lamont Public Utilities District (LPUD)	2.0 mgs / 1.4 mgd	Southeast KRGSA	Secondary wastewater treatment effluent is recycled at a nearby Green Waste Compositing facility and also used for irrigation of non-human consumption crops (silage, winter wheat, alfalfa) on 130 acres of land owned by the District.
Septic		Northwest, south, and southeast KRGSA	Unincorporated northwest Bakersfield, southern and southeastern Plan Area primarily served by private septic systems. Newer developments have dry sewer systems. Limited to areas not in close proximity to main sewer trunk lines for City of Bakersfield or North of the River Sanitary District.

2.4.5 Water Purveyors

Numerous water purveyors provide water supply for municipal, industrial or agricultural water uses in the KRGSA Plan Area. The entire Plan Area is also within the jurisdictional boundaries of the Kern County Water Agency and the Central Valley Regional Water Quality Control Board.

Figure 2-4 shows the boundaries of the larger local water purveyors within the Plan Area, including:

- California Water Service Company-Bakersfield (Cal Water)
- City of Bakersfield-Domestic Water System (City Domestic Water System)
- East Niles Community Services District (ENCSD)
- Kern County Water Agency (KCWA) Improvement District No. 4 (ID4)
- Kern Delta Water District (KDWD)
- North of the River Municipal Water District (NORMWD)/Oildale Mutual Water Company (OMWC)
- Vaughn Water Company (VWC) (portion of service area only)
- Greenfield County Water District
- Lamont Public Utilities District (LPUD)

Although Greenfield CWD is a separate GSA, the district is cooperating through an MOU with the KRGSA for the GSP and is included in the Plan Area (see MOU in **Appendix C**). Additionally, the Lamont Public Utility District (LPUD) is also part of a separate GSA (Kern Groundwater Authority GSA), although 70 percent of its service area overlies portions of the Plan Area (see **Figure 2-4**).

Table 2-2 provides a list of water purveyors in the KRGSA Plan Area including the larger purveyors listed above and additional smaller public and private water purveyors. Of those listed in **Table 2-2**, the City of Bakersfield, KDWD, ID4, ENCSD, and NORMWD/OMWC are members of the KRGSA. Information on the water supply portfolio for each purveyor also is provided.

Table 2-2: Water Supply Portfolios for Water Purveyors within KRGSA

Purveyors	Ground-water	Surface Water			Recycled	Other/ Notes	M & I / Residential	Whole-sale	Ag.
		Kern River	SWP	Section 215*					
Athal Mutual Water System	X						X		
Bear Mountain RV Park Water System	X						X		
California Water Service Company	X	X	X		X	SWP from ID4	X	X	
Casa Loma Water Company	X					Purchase from City	X		
City of Bakersfield-Domestic Water System	X	X	X		X	SWP from ID4	X	X	
East Niles CSD	X		X			SWP from ID4	X		
East Wilson Road Water Company	X						X		
El Adobe POA, Inc.	X						X		
Fuller Acres MWC	X						X		
Gosford Road WC	X						X		
Greenfield CWD	X	X					X		
Kern County Water Agency - ID4	X	X	X	X				X	X
Kern Delta Water District	X	X	X	X	X				X
North of the River Municipal Water District	See OMWC		X			ID4 wholesaler	X	X	
Oasis Property Owners Association	X						X		
Oildale Mutual Water Company	X		X				X		
Old River MWC	X						X		
Palm Mutual (data uncertain)	X						?		
Panama Road Property Owners Association	X						X		
Plainview PUD (data uncertain)	X						?		
Rancho Del Rio MWC	X						X		
Redbank Water System	X						X		
Ski West Village Water System	X					Ski Lakes	X		
South Kern MWC	X						X		
Stockdale Annex	X						X		
Stockdale Mutual	X						X		
Vaughn Water Company, Inc.	X						X		
Wini MWC	X						X		

No direct CVP or Oil Field water use within KRGSA boundaries.

* Section 215 water is a temporary (not to exceed one year) supply of CVP water made possible as a result of an annually large water supply not otherwise storable for project purposes, or infrequent and otherwise unmanaged flood flows of short duration.

Table 2-3 summarizes estimated annual water use by source for the larger water purveyors in the KRGSA Plan Area (listed in alphabetical order). Most of the water use data was compiled from published planning documents including Urban Water Management Plans (UWMPs), Groundwater Management Plans, and Agricultural Water Management Plans (AWMPs). Some data sets were provided directly from the agency. Data in this table are provided for general context of water use in the Plan Area; more detailed data are provided in the water budget analysis in **Section 4** of this GSP.

Table 2-3: Estimated Water Use by Larger Water Agencies in KRGSA Plan Area

Larger Water Purveyors in KRGSA Plan Area	Estimated Groundwater Use (AFY)	Estimated Kern River Water Use (AFY)	Estimated Imported or Purchased Water Use (AFY)
California Water Service Company (Cal Water)	33,388 (2015)	9,149 (2015)	12,496 (2015)
City of Bakersfield	32,210 (avg)	4,500 (avg)	6,500 (avg)
East Niles Community Services District	2,929 (2015)	0	4,573 (2015)
Greenfield County Water District	1,999 (2015)	0	3,322 (2015)
Kern County Water Agency Improvement District 4 (ID4)	Recovery of banked water only	9,000 (avg) (Lower River right or by exchange)	17,103 (2015)
Kern Delta Water District	165,000 (1995-2014)	174,074 (1995-2014)	18,443 (1995-2014)
North of the River Municipal Water District (NORMWD)/ Oildale Mutual Water Company (OMWC)	341 (2015)	0	7,574 (2015 from NORMWD/ID4)
Vaughn Water Company	9,847 (2015)	0	0

As indicated in the table, groundwater, which also includes some banked and recharged surface water for the purpose of this table, provides most of the supply in the KRGSA Plan Area. Given the large-scale conjunctive use operations and banking programs throughout the Plan Area, most groundwater extractions by the KRGSA agencies include banked and intentionally recharged water. Purveyor operations and provision of water supply to the Plan Area are summarized below.

2.4.5.1 California Water Service Company Water Supply

Cal Water is the largest municipal water supplier in Bakersfield. Its system serves a large portion of the City and segments of unincorporated lands adjacent to the City (**Figure 2-4**). Cal Water's Bakersfield District was formed with the purchase of Bakersfield Water Works in 1926 (Cal Water, 2016b).

Between 2011 and 2015, Cal Water provided water supply from the following sources (Cal Water, 2016a):

- Groundwater (including recovery of banked and recharged water) – 58 percent
- Untreated Kern River water purchased from the City – 21 percent
- Treated SWP and Kern River water purchased from wholesaler KCWA ID4 – 21 percent

Groundwater: Groundwater (including banked water) has historically supplied up to 80 percent of demands in the Cal Water service area (Cal Water, 2016a). Cal Water currently operates about 77 active wells to supply Bakersfield customer needs (Cal Water, 2016b). In recent years, Cal Water has replaced a portion of its groundwater and banked surface water supply with treated Kern River water as treatment plant capacity has increased. From 2007 to 2015, Cal Water reduced groundwater pumping from 53,889 AFY to 33,388 AFY (Cal Water, 2011 and 2016a).

Kern River Water from the City: Cal Water has a long-term supply agreement with the City of Bakersfield for 67,200 AFY of Kern River water. Cal Water owns and operates the Northeast Bakersfield Water Treatment Plant, which can treat 22,400 AFY. Future expansions of the plant will increase its capacity to 67,200 AFY. The North Garden Water Treatment Plant has a capacity to treat 8,960 AFY of Kern River water. Half of this amount (4,480 AFY) is supplied to the City under contract. Additional water treatment plants (Southwest Bakersfield WTP and Rosedale Ranch and Seventh Standard Corridor WTP) are proposed to provide additional capacity in staged phases, with some portion of the water committed to the City. Source water for these WTPs will be Kern River water from long-term contracts with the City (Cal Water, 2016b).

SWP and Kern River Water from KCWA ID4: ID4 provides wholesale water to Cal Water from the SWP and from Kern River flows. Water is recharged or treated in the Henry C. Garnett Water Purification Plant and conveyed to three retail suppliers including Cal Water (Cal Water, 2016b). Cal Water's contract for SWP from ID4 is for 20,500 AFY.

2.4.5.2 City of Bakersfield Domestic Water System Water Supply

The City Domestic Water System service area covers about 35 percent of the western portion of Bakersfield (about 38 square miles) (**Figure 2-4**) and provides supply from multiple water sources including groundwater, Kern River water, imported SWP water, and recycled water. The City contracts with Cal Water to operate its municipal water distribution system.

In 2015, the City Water System supplied water from the following sources (Stetson, 2017):

- Groundwater (including banked water) – 86 percent
- Treated water from Cal Water's North Garden Treatment Plant – 3 percent
- Treated SWP and Kern River water purchased from wholesaler KCWA ID4 – 9 percent
- Recycled Water from WWTP#3 for Sports Village irrigation – 2 percent

Groundwater: The City has about four wells per square mile within the City's Domestic Water System service area. Between 2011 and 2015, wells pumped between 30,806 AFY and 38,073 AFY for municipal water supply (Stetson, 2017). The City also owns recharge ponds along the Kern River, termed the 2800 Acre Groundwater Banking Area and uses the Kern River channel and other portions of the City for recharge of surface water supplies.

Kern River Water: The City holds pre-1914 appropriative Kern River water rights that average about 163,193[3] AFY Since its 1976 purchase of the canal company that was the former record keeper for these rights, the City of Bakersfield has taken over Kern River operations and record keeping. The Kern River water is treated for domestic use, provided for agricultural use in accordance with various City's water supply contracts, or used for recharge, including the 2800 Acre recharge ponds, the Kern River channel, and the Carrier Canal.

Recycled Water: The City uses tertiary treated wastewater to irrigate parkland within City boundaries that would have otherwise used potable water. In 2015, this use amounted to 733 AFY. An additional 7,936 AF of secondary treated water was recharged via effluent storage ponds and 9,924 AF was exported outside City boundaries for local irrigation in 2015 (Stetson, 2017). Recycled water use within City boundaries is expected to increase to 2,240 AFY by 2020 (Stetson, 2017).

2.4.5.3 East Niles Community Services District Water Supply

ENCSD is a public water supplier that formed in 1954 to provide water distribution services to residents within its boundaries. Its 6,202-acre service area is largely residential with intermixed areas of commercial, industrial, and agricultural (MKN, 2016). The ENCSD supply is derived from its seven groundwater wells and imported water from ID4. ID4, the City of Bakersfield, KDWD, and Arvin-Edison Water Storage District (AEWSD) underlie portions of its service area.

In 2015, groundwater provided 2,929 AF of supply and ID4 provided 4,573 AF of water. ENCSD's well pumping capacity is about 8,550 AFY. Its ID4 contract amounts to 11,000 AFY of water (MKN, 2016).

2.4.5.4 Greenfield County Water District Supply

Greenfield CWD provides drinking water supply to residential areas covering about 2,200 acres in unincorporated Kern County and the City of Bakersfield (lands within the KRGSA Plan Area). Currently, Greenfield CWD provides groundwater from five local wells serving about 3,000 connections (QK, 2016). Facilities include three booster pump stations and five water storage tanks; two additional wells and arsenic treatment facilities are currently in design (QK, 2016). In 2015, Greenfield CWD delivered 1,999 AFY of groundwater supply.

2.4.5.5 Kern County Water Agency ID4 Water Supply

KCWA was established in 1961 to negotiate and administer a water supply contract for State Water Project supply. ID4 was formed subsequently in 1971 to provide SWP water supply for portions of the metropolitan Bakersfield area. ID4 is a participant in the Cross Valley Canal, which conveys water from the California Aqueduct, and utilizes the 21.5 mile facility to move water into the ID4 service area and adjacent groundwater banking areas. Water delivered to ID4 is either directly recharged to replenish the groundwater basin or delivered to the Henry C. Garnett Water Purification Plant where it is treated and

[3] The City's Kern River entitlement averaged 163,139 AFY from WY 1995 through WY 2014, representing average hydrologic conditions for the Kern River (see **Section 4.6.1**). During that period, annual entitlements ranged from 23,476 AFY (WY 2014) to 408,717 AFY (WY 1998).

then delivered to four water purveyors. These retail purveyors include the California Water Service Company, City of Bakersfield, East Niles Community Services District, and North of the River Municipal Water District which wholesales to Oildale Mutual Water Company. The 103 million gallon-per-day facility serves about 185,000 residents of the metropolitan Bakersfield area. During calendar year 2016, about 33,860 AF of surface water was treated and delivered to water purveyors in ID4.

ID4 also conducts groundwater recharge utilizing imported SWP or exchanged Kern River water. Recharge made possible by water exchanges with Kern River interests commenced in 1971 and recharge using SWP water commenced in 1975 with the completion of the Cross Valley Canal. Actual annual amounts of recharge may vary from about 8,000 AF of unavoidable seepage losses to over 90,000 AF, depending on local and SWP water conditions and regulation afforded by exchanges. ID4 also is responsible for groundwater monitoring and reporting, most notably through its annual Report on Water Conditions within ID4.

In addition to its SWP supply, ID4 can receive Kern River water through KCWA rights for the Lower River. Historically, KCWA has allocated some portion of its available Lower River water right to ID4 during wet years; since about 2011, KCWA has allocated the first 40,000 AF of this right to ID4. Estimates for future Lower River supply available to ID4 have been developed based on Kern River annual indices covering a 20-year average hydrologic period. During that time, ID4 would have received an average annual 9,000 AFY, based on the current allocation. This amount is used for water supply planning as described in **Section 4.6.1** (see **Table 4-12**).

2.4.5.6 Kern Delta Water District Water Supply

For more than 130 years, canal systems located within the KDWD boundary have delivered water to support the agricultural economy on District lands south of the Kern River. These systems were first developed as separate canal companies, each with its own Kern River water right and defined service area and were later consolidated. KDWD was formed in 1965 to provide a public entity that secures and manages a diverse portfolio of water supplies conjunctively to benefit water users and to preserve the service areas' existing water rights to the Kern River. Facilities and Kern River water rights were subsequently acquired by the District in 1976. The KDWD boundary covers approximately 129,000 acres, about 100,000 of which are irrigated agriculture. Of that amount, about 90,000 acres are planted with about 10,000 acres fallowed each year. KDWD water supply includes groundwater (including banked surface water), Kern River water, and SWP water.

Groundwater. Significant quantities of conveyed water percolate beneath the permeable bottoms of the unlined canals, providing recharge to the groundwater basin. Additional recharge occurs through irrigation in excess of crop consumptive use (referred to as return flows). Beginning in the early 1900s, groundwater (including recharged water) has been developed to supplement surface water supply; demand for this water supply has increased over time and currently represents more than one-half to about two-thirds (in dry years) of the District's total applied surface irrigation supply. Municipal demand has also increased within KDWD as the City of Bakersfield has expanded into the northern portions of the District. Small community water systems, including Greenfield CWD and Lamont PUD, also pumps

groundwater from the KDWD service area. Groundwater use (including banked water) has been estimated to average about 165,000 AFY, based on data from WY 1995 through WY 2014 (see **Section 4.3**).

Kern River Water. Distribution of water within the First Point service area of the Kern River was adjudicated in the 1900 Shaw Decree. Over the years, Kern River water has been apportioned among many users based on entitlements determined through canal company consolidations, water rights acquisitions, court decisions, and agreements. Kern River surface water use by KDWD averaged 174,074[4] AFY from WY 1995 through WY 2014 and has ranged between about 110,268 AF (WY 2014) and 228,957 AFY (WY 1997).

State Water Project Water. In 1972, KDWD contracted with KCWA to receive 30,000 AFY of SWP water imported into the county via the California Aqueduct (KDWD, 1974). KDWD's SWP contract included a buildup schedule that reached the maximum amount in 1990, consisting of 25,500 AF of firm supply and 4,500 AF of unregulated surplus supply to be delivered during four winter months on an as-available basis (AECOM, 2004). In 1994, the surplus water was eliminated as part of the Monterey Agreement, revising the District's SWP maximum amount to 25,500 AFY. The SWP water supply is used to reduce the area's groundwater overdraft and provide supplemental surface water deliveries to the various portions of the District.

In the absence of a readily-available means to convey SWP water into the District, KDWD executed exchange agreements with Buena Vista Water Storage District (BVWSD) to allow BVWSD access to KDWD's SWP allotment for an equal amount of BVWSD water supply on the Kern River. This arrangement allowed KDWD to divert its SWP allotment from the Kern River using existing facilities while BVWSD accessed the SWP water directly from the California Aqueduct.

Since the early 1990s, the availability of SWP water has declined. Recent restrictions on the importation of SWP water by the courts have resulted in greater uncertainty for future supplies (AECOM, 2009). For the 14-year period of 1998 through 2011, the District's full allotment of SWP water was available during only one year.

2.4.5.7 North of the River Municipal Water District/Oildale Mutual Water Company Water Supply

In 2014, the retail portion of NORMWD's service area was merged into OMWC's service area. NORMWD continues to be a wholesaler of water to OMWC and has contracted with ID4 for 15,000 AFY of treated water from ID4's Henry C. Garnett Water Purification Plant.

OMWC derives additional supply from eight active groundwater wells (SWRCB, 2017). These wells can provide over 50 percent of current average daily water demand (Dee Jaspar, 2016a). In 2015, OMWC

[4] This average reflects actual use and incorporates Reed Decision water right restrictions starting in 2008.

provided 7,915 AF of water to 10,254 connections. Groundwater supplied 341 AF of this water with ID4 water from NORMWD making up the remainder (Dee Jaspar, 2016a and 2016b).

2.4.5.8 Vaughn Water Company Water Supply

The Vaughn Water Company (VWC) provides groundwater to users within its service area with 12 active wells. In 2015, it served a population of 32,257 through 9,956 connections, with 96 percent of these connections being residential (Dee Jaspar, 2016c). Groundwater use in 2015 was 3,209 AF over the entire VWC service area. Portions of VWC's service area overlie the City of Bakersfield and ID4, and thus are within the KRGSA; the remainder overlies the Rosedale Rio-Bravo Water Storage District and is within the Kern Groundwater Authority GSA (**Figure 2-1**).

2.4.6 Water Supply Wells

For almost 100 years, wells have been used in the KRGSA to supplement surface water with groundwater supplies (which also includes banked surface water). Data from DWR well completion reports indicate that several thousand wells have been drilled throughout the Plan Area, with most of the early wells providing agricultural water supply along the Kern River and extending throughout the southern KRGSA. Data indicate that about 60 percent of the wells in the southern Plan Area were drilled in the 1950s and 1960s; about 75 percent were drilled before 1980.

DWR has compiled statistical data from well completion reports on a series of maps to illustrate well densities and varying well depths on a square mile basis across the state. These maps combine large amounts of data with inherent limitations such as incomplete or inaccurate data, duplicate or missing records, and significant uncertainty associated with both location and status (e.g., whether the well is currently active). Regardless of these issues, the DWR maps provide the best available data for a first approximation of relative well densities in the Plan Area.

Three of the DWR well density maps for the KRGSA Plan Area have been downloaded from the DWR online Well Completion Report Map Application. **Figure 2-11** shows the density of production wells estimated in the KRGSA including agricultural, municipal, industrial, and other public water supply wells. The well density map is color-coded based on the number of wells that have been drilled in each square mile across the area using Public Land Survey System sections. As shown on **Figure 2-11**, at least one production well per square mile is indicated throughout the Plan Area. Most of the production wells are concentrated in the northwest KRGSA (north of the Kern River) and in the central portion of the KRGSA. One map cell located on and north of the river indicates 25 production wells. Although this square mile contains known municipal and industrial wells, 25 active production wells cannot be confirmed. These maps appear most useful to indicate relative well densities across the area.

A similar DWR well density map showing the number of public water supply wells per square mile is provided on **Figure 2-12**. As shown on the map, most of the public water supply wells in the Plan Area are located in the northern half of the Plan Area and represent municipal wells in the Bakersfield city limits. The few public water supply wells in the southern Plan Area are associated with Greenfield CWD,

Lamont PUD, and other small water systems. As indicated on **Figure 2-12**, there are generally less than 5 public water supply wells per square mile, with only 1 well in most sections where such wells have been drilled. One exception is a section located south of the Kern River in the north-central KRGSA where a cluster of six public water supply wells has been estimated from well completion reports (29S/28E-19).

The density of domestic wells drilled in the Plan Area is shown on **Figure 2-13**. Although the map indicates that domestic wells have been drilled throughout the Plan Area, most of the domestic wells have been drilled in the northwestern Plan Area (north of the Kern River) and the central Plan Area – a distribution similar to that shown for the production wells (**Figure 2-11**). In those areas, several sections contain 25 to 37 wells per square mile (the highest density in the Plan Area). Although some homeowners retain domestic wells, the area is covered by the City of Bakersfield municipal water service. Two additional sections in the southern Plan Area contain between 20 and 30 wells per square mile. These areas appear to contain pockets of industrial, commercial, and residential development. Small water systems surround the area and could be providing residential water in lieu of older domestic wells.

Although these three DWR well density maps are useful to illustrate the large number of wells that have been drilled in certain areas over time, maps do not necessarily reflect the density of active wells that are being relied on currently for water supply. To provide a better estimate of active wells, numerous additional data sources have been relied upon to supplement the DWR well completion reports.

Well data were compiled directly from the KRGSA member agencies and other larger water purveyors in the Plan Area in support of the KRGSA GSP (see **Figure 2-4** for water purveyor service areas). Locations of smaller water systems and other active wells have been compiled from public resources. ID4 provided information on well locations and production in its service area. KDWD provided well survey data to estimate locations of active agricultural and/or domestic wells in the southern Plan Area. Recovery wells associated with various recharge and banking programs within and adjacent to the Plan Area were provided by KCWA, ID4, City of Bakersfield, and KDWD.

Finally, a well database compiled by Kern County was used to supplement these KRGSA sources. Although the status of wells in the County is less certain, the database provides a source of domestic/industrial wells and agricultural wells in areas not readily available from other sources. The County database also contained a relatively large number of wells (184) in the KRGSA that did not have a well-use classification; although it is recognized that some of these wells are likely the same wells identified from other resources, many of the wells identified by the County did not plot on or near other well locations. Accordingly, these wells are also included in the active well analysis for completeness.

Wells from data sources described above have been compiled into GIS shapefiles and are mapped in the KRGSA on **Figure 2-14**. As illustrated on **Figure 2-14**, there are likely about 1,260 active supply wells located in the Plan Area.

- 642 agricultural wells

- 162 municipal wells (including wells temporarily offline)
- 67 public water supply and Small Water System wells
- 151 industrial, domestic, and other private wells
- 54 recovery wells
- 184 wells with unknown well type (may duplicate some wells above).

As shown on **Figure 2-14**, most of the agricultural wells are located in the southern Plan Area (in KDWD). Most drinking water wells are located in the northern Plan Area including municipal wells in the City of Bakersfield and other public water supply wells associated with smaller water systems. Domestic wells are scattered throughout the Plan Area but are mostly outside of the Bakersfield city limits. Monitoring wells are not included in the analysis and are described separately in **Section 2.5** and subsequent sections of this GSP.

2.5 WATER RESOURCES MONITORING AND MANAGEMENT PROGRAMS

Water resources monitoring and management programs have a long history in the KRGSA Plan Area. Such programs are conducted by local water agencies and municipal water suppliers at regional and local scales, ranging from participation in State programs (e.g., CASGEM[5]) and regional plans (e.g., Integrated Regional Water Management Plan) to individual water system monitoring by local water suppliers.

2.5.1 Water Resources Monitoring

Water resource monitoring programs considered in this GSP address:

- Climate
- Groundwater levels
- Wells and groundwater pumping
- Imported water deliveries
- Surface water flows and deliveries
- Groundwater banking
- Wastewater discharge and recycled water delivery
- Land use and cropping
- Groundwater, surface water, imported water, and wastewater/recycled water quality
- Land subsidence

Multiple agencies are involved in water resources monitoring, with data shared through several key annual reports. KCWA has assumed major responsibility for collecting data on groundwater and surface water supplies and water quality. Since its formation in 1961, KCWA has collected information on water supply and demand in the Kern County Subbasin and since 1977, has published this information in its annual Water Supply Report. Other key and regularly published

[5] CASGEM – California Statewide Groundwater Elevation Monitoring program

documents are the annual Kern River *Hydrographic Reports* produced by the City of Bakersfield, the *Report on Water Conditions* prepared by ID4, and the *Kern Fan Area Operations and Monitoring Report* produced by the Kern Fan Monitoring Committee (KFMC).

In addition, Kern Delta Water District has documented its monitoring activities in its Groundwater Management Plan (Todd, 2013), providing monitoring objectives, methods, protocols, locations, and data management.

Other Kern Subbasin organizations involved in monitoring and reporting are discussed in **Section 6** of this GSP.

Groundwater levels. Water levels are monitored in the KRGSA Plan Area as part of the DWR California Statewide Groundwater Elevation Monitoring Program (CASGEM). Local CASGEM monitoring entities in the KRGSA Plan Area include ID4 for its service area and the Kern River Fan Group, which involves Kern Delta Water District.

Groundwater levels have been recorded in the subbasin outside of formal monitoring programs since at least the 1920s, but data before the 1950s and 1960s are sparse. Available data have been compiled into large data sets by KCWA, who conducts water level monitoring and/or water level data compilation across the Kern County Subbasin for a variety of activities.

KCWA monitors semiannual groundwater levels in approximately 800 production wells and 200 monitoring wells within the Kern Subbasin and monitors monthly groundwater levels in about 240 production and monitoring wells within the Kern River alluvial fan area. Data have been analyzed and reported in the KCWA publication, Report on Water Conditions, which includes long-term hydrographs of key wells, maps of spring groundwater elevation contours, depth to groundwater in wells, and change in groundwater depth (spring to spring). KCWA Water Supply Reports from past years also present similar hydrographs and maps. KCWA also conducts water level monitoring in the vicinity of groundwater banking projects on the Kern Fan as part of the requirements of the Kern Fan Monitoring Committee, discussed in more detail in the section on groundwater banking below.

Since 1989, KDWD has conducted a groundwater level monitoring program involving approximately 100 to 150 wells. Typically, semi-annual measurements are made in Spring and Fall. Eight key wells have been selected for more systematic water level monitoring as part of the CASGEM program.

Wells and groundwater pumping. Groundwater extractions are reported to ID4 within its service area on a semi-annual basis. This program includes most of the municipal wellfields and accounts for a significant percentage of the active wells in the Plan Area. Wells within ID4 are registered and the number of wells and well uses (commercial, domestic, irrigation, purveyor) are tabulated in the ID4 *Report on Water Conditions.* Extractions are reported based on either well meters, if available, or other estimates including electrical records or land use.

Imported water deliveries. As wholesaler for SWP water, ID4 regularly accounts for and reports its SWP supplies in the *Report on Water Conditions* within ID4. KCWA monitors all turnouts from the California Aqueduct in Kern County and all turnouts along the Cross Valley Canal. Measurements are taken daily (KCWA, Initial Water Management Plan, 2001).

Surface water flows and deliveries. The City of Bakersfield monitors surface water flow at First Point on the Kern River and at various locations along the Carrier and River canals. Measurements of the Kern River at First Point date back to October 1893. The City of Bakersfield compiles and reports the data in annual Hydrographic Reports. These reports provide accounting of monthly diversions, deliveries, and loss along the canals among all First Point diverters with records extending back to the 1890s, per files from the City of Bakersfield Water Resources Department.

KDWD monitors daily Kern River diversions at four monitoring points and daily water deliveries from KDWD main canals and laterals, allowing estimates of groundwater recharge along the unlined canals. These surface water flow and diversion monitoring data are provided to the City of Bakersfield for compilation into the annual Hydrographic Reports.

Groundwater banking. The Kern Fan Monitoring Committee (KFMC) was established by MOU among certain participants in local groundwater banking projects (including and near the Kern Water Bank) and adjoining entities. The KFMC is responsible for collecting data from participants/adjoining entities and reporting that data in the KFMC's *Kern Fan Area Operations and Monitoring Report*. The KFMC monitors 57 monitoring wells and 85 recovery wells regularly (ESA, 2018). Published data include deliveries for recharge and recovery pumping, groundwater levels (hydrographs and maps of groundwater elevations and depth to groundwater), groundwater and surface water quality sampling results.

Wastewater discharge and recycled water delivery. Metropolitan Bakersfield is served by four wastewater treatment plants. The City of Bakersfield operates two of the treatment plants: Wastewater Treatment Plant 2 (WWTP 2) and Wastewater Treatment Plant 3 (WWTP 3); the Kern Sanitation Authority and the North of River Sanitary District No. 1 each operate plants. Monitoring of WWTP discharges and quality is regulated by the Central Valley Regional Water Quality Control Board.

Land use. KCWA has conducted annual land use surveys since 1972. The land use information has been reported in the Report on Water Conditions (and in the KMFC's *Kern Fan Area Operations and Monitoring Report*) and used, in part, to estimate groundwater production. Annual cropping data also are available from the Kern County Agricultural Commission and Kern Delta Water District.

Groundwater, surface water, imported water, and wastewater/recycled water quality. The City of Bakersfield monitors surface water quality at various locations along the Carrier and River canals. ID4 also produces or participates in updating Watershed Sanitary Surveys for the Cross Valley Canal, Friant-Kern Canal, Kern River and State Water Project. The City of Bakersfield compiles and reports the data in its annual Hydrographic Reports. Groundwater quality data are collected by various agencies and often in response to various groundwater management and regulatory programs and requirements; these

include federal and state programs protecting drinking water quality and the Irrigated Lands Regulatory Program (ILRP) that addresses water quality in agricultural areas.

In the Report on Water Conditions within ID4, extensive documentation is provided on water quality from the Henry C. Garnett Water Purification Plant, including source water and treated water in terms of bacteria, inorganic constituents, and organic chemicals. Consistent with federal and state requirements, local potable water providers monitor water quality. Public water systems (consistent with the California Health and Safety Code) regularly sample water quality and annually prepare an Annual Consumer Confidence Report. The Kern County Public Health Services Department administers the Small Water System Program that includes monitoring of small public water systems (2-14 connections) and nonpublic water systems (1-5 connections).

The IRLP issues Waste Discharge Requirements (WDRs) or conditional waivers of WDRs (orders) to growers that require water quality monitoring of receiving waters. The Kern River Watershed Coalition in the Tulare Lake Basin has created a database with over 100,000 records for total dissolved solids (TDS), nitrate, and pesticides over the 1909 through 2014 period (P&P, 2015).

The Kern Fan Monitoring Committee (KFMC) evaluates groundwater quality in and around the Kern Water Bank and other Kern Fan banking projects.

Land subsidence. Subsidence has occurred mostly to the north and south of the KRGSA area and has been documented through a series of key studies by the USGS and DWR. The Friant-Kern Canal extends through NKWSD to the Kern River. The U.S. Bureau of Reclamation monitors two multi-port monitoring wells in NKWSD (and other monitoring points outside of the Plan Area) to track the ongoing potential for subsidence-related problems.

Incorporation of Existing Monitoring into GSP. As documented above and as recognized in the IRWM Plan, monitoring and data collection have not been centralized. Various types of data are collected by a variety of public and private entities, at state, regional, and local levels. Data have not been compiled into a central database, although the KCWA Water Supply Report has attempted to serve at least part of that function. Review of monitoring programs in the IRWM Plan suggests that methods for data collection are similar and thus support creation of regional datasets and databanks.

The monitoring program for the KRGSA GSP is described in **Section 6**. This program makes best use of the multiple monitoring networks that are already in place in the KRGSA Plan Area. Each member agency of the KRGSA already conducts groundwater monitoring and/or participates in other local monitoring programs in its service area. These programs have already selected wells with appropriate construction (when known) and historical data records. These wells have been prioritized for incorporation into the KRGSA GSP monitoring network and are supplemented as required to monitor the established sustainable management criteria described in more detail in **Section 5**. None of these plans should impact operational flexibility for monitoring and management in the GSP; rather, these programs collectively provide an extensive monitoring network to assist with GSP monitoring.

2.5.2 Water Resources Management Programs

Numerous planning documents provide details on the myriad of water resources management programs in the KRGSA Plan Area. In brief, daily coordination among water managers, an interconnected web of conveyance canals and pipelines, and numerous water sources to balance and manage on a real-time basis have provided KRGSA Plan Managers with the tools for flexible and reliable water management programs. Water management plans have been developed by KCWA (Initial Water Management Plan, 2001) and KDWD (Groundwater Management Plan, 2015). Urban Water Management Plans (UWMPs) have been prepared by the City of Bakersfield, California Water Service Company (Cal Water), ID4, Oildale MWC, ENCSD, Lamont PUD, and other local water suppliers in the KRGSA. Separately, each plan describes numerous policies and programs being implemented by KRGSA member agencies for conjunctive management of surface water and groundwater; collectively, the plans demonstrate coordination at an intricate level to maximize use of water resources.

While some local water suppliers in the Plan Area rely solely on groundwater, most agencies (City of Bakersfield, California Water Service Company, ID4, KDWD, ENCSD, NORWD/OMWC) have multiple water sources including groundwater, local Kern River surface water, banked and recharged surface water, and/or imported water (sources described previously in **Section 2.4** and in **Table 2-2**). These sources have been successfully managed and used conjunctively for decades; the Kern River Fan is recognized for its active recharge and banking programs. In addition, KCWA is an acknowledged long-time leader in water exchanges and transfers.

Descriptions and details of the conjunctive management programs including conveyance, distribution, recharge and use are provided in other sections of this GSP. Many of these programs were introduced in the discussions of water supplies in the KRGSA Plan Area, **Section 2.4**. Information on surface water conveyance and conjunctive management of Kern River water, SWP water, and water associated with local banking programs is provided in **Section 3.2.4.3**. Inflows and outflows associated with these conjunctive management programs are provided in the description of water budgets in **Section 4**.

Examples of local conjunctive use include (but are not limited to) the following:

- Storage space in Isabella Reservoir is managed for Kern River water and, by exchange, imported SWP water.
- Recycled water is used for recharge and irrigation.
- The City of Bakersfield maintains over 340 storm water drainage basins to capture and recharge stormwater throughout the City.
- Kern River water is regulated and managed for recharge within the Kern River channel.
- Kern River water is intentionally discharged to unlined canals to promote surface water seepage and groundwater recharge.
- Recharge basins and banking programs in the KRGSA Plan Area include the City of Bakersfield 2800 Acres project (COB 2800); Berrenda Mesa Spreading Grounds, Kern Delta Water District recharge basins; and managed recharge in the Kern River Channel.

- Water banking programs are active with participation by local agencies and out-of-basin agencies.

Recognizing the intensity of local conjunctive use, recharge, and banking operations, numerical models have been developed and/or applied by local agencies. Two existing regional models cover the entire Kern River Area and beyond. These are the USGS Central Valley Hydrologic Model (CVHM) (Faunt, 2009) and the DWR California Central Valley Groundwater-Surface Water Simulation (C2VSim) Model (Brush, Dogrul and Kadir, 2013). In addition, several local models have been developed for specific purposes by the various water agencies in the area. The Beta version of the updated DWR C2VSim (released in May 2018) provided the best available tool for simulating integration of surface water and groundwater throughout the entire Kern County Subbasin. That model has been obtained and revised to reflect these water management programs in the KRGSA Plan Area (and remaining areas in the Kern County Subbasin) for application to water budget analyses included in this GSP.

The water resources programs are coordinated among agencies for optimized use of water resources. Kern River water and SWP are managed through exchanges and sales to others. Banking programs, including intentional recharge along canals, provide flexibility for storing water when available and recovering water for use during times of water scarcity. These programs also incorporate monitoring networks to measure performance and avoid adverse impacts. These issues are also being addressed through regional coordination of sustainable management criteria for the entire Kern County Subbasin.

2.6 GENERAL PLANS AND LAND USE ELEMENTS

Implementation of existing land use plans by various jurisdictions has important ramifications for water supply sustainability. Urban, rural and agricultural growth tends to increase water demand, but land use policies and programs can support sustainable water supply planning through water conservation, conjunctive use of surface water and groundwater supplies, water recycling, and stormwater management.

Land use planning within the KRGSA Plan Area is guided by the General Plan for the City of Bakersfield metropolitan area, by the Kern County General Plan for unincorporated areas, and by the Kern River Plan Element. Unincorporated Kern County within the Metropolitan Bakersfield Sphere of Influence Area is addressed in the Metropolitan Bakersfield General Plan. Land use designations and policies within the metropolitan planning area are different than those within the Kern County General Plan.

2.6.1 Metropolitan Bakersfield General Plan

The Metropolitan Bakersfield General Plan (Bakersfield, 2002) covers the northern portion of the KRGSA. Zoning designations include agricultural, industrial, and commercial land uses as shown on **Figure 2-6**.

The General Plan was adopted originally in December 2002 and was most recently updated in January 2016 per Resolution Nos. 018-16, 019-16, and 020-16. Two sections are most relevant to the GSP: the Water Resources section of the Conservation Element and Water Distribution section of the Public

Services and Facilities Element. **Table 2-4** summarizes goals, policies, and implementation measures for these sections. As a summary, this table may not include all General Plan policies relevant to the GSP; accordingly, specific issues will likely involve consultation with Planning Department staff.

The *Water Resources* section of the Conservation Element recognizes three long-standing issues:

- The conservation and effective utilization of planning area water resources is complicated by multi-jurisdiction control over such resources.
- There are portions of the planning area which are water deficient and/or in which there are problems with water quality.
- Water transport, groundwater recharge needs, recreational usage of water resources, and the preservation and enhancement of water-related natural habitat all compete for the usage of scarce water resources in the planning area.

These issues are addressed through the Goals, Policies, and Implementation Measures summarized in the Water Resources section of **Table 2-2.** Similarly, the Public Services and Facilities Element of the Metropolitan Bakersfield General Plan includes a Water Distribution Section that addresses the following water distribution issues:

- Provision of adequate water service to the planning area.
- Coordination of water purveyors and water rights holders.

Sections on Sewer Service and Stormwater in the 2002 Metropolitan Bakersfield General Plan are oriented toward wastewater and water disposal, but do not address water recycling or recharge.

2.6.2 Kern River Plan Element

The Kern River Plan Element was adopted in July 1985 as an integral part of the City of Bakersfield General Plan and the Kern County General Plan. The plan element covers the primary and secondary floodways of the Kern River and was incorporated by reference into the updated Metropolitan Bakersfield General Plan when it was adopted in 2002. **Table 2-5** provides a summary of key goals, policies, and implementation measures relevant to the KRGSA GSP.

Table 2-4: Selected Bakersfield Metropolitan Area General Plan Policies

Goal	Policy	Implementation Measure
Water Resources		
Goal 1. Conserve and augment the available water resources of the planning area. **Goal 2.** Assure that adequate groundwater resources remain available to the planning area. **Goal 3.** Assure that adequate surface water supplies remain available to the planning area. **Goal 4.** Continue cooperative planning for and implementation of programs and projects which will resolve water resource deficiencies and water quality problems. **Goal 5.** Achieve a continuing balance between competing demands for water resource usage. **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.	**Policy 1.** Develop and maintain facilities for groundwater recharge in the planning area. **Policy 2.** Minimize the loss of water which could otherwise be utilized for groundwater recharge purposes and benefit planning area groundwater aquifers from diversion to locations outside the area. **Policy 3.** Support programs to convey water from other than San Joaquin Valley basin sources to the planning area. **Policy 4.** Support programs and policies which assure continuance or augmentation of Kern River surface water supplies. **Policy 5.** Work towards resolving the problem of groundwater resource deficiencies in the upland portions of the planning area. **Policy 6.** Protect planning area groundwater resources from further quality degradation. **Policy 7.** Provide substitute or supplemental water resources to areas already impacted by groundwater quality degradation by supporting facilities construction for surface water diversions. **Policy 8.** Consider each proposal for water resource usage within the context of total planning area needs and priorities-major incremental water transport, groundwater recharge, flood control, recreational needs, riparian habitat preservation and conservation. **Policy 9.** Encourage and implement water conservation measures and programs.	**Measure 1.** Maintain, and utilize to the fullest extent possible, the City of Bakersfield's 2800-Acre spreading facility and all other existing recharge facilities and channels in or serving the planning area groundwater resource, including the Kern River channel through Bakersfield. **Measure 2.** Support all financially feasible and practical groundwater projects, for the augmentation of groundwater recharge for the south San Joaquin Valley basin by the construction and operation of additional recharge facilities or the importation of additional water for basin recharge. **Measure 3.** Oppose the diversion or exportation of water resources which would unduly diminish the availability of such resources for planning area groundwater recharge. **Measure 4.** Provide necessary legislative advocacy and/or funding for the Planning area. **Measure 5.** Initiate and/or support planning, financing, construction and implementation programs for supplying upland portions of the planning area having groundwater deficiencies with an adequate water supply. **Measure 6.** Support the provision of adequate wastewater collection systems and treatment reclamation and disposal facilities which will prevent groundwater degradation by on-site wastewater systems. **Measure 7.** Maintain industrial waste discharge regulation and monitoring programs which protect the planning area groundwater from contaminants. **Measure 8.** Provide supplemental or replacement water supplies (such as the City's conjunctive use project) to metropolitan area distribution systems which utilize currently or potentially degraded water supplies. **Measure 9.** Utilize the Kern River Plan Element as a policy guide for consideration of competing water resource needs, including water for municipal, industrial, direct irrigation, groundwater recharge, habitat restoration and multi-purpose recreational uses. **Measure 10.** Support additional water conservation measures and programs of benefit to the planning area.
Water Distribution		
Goal 1. Ensure the provision of adequate water service to all developed and developing portions of the planning area.	**Policy 1.** Reach agreement regarding mutually beneficial improvements in domestic water service and distribution facilities as required to improve overall metropolitan water service capabilities. **Policy 2.** Continue to provide domestic water facilities which are contributed directly by developers, through development and/or availability fees. Policy 3. Require that all new development proposals have an adequate water supply available.	**Measure 1.** Utilize the Kern County Water Agency's Urban Bakersfield advisory committee for coordination of planning efforts. **Measure 2.** Implement the Urban Water Management Plan prepared by ID4 (1985). **Measure 3.** Review, and modify as required, existing fee structures and ordinances to assure desired system financing and policy implementation. **Measure 4.** Study alternatives to provide an adequate water supply to the northeastern "non- district" area.

Table 2-5: Kern River Plan Element of the Bakersfield Metropolitan Area General Plan and the Kern County General Plan

Goal	Policy	Implementation Measures
Open Space		
Goal 3.2.2: To ensure that the open spaces of the Kern River are maintained and enhanced as a unique and valuable resource for the Bakersfield metropolitan area.	**Policy 3.2.3.5:** Natural topography, vegetation, and scenic features shall be retained to the greatest feasible extent in future development along the River.	Short-term implementation measures for all policies involve land trades, transfer of development rights (TDRs), easements, gifts, maintenance of existing open space, and land acquisition by responsible parties, plus developing education, promoting acquisition of funding, and continuing design review, and the planning and approval process. Long-term implementation measures for all policies involve application for State and federal funding and/or funds under the Quimby Act for open space preservation and acquisition of lands essential for plan implementation. Additional measures consider formation of a special purpose district or a special assessment district.
Riparian Vegetation and Wildlife Habitat		
Goal 3.3.2: To protect and enhance endangered and nonendangered indigenous wildlife and wildlife habitat of the River.	**Policy 3.3.3.8:** The County of Kern, the City of Bakersfield, and the Kern County Water Agency, and appropriate water districts shall consult with each other, and the City Department of Water Resources shall report to the City Council and Board of Supervisors on the potential for establishing and maintaining a minimum annual flow of water within the Kern River between Manor Street and the Stockdale Highway Crossing.	
Floodplain Management		
Goal 3.4.2: To maximize and fully utilize the groundwater recharge potential of the Kern River, its floodplains, and other potential recharge aquifers.	**Policy 3.2.3.7:** Agricultural land preparation, vegetative plantings, and minor structural improvements or appurtenances shall blend with and enhance the open space qualities of the River corridor to the greatest extent possible. **Policy 3.4.3.12:** Groundwater recharge shall be considered a principal allowable use of both primary and secondary floodways. The continued groundwater recharge program involving properties owned by the City are of paramount importance.	

2.6.3 Kern County General Plan

The general Land Use Planning Designations of the Kern County General Plan (Kern County Planning Department, 2009) are shown on **Figure 2-5**. An update of the Kern County General Plan is underway; this process was initiated in October 2016 and is anticipated to extend to 2019. As part of this effort, the water element for the update is considering reliable long-term water supply, water quality, watershed and groundwater protection and conservation. Staff of the Kern County Planning and Natural Resources Department are assessing the county's water supply and facilities and drafting policies that reflect future growth and goals.

Consistent with the California Government Code, portions of the Land Use, Open Space, and Conservation Element were developed in coordination with KCWA and other local water agencies. Groundwater management is addressed in four sections of the Land Use, Open Space, and Conservation Element: Physical and Environmental Constraints, Public Facilities and Services, Resource, and General Provisions. For each, the relevant goals, policies, and implementation measures are summarized in **Table 2-6**. This table is a summary and may not include all General Plan policies relevant to the GSP; accordingly, specific issues will likely involve consultation with Planning Department staff.

Table 2-6: Selected Kern County General Plan Goals, Policies, and Implementation Measures

Goal	Policy	Implementation Measure
Physical and Environmental Constraints **(Shallow groundwater within 15 feet of the land surface is considered a constraint.)**		
Goal 1. To strive to prevent loss of life, reduce personal injuries, and property damage, minimize economic and social diseconomies resulting from natural disaster by directing development to areas which are not hazardous.	**Policy 1.** Kern County will ensure that new developments will not be sited on land that is physically or environmentally constrained	**Measure C**. Cooperate with the Kern County Water Agency to classify lands in the County overlying groundwater according to groundwater quantity and quality limitations.
Public Facilities and Services **(Relevant to water supply development and groundwater protection.)**		
Goal 5. Ensure that adequate supplies of quality (appropriate for intended use) water are available to residential, industrial, and agricultural users within Kern County. **Goal 9.** Serve the needs of industries and Kern County residents in a manner that does not degrade the water supply and the environment and protect the public health and safety by avoiding surface and subsurface nuisances resulting from the disposal of hazardous wastes, irrespective of the geographic origin of the waste. **Goal 11.** Reduce residential contamination of groundwater by encouraging sanitary sewer systems.	**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. • Ensure that water quality standards are met for existing users and future development. • Ensure that adequate storage, treatment, and transmission facilities are constructed concurrently with planned growth. • Ensure the maintenance and repair of existing water systems. • Encourage utilization of wastewater treatment facilities which provide for reuse of wastewater. • Encourage the consolidation or elimination of small water systems. • Encourage the conversion of private sewer systems (septic tanks) to public systems. • Ensure that adequate collection, treatment, and disposal facilities are constructed concurrently with planned growth. • Ensure that appropriate funding mechanisms are in place to fund the needed improvements which result from development and subsequent growth.	**Measure K.** The appropriate agency should develop sewer and water master plans in areas where these services are lacking or deficient and in areas where urban development exists or is designated.
Resources (Agriculture is vital to the future of Kern County and development of major water projects has greatly increased the amount of land in agricultural production.)		
Goal 2: Protect areas of important mineral, petroleum, and agricultural resource potential for future use. **Goal 5**: Conserve prime agriculture lands from premature conversion.	**Policy 10:** To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered: • Promote groundwater recharge activities in various zone districts. • Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers. • Support the development of groundwater management plans. • Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.	**Measure F:** Prime agricultural lands, according to the Kern County Interim-Important Farmland map produced by the Department of Conservation, which have Class I or II soils and a surface delivery water system, shall be conserved through the use of agricultural zoning with minimum parcel size provisions.

Selected Kern County General Plan Goals, Policies, and Implementation Measures, continued		
Goal	**Policy**	**Implementation Measure**
General Provisions **(includes a specific subsection on surface water and groundwater.)**		
Goal 1. Ensure that the County can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving valuable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.	**Policy 33**. Water related infrastructure shall be provided in an efficient and cost-effective manner. **Policy 34**. Ensure that water quality standards are met for existing users and future development. **Policy 35**. Ensure that adequate water storage, treatment, and transmission facilities are constructed concurrently with planned growth. **Policy 36**. Ensure that appropriate funding mechanisms for water are in place to fund the needed improvements resulting from growth and subsequent development. **Policy 37**. Ensure maintenance and repair of existing water systems. **Policy 38**. Encourage utilization of wastewater treatment facilities which provide for the reuse of wastewater. **Policy 39**. Encourage the development of the County's groundwater supply to sustain and ensure water quality and quantity for existing users, planned growth, and maintenance of the natural environment. **Policy 40**. Encourage utilization of community water systems rather than the reliance on individual wells. **Policy 41**. Review development proposals to ensure adequate water is available to accommodate projected growth. **Policy 42**. Encourage water supply purveyors to prepare master water plans for those areas of the County approaching existing design thresholds, including documentation of areas in need of system maintenance and repair. **Policy 43**. Drainage shall conform to the Kern County Development Standards and the Grading Ordinance. **Policy 44**. Discretionary projects shall analyze watershed impacts and mitigate for construction-related and urban pollutants, as well as alterations of flow patterns and introduction of impervious surfaces as required by California Environmental Quality Act (CEQA), to prevent the degradation of the watershed to the extent practical. **Policy 45**. New high consumptive water uses, such as lakes and golf courses, should require evidence of additional verified sources of water other than local groundwater. Other sources may include recycled stormwater or wastewater. **Policy 46**. In accordance with the Kern County Development Standards, tank-truck hauling of domestic water for land developments or lots within new land developments is not permitted.	**Measure T**. The Kern County Environmental Health Services Department will develop guidelines which will establish criteria for development of proposed new water systems when an existing water system, within a reasonable distance, is able to supply water. **Measure U**. The Kern County Environmental Health Services Department will develop guidelines for the protection of groundwater quality which will include comprehensive well construction standards and the promotion of groundwater protection for identified degraded watersheds. **Measure V**. Water and sewer purveying agencies should develop long-term sewer and water master plans in areas where these services are lacking or deficient and in areas where urban development exists or is designated. **Measure W**. Applications for General or Specific Plan Amendments will include sufficient data for review to facilitate desirable new development proposals consistent with General Plan policies, using the following criteria and guidelines: • The provision of adequate water, sewer, and other public services to be used. • The provision of adequate on-site nonpublic water supply and sewage disposal if no public systems are available or used. **Measure X**. Encourage effective groundwater resource management for the long-term benefit of the County through the following: • Promote groundwater recharge activities in various zone districts. • Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers. • Support the development of Groundwater Management Plans. • Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water, and groundwater and desalination. **Measure Y**. Promote efficient water use by utilizing measures such as: • Requiring water-conserving design and equipment in new construction. • Encouraging water-conserving landscaping and irrigation methods. • Encouraging the retrofitting of existing development with water conserving devices. **Measure Z**. General Plan Amendments subject to environmental review and not otherwise subject to California Water Code Section 10910 shall demonstrate through a water supply assessment that a long-term water supply for a 20-year timeframe is available. The water assessment shall include, but not be limited to, the following: • Source and quantity of historical water use on the site. • Estimated water consumption of the proposed development. • Estimated storage, if any, in meeting the projected need. • Recommendations for additional sources of water to address demand shortage. Such measures may include, but are not limited to, development of future sources of additional surface water and groundwater, including water transfers, conjunctive use, recycled water, conservation, and additional storage of surface water, groundwater, and desalination. Written acknowledgement that water will be provided by a community or public water system with an adopted Urban Water Management Plan shall constitute compliance with this requirement.

2.6.4 Kern County Environmental Health Services and Well Permitting

Permitting of new or replacement water supply wells in Kern County is administered by the Kern County Public Health Services Department through the Environmental Health Services (EHS) Water Well Program. The Kern County Ordinance Code, Chapter 14, provides for the design, construction, repair, and reconstruction of agricultural wells, domestic wells, cathodic protection wells, industrial wells, monitoring wells, observation wells, geothermal heat exchange wells, and test wells in such a manner that the groundwater of the county will not be contaminated or polluted, and that water obtained for beneficial uses will not jeopardize the health and safety or welfare of the people of Kern County.

Well permitting policies, procedures, and guidelines are presented on the EHS website for Water Wells & Small Water Systems and in the Water Well Permits Policy Manual; links are provided below:
http://kernpublichealth.com/water/water-wells-small-water-systems/
http://kernpublichealth.com/wp-content/uploads/2016/03/EHSWellPolicyManual_2008_09_11_08.pdf

The Manual presents the procedures to obtain, complete and apply for a water well permit. To summarize, the application is reviewed by EHS staff to determine if an annular seal would be required, accounting for location and groundwater quality data indicating differences in quality between unconfined and confined aquifers. One or more site inspections is conducted by EHS staff. Water quality testing is required of the applicant with submittal and review by EHS.

EHS staff forwards water well permit applications to KCWA under certain conditions Including when the proposed well is within the extent of Corcoran Clay or shallow groundwater. Conditions also include location within a one-mile radius of:

- a public drinking water supply well
- sphere of influence of any Kern County municipality
- established or proposed groundwater recharge/recovery facility
- proposed dairy or feedlot operation
- biosolids composting, disposal, or land application area
- known or suspected hazardous waste site
- active or inactive sanitary landfill, burn dump, or hazardous materials facility
- known area of poor water quality
- active or proposed fruit or vegetable processing facility.

All water well destruction permit applications should be reviewed by KCWA and any water district or public entity having jurisdiction for the site. The Water Well Permits Policy Manual also specifies approved sealing materials for well construction and well destruction.

The Kern County EHS also has established Standards and Rules and Regulations for Land Development that address sewage disposal, water supply, and preservation of environmental health (Kern County EHS, 2010). Chapter III, Water Supply, lists requirements for domestic water supply systems that mandate documentation of an adequate supply, provision of water quality meeting drinking water

standards, and compliance with water well drilling standards and setbacks and the Kern County Zoning Ordinance.

The policy in the local, adopted land use plans that is most pertinent to well permitting is the Kern County Policy 40, which encourages utilization of community water systems rather than the reliance on individual wells.

2.6.5 Nexus of Land Use Plans and Sustainable Groundwater Management

This GSP considers and complements the current land use plans that cover the KRGSA as prepared by the City and County. The City General Plan goals, policies, and implementation measures for water resources (**Table 2-4**) all align well with both the Sustainability Goal and proposed projects and management actions in this GSP. In particular, policies support increased groundwater recharge, importation of SWP water, resolution of any groundwater deficiencies, and preservation of riparian habitats, all of which are supported by increased recharge along the Kern River channel and other GSP projects and actions. The Bakersfield Kern River Element reinforces the common goals of riparian habitat along the river and increased groundwater recharge (**Table 2-5**).

The Kern County General Plan also recognizes the need for water supply development and groundwater protection (**Table 2-6**). Shallow groundwater (within 15 feet of the land surface) is considered a constraint for new development, but this can be managed through monitoring and operations of recharge facilities, including the Kern River channel. The General Plan also recognizes that agriculture is vital to the future of Kern County and includes a goal to conserve prime agricultural lands from premature conversion. This GSP assumes some limited urbanization of agricultural lands as City growth continues, but also includes assurances for adequate agricultural water supplies for the future.

This GSP development included review and consideration of the UWMPs developed by the water purveyors in the Plan Area. Data and information from the UWMPs were incorporated into this GSP including estimates for population growth, conservation and decreases in per capita demand, expansion of water treatment facilities, and increased reliability of imported supplies. In this manner, the GSP coordinates and complements both local land use and water supply planning efforts in the KRGSA Plan Area. Finally, land use plans outside of the Kern County Subbasin are not expected to have any effect on GSP actions in the KRGSA.

2.6.6 Additional GSP Elements

The California Water Code contains a checklist for preparation of GSPs, which provide groundwater management elements that may be applicable for incorporation into the KRGSA GSP. Most management programs relevant to this checklist are described in **Section 2.5** above; programs are summarized below for each topic to ensure that the additional plan elements listed in the GSP regulations (Section 354.8 (g)) have been considered.

(a) *Control of saline water intrusion*: seawater intrusion is not applicable because this is not a coastal Subbasin. Saline water at depth is discussed in **Section 3.2.5.2**, Base of Fresh Water.

(b) *Wellhead protection areas and recharge areas*: KRGSA wells are discussed in **Section 2.4.6**. Managed aquifer recharge and conjunctive use activities are summarized in **Section 2.5.2**. More information on areas of natural recharge is discussed in **Section 3**.

(c) *Migration of contaminated groundwater*. KRGSA will ultimately coordinate with responsible parties and regulatory agencies to oversee the investigation and remediation of contaminated groundwater and will inform local agencies of the status of such work. The oversight agencies may include the Central Valley Regional Water Quality Control Board, the State Department of Toxic Substances Control (DTSC), or the County Department of Environmental Health. More information on regulated environmental sites is provided in **Section 3.4.6**.

(d) *A well abandonment and well destruction program:* Well abandonment and destruction programs are implemented by Kern County in cooperation with both KCWA and local water districts, as summarized in **Section 2.6.4**.

(e) *Replenishment of groundwater extractions*: significant replenishment and managed aquifer recharge projects are conducted on an ongoing basis throughout the KRGSA as summarized in **Section 2.5.2** above.

(f) *Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage*. Conjunctive use and managed aquifer recharge are active groundwater management strategies being implemented by numerous agencies in the Subbasin as summarized in **Section 2.5.2.** above.

(g) *Well construction policies*. The well permitting program is conducted by Kern County in cooperation with local agencies. Kern County Ordinance Code, Chapter 14 ensures proper well design and construction (see **Section 2.6.4.**).

(h) *Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects*. Local agencies in the Plan Area cooperate with state and county regulators on contaminated sites; more information is provided in **Section 3.4.6**. Groundwater recharge, in-lieu, and other managed aquifer recharge programs are summarized in **Section 2.5.2** and discussed throughout this GSP. Water recycling is discussed in **Section 2.4.4** and summarized on **Table 2-1**. Intentional recharge along unlined canals illustrates the use of conveyance for groundwater replenishment.

(i) *Efficient water management practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use*. Efficient water practices are provided in the UWMPs and AWMPs of the Plan Area local agencies.

(j) *Efforts to develop relationships with state and federal regulatory agencies*. Such relationships are implicit in many local efforts. These include, for example, the cooperation of local agencies with state and federal agencies on contamination sites, local efforts toward SGMA compliance in cooperation with DWR and the State Water Resources Control Board (SWRCB), cooperation with USEPA and USACE on the Kern River and wetlands with respect to the federal Clean Water Act, and cooperation with US Fish & Wildlife Service and CDFW (among others) on environmental issues and endangered species.

(k) *Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.* As the sole municipality in the Plan Area, the City of Bakersfield coordinates land use planning and groundwater quantity and quality. The City is actively involved in groundwater protection and replenishment as summarized in **Section 2.5.2** and on **Tables 2-4** and **2-5**, which describe numerous land use planning activities for the protection of groundwater including management of municipal wastewater and implementation of an industrial waste discharge program.

(l) *Impacts on groundwater dependent ecosystems (GDEs).* Groundwater elevation data collected as part of the groundwater level monitoring programs described in **Section 2.5.1** will be enhanced and used to analyze the interconnectedness of surface water and groundwater and potential impacts on groundwater dependent ecosystems (GDEs). These data will supplement other analyses in the GSP for interconnected surface water and GDE impacts.

2.7 NOTICE AND COMMUNICATION

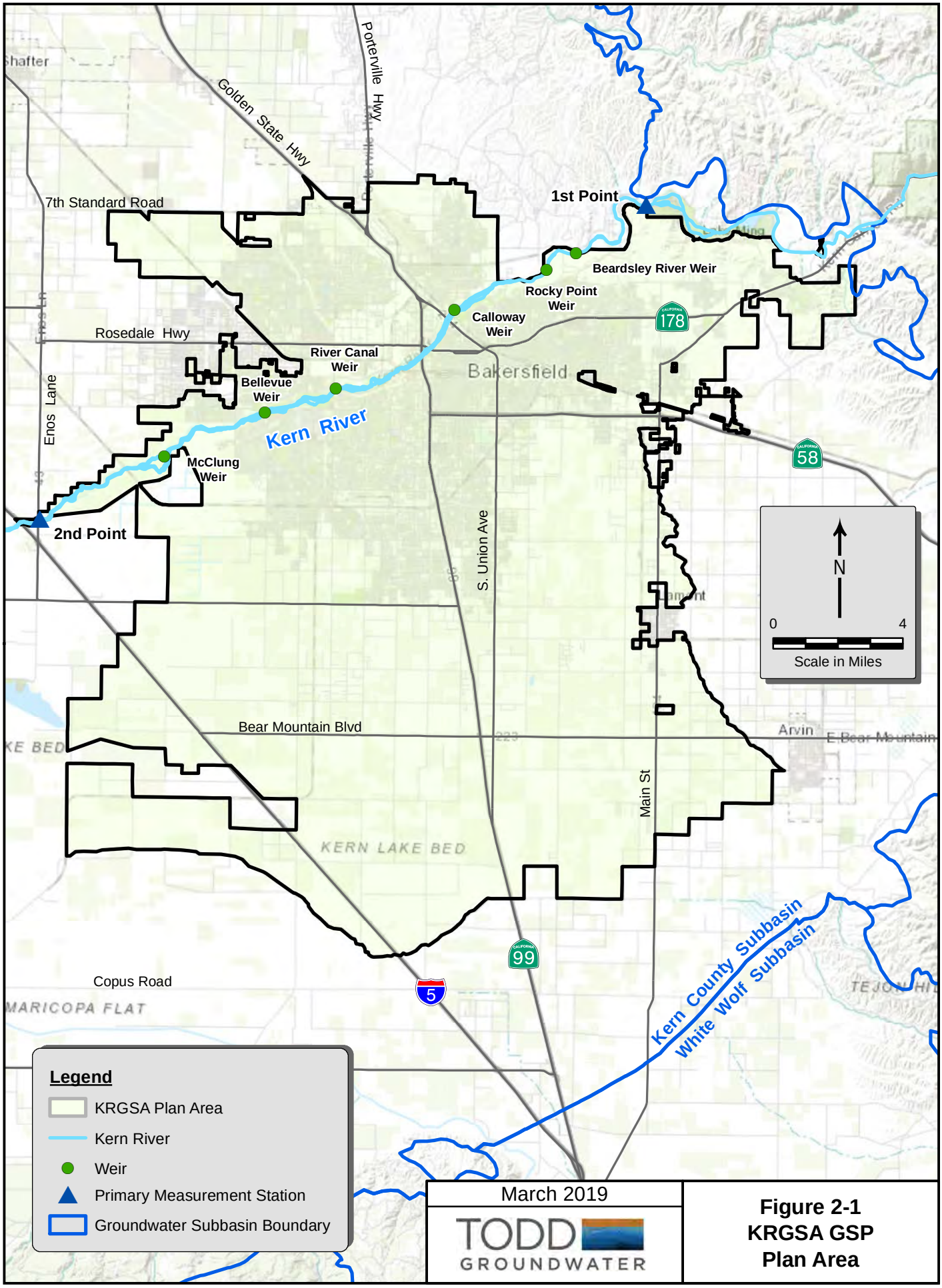
The importance of groundwater and banked and recharged surface water as a source of supply for water purveyors, landowners, residents, business owners, disadvantaged communities, small water systems and multiple other stakeholders is well-documented throughout this GSP. Recognizing the importance of communication and engagement with stakeholders for GSP development and implementation, KRGSA has developed a Communication and Engagement Plan for the GSP. This plan serves as a living document to guide the process by which KRGSA engages with the community and stakeholders. This KRGSA Communication and Engagement Plan is included as **Appendix F**.

The Communication and Engagement Plan in **Appendix F** also provides an overview of stakeholder outreach through the KRGSA website, regular and special KRGSA Board meetings, public meetings and workshops, general outreach and audience mapping, and targeted meetings with interested parties. These activities inform stakeholders and the public about the GSP development and implementation process and encourage active involvement by interested parties.

Focused outreach has focused on landowners reliant on groundwater for their agricultural business and livelihood, businesses and industries essential to the economic vitality of Metropolitan Bakersfield, and members of the public who depend on a safe and reliable water supply. In particular, focused outreach has also involved the disadvantaged communities (DACs) within the KRGSA service area, who are dependent on groundwater for drinking water supply yet have limited means to address issues relating

to groundwater quality and supply. The distribution of DACs in the KRGSA Plan Area by census place, tract and block is provided on **Figure 2-15**.

The KRGSA has been actively coordinating with all GSAs in the Subbasin throughout the GSP development process. Members of the KRGSA participate in weekly Subbasin-wide Managers Meetings organized by the KGA. KRGSA Board members are also members of the Subbasin Policy Subcommittee. These Subbasin activities have produced a Sustainability Goal for the Subbasin, a coordinated technical approach for development of a Subbasin-wide numerical model for GSP analyses, sustainable management criteria including definitions of undesirable results for the Subbasin and coordinated monitoring efforts to support the Subbasin GSPs.


Shafter
Golden State Hwy
Porterville Hwy
7th Standard Road
1st Point
Beardsley River Weir
Rocky Point Weir
Calloway Weir
Rosedale Hwy
River Canal Weir
Bellevue Weir
Kern River
McClung Weir
2nd Point
Enos Lane
Bakersfield
178
58
S. Union Ave
N
0
4
Scale in Miles
Bear Mountain Blvd
Arvin
E Bear Mountain
Main St
KERN LAKE BED
99
5
Copus Road
MARICOPA FLAT
Kern County Subbasin
White Wolf Subbasin
Legend
KRGSA Plan Area
Kern River
Weir
Primary Measurement Station
Groundwater Subbasin Boundary
March 2019
TODD GROUNDWATER
Figure 2-1
KRGSA GSP
Plan Area

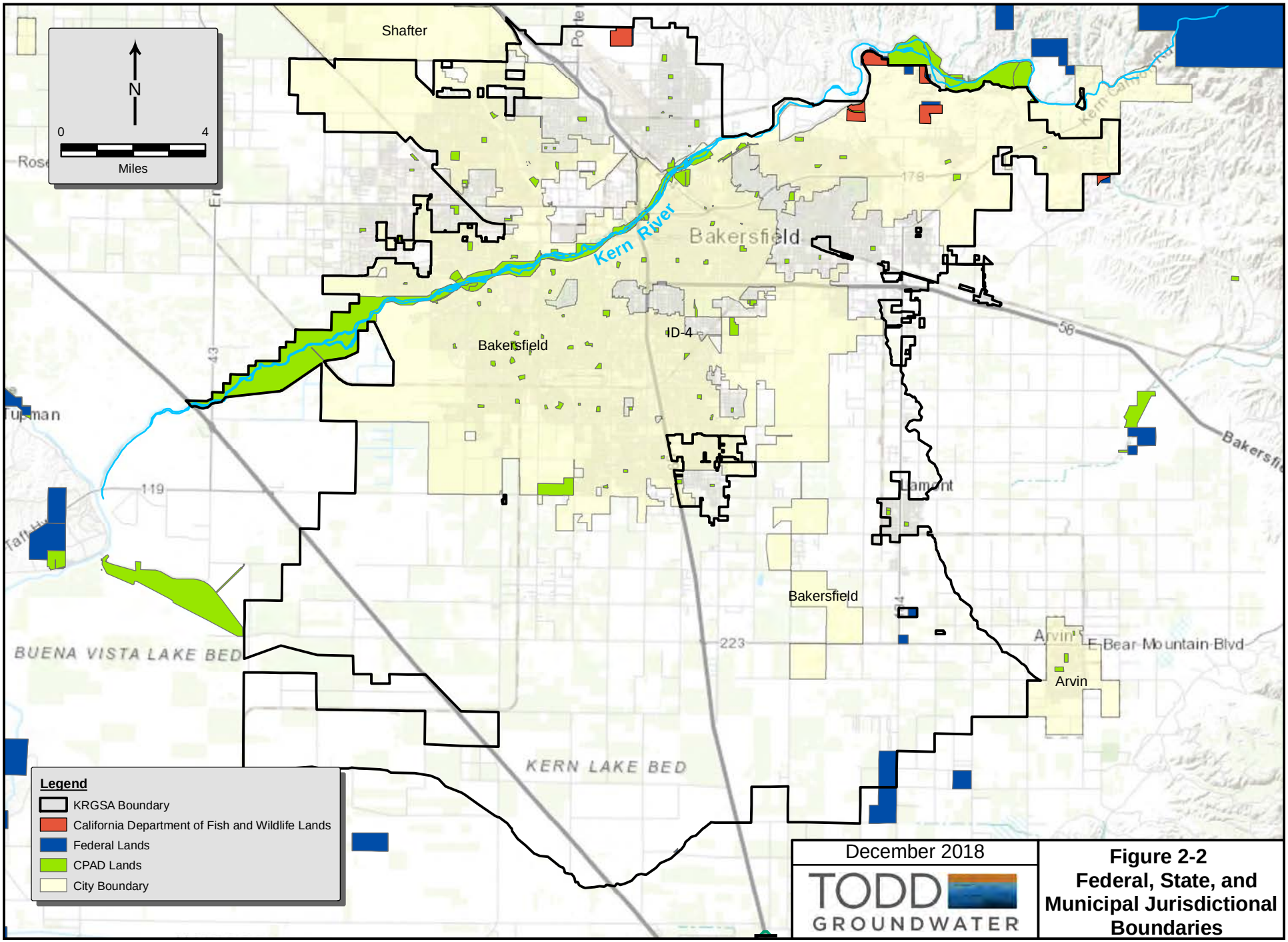
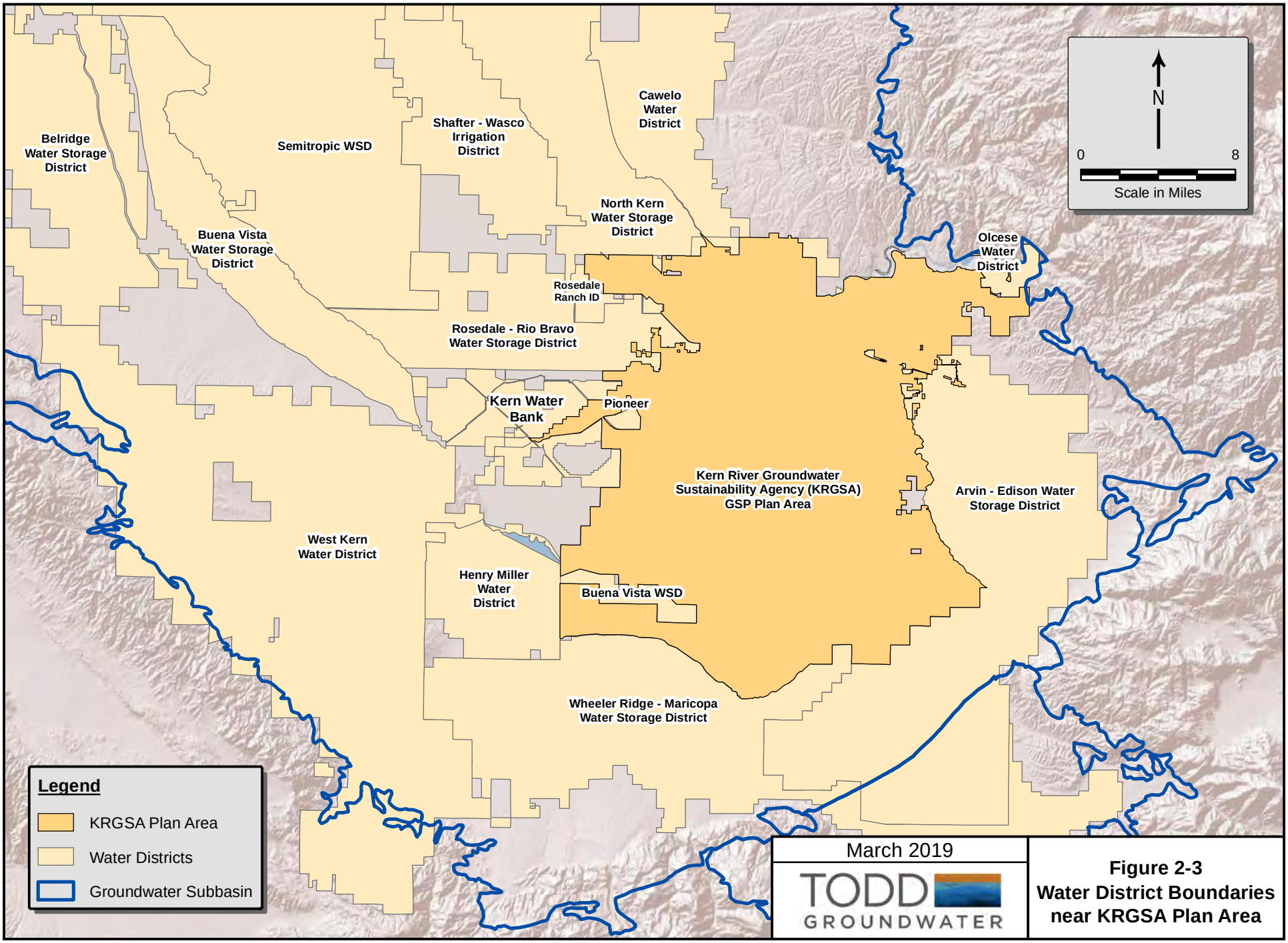


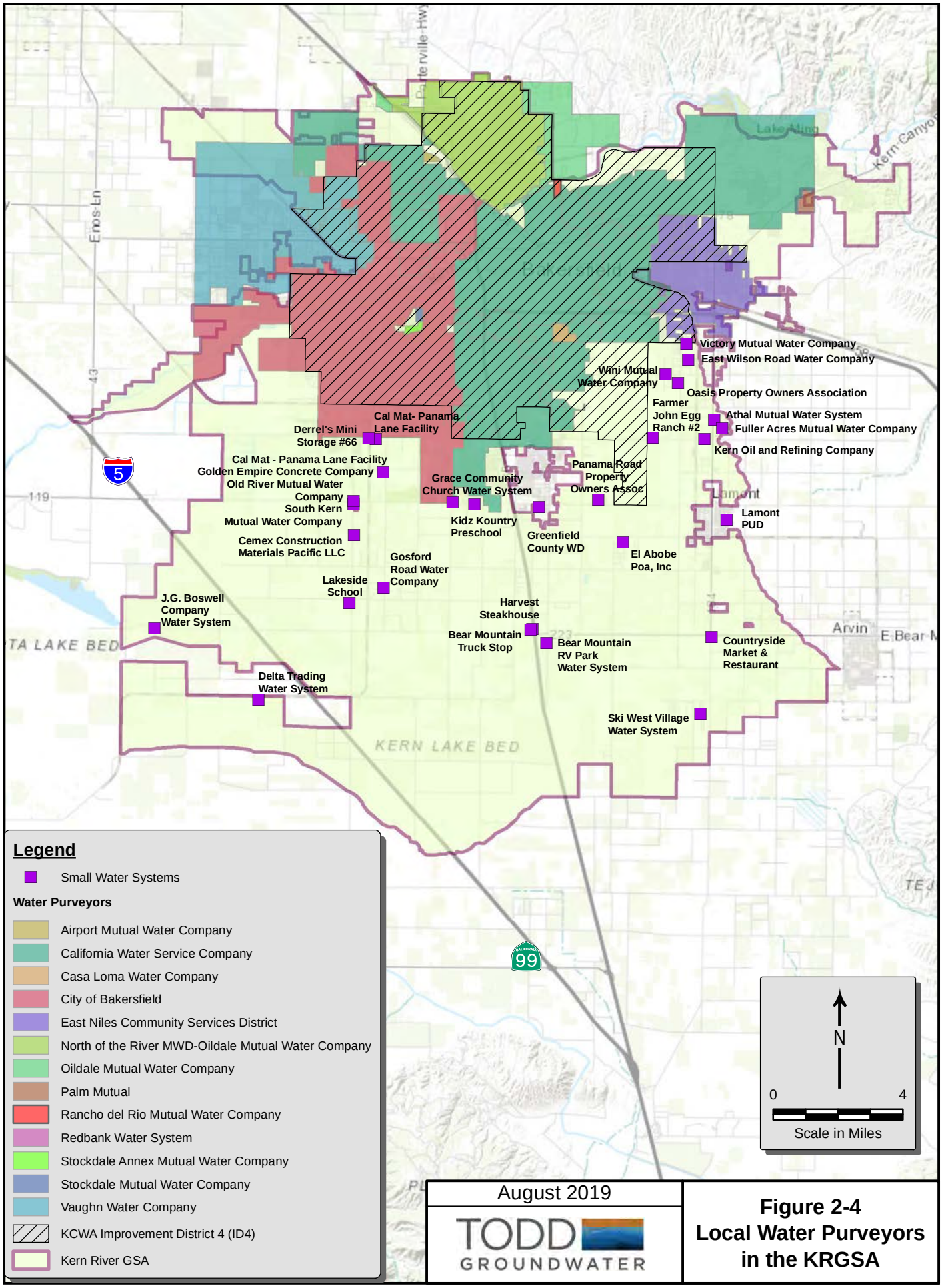
Figure 2-2
Federal, State, and Municipal Jurisdictional Boundaries



March 2019

TODD GROUNDWATER

Figure 2-3
Water District Boundaries near KRGSA Plan Area



August 2019

TODD GROUNDWATER

Figure 2-4
Local Water Purveyors in the KRGSA

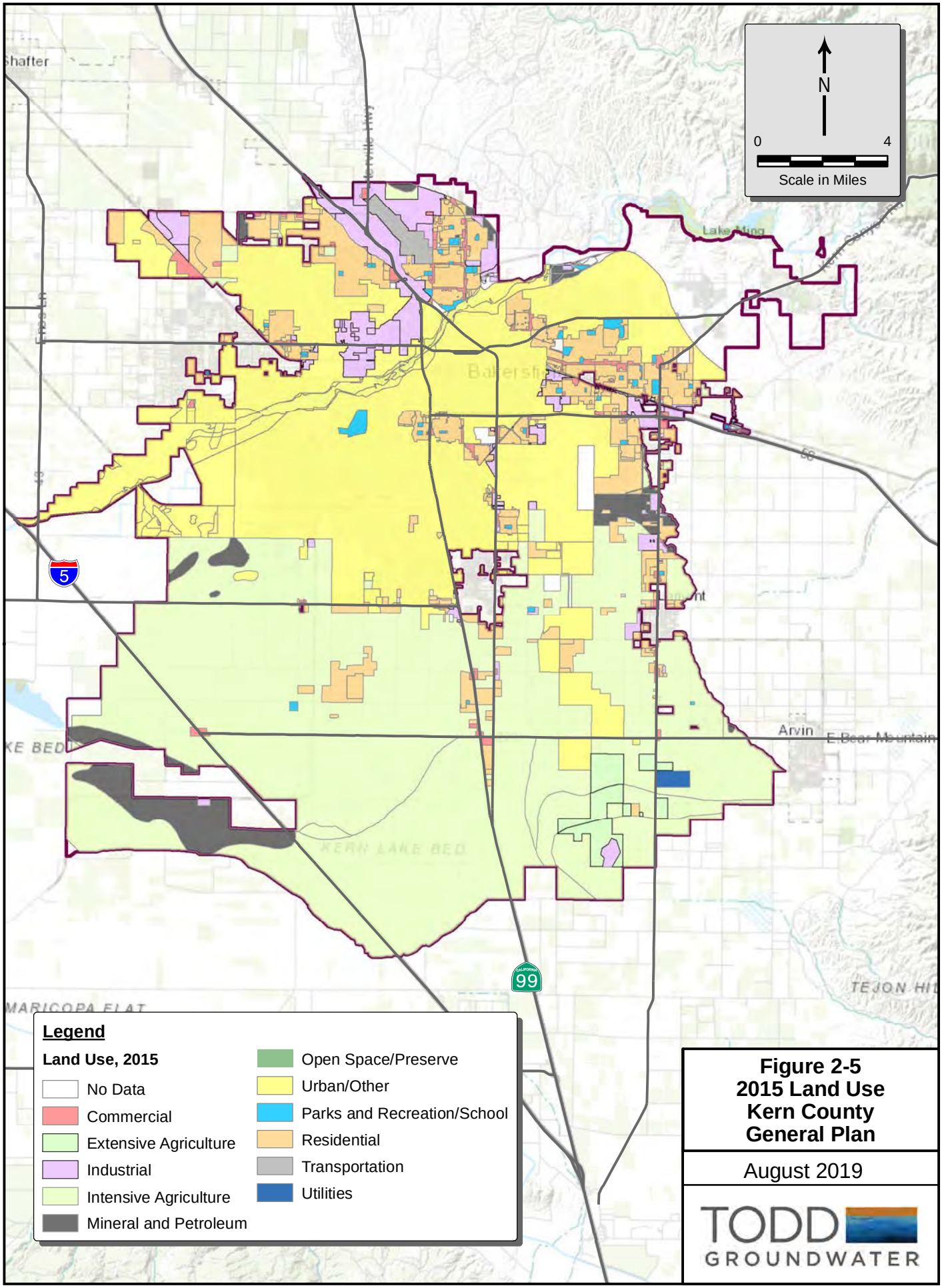


Figure 2-5
2015 Land Use
Kern County
General Plan

August 2019

TODD GROUNDWATER

SEE CITY OF SHAFTER GENERAL PLAN

KERN RIVER PLAN ELEMENT

STATE AND FEDERAL LANDS

RIVERLAKES RANCH SPECIFIC PLAN

KERN RIVER PLAN ELEME

WEST MING SPECIFIC PLAN

McALLISTER RANCH SPECIFIC PLAN

KRGSA Plan Area

N

0 2 4

Miles

RESIDENTIAL

- RR — RURAL RESIDENTIAL MINIMUM 2.5 GROSS ACRES/UNIT
- ER — ESTATE RESIDENTIAL MINIMUM 1 NET ACRE/UNIT
- UER — URBAN ESTATE RESIDENTIAL MINIMUM 0.5 NET ACRE/UNIT
- SR — SUBURBAN RESIDENTIAL ≤ 4 D.U./NET ACRE
- SR/LR — COUNTY JURISDICTION: ≤ 4 D.U./NET ACRE CITY JURISDICTION: ≤ 7.26 D.U./NET ACRE
- LR — LOW DENSITY RESIDENTIAL ≤ 7.26 D.U./NET ACRE
- LMR/LR — COUNTY JURISDICTION: ≤ 10 D.U./NET ACRE CITY JURISDICTION: > 4 AND ≤ 7.26 D.U./NET ACRE
- LMR — LOW MEDIUM DENSITY RESIDENTIAL COUNTY JURISDICTION: ≤ 10 D.U./NET ACRE CITY JURISDICTION: > 4 AND ≤ 10 D.U./NET ACRE
- HMR/LMR — COUNTY JURISDICTION: ≤ 17.42 D.U./NET ACRE CITY JURISDICTION: > 4 AND ≤ 10 D.U./NET ACRE
- HMR — HIGH MEDIUM DENSITY RESIDENTIAL COUNTY JURISDICTION: ≤ 17.42 D.U./NET ACRE CITY JURISDICTION: > 7.26 AND ≤ 17.42 D.U./NET ACRE
- HR — HIGH DENSITY RESIDENTIAL > 17.42 AND ≤ 72.6 D.U./NET ACRE

COMMERCIAL

- HC — HIGHWAY COMMERCIAL
- GC — GENERAL COMMERCIAL
- OC — OFFICE COMMERCIAL
- MC — MAJOR COMMERCIAL
- MUC — MIXED USE

INDUSTRIAL

- LI — LIGHT INDUSTRIAL
- SI — SERVICE INDUSTRIAL
- HI — HEAVY INDUSTRIAL

PUBLIC FACILITIES

- P — INCLUDES: GOVERNMENT BUILDINGS, HOS PUBLIC UTILITIES, CEMETERIES, SEWAGE TREATMENT PLANTS, WASTE DISPOSAL SIT AND OTHER PUBLICLY OWNED FACILITIES
- PS — PUBLIC AND PRIVATE SCHOOLS
- PT — PUBLIC TRANSPORTATION CORRIDOR
- P-SW — SOLID WASTE FACILITY SITES
- LR/PS — LOW DENSITY RESIDENTIAL/ PUBLIC AND PRIVATE SCHOOLS

OPEN SPACE

- OS — INCLUDES: RESOURCE MANAGEMENT ARE/ AGRICULTURE AND FLOODPLAINS
- OS-P — PARKS AND RECREATION FACILITIES
- OS-S — SLOPES EXCEEDING 30%

RESOURCE

- R-IA — INTENSIVE AGRICULTURE: MINIMUM 20 ACRE PARCEL SIZE
- R-EA — EXTENSIVE AGRICULTURE: MINIMUM 20 ACI PARCEL SIZE (LANDS UNDER WILLIAMSON / MINIMUM 80 ACRE PARCEL)
- R-MP — MINERAL PETROLEUM AND MINIMUM 5 ACRE PARCEL

- BAKERSFIELD CITY LIMITS
- BAKERSFIELD SPHERE OF INFLUENCE BOU
- METROPOLITAN BAKERSFIELD GENERAL PLAN BOUNDARY

WEST MING SPECIFIC PLAN

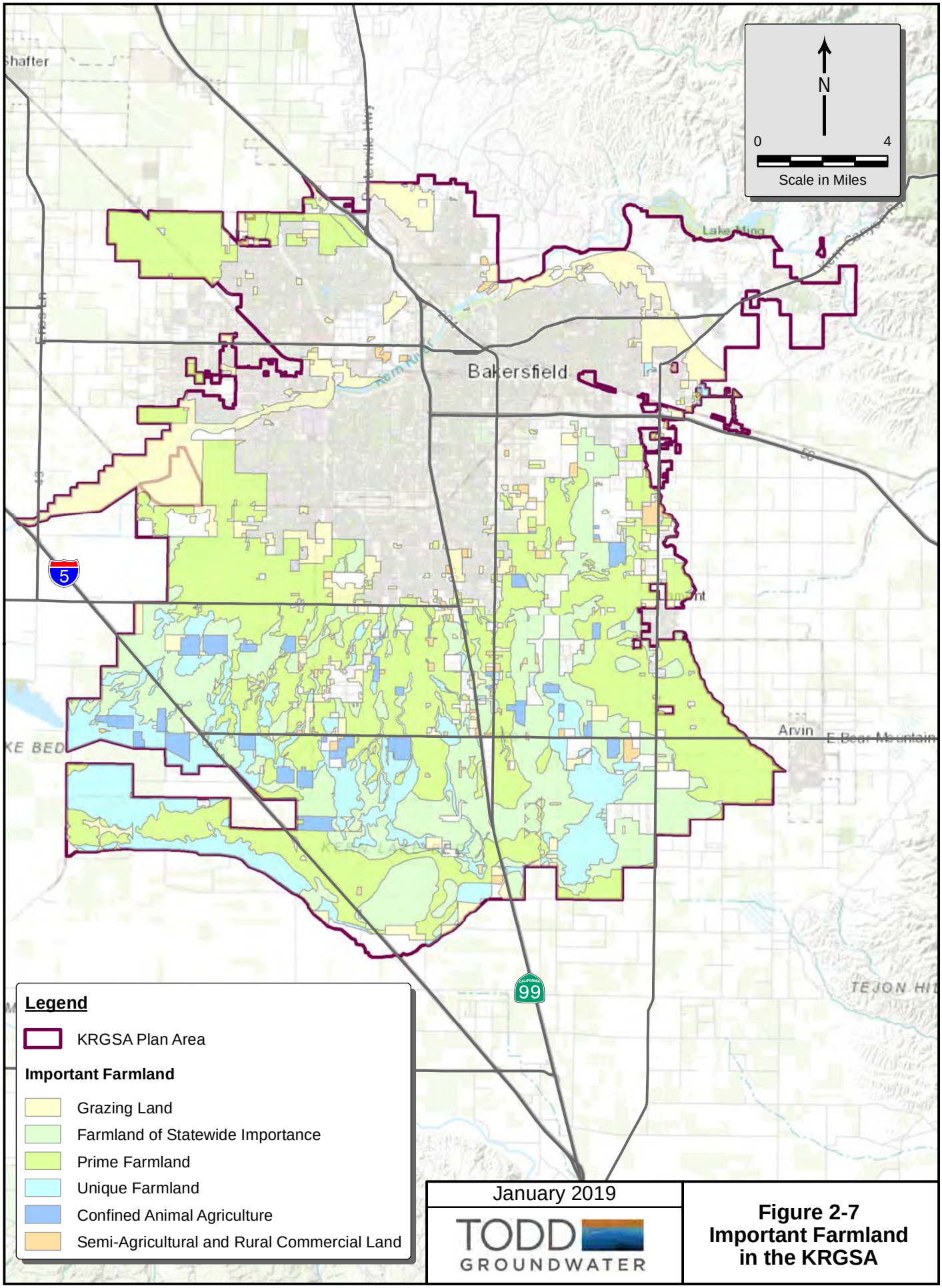
- WM-LR — LOW DENSITY RESIDENTIAL ≤ 7.26 D.U./NET ACRE
- WM-LMR — LOW MEDIUM DENSITY RESIDENTIAL ≤ 10 D.U./NET ACRE
- WM-HMR — HIGH MEDIUM DENSITY RESIDENTIAL ≤ 17.42 D.U./NET ACRE
- WM-HR — HIGH DENSITY RESIDENTIAL ≤ 72.6 D.U./NET ACRE
- WM-GC — GENERAL COMMERCIAL
- WM-OC — OFFICE COMMERCIAL
- WM-MU — MIXED USE
- WM-SU — SPECIAL USE

ADOPTED BY KERN COUNTY - 12/3/2002
ADOPTED BY CITY OF BAKERSFIELD - 12/11/2002
UPDATED: 04/21/2016
METRO BKRSFLD GP
COMMUNITY DEVELOPMENT DEPARTMENT

January 2019

TODD GROUNDWATER

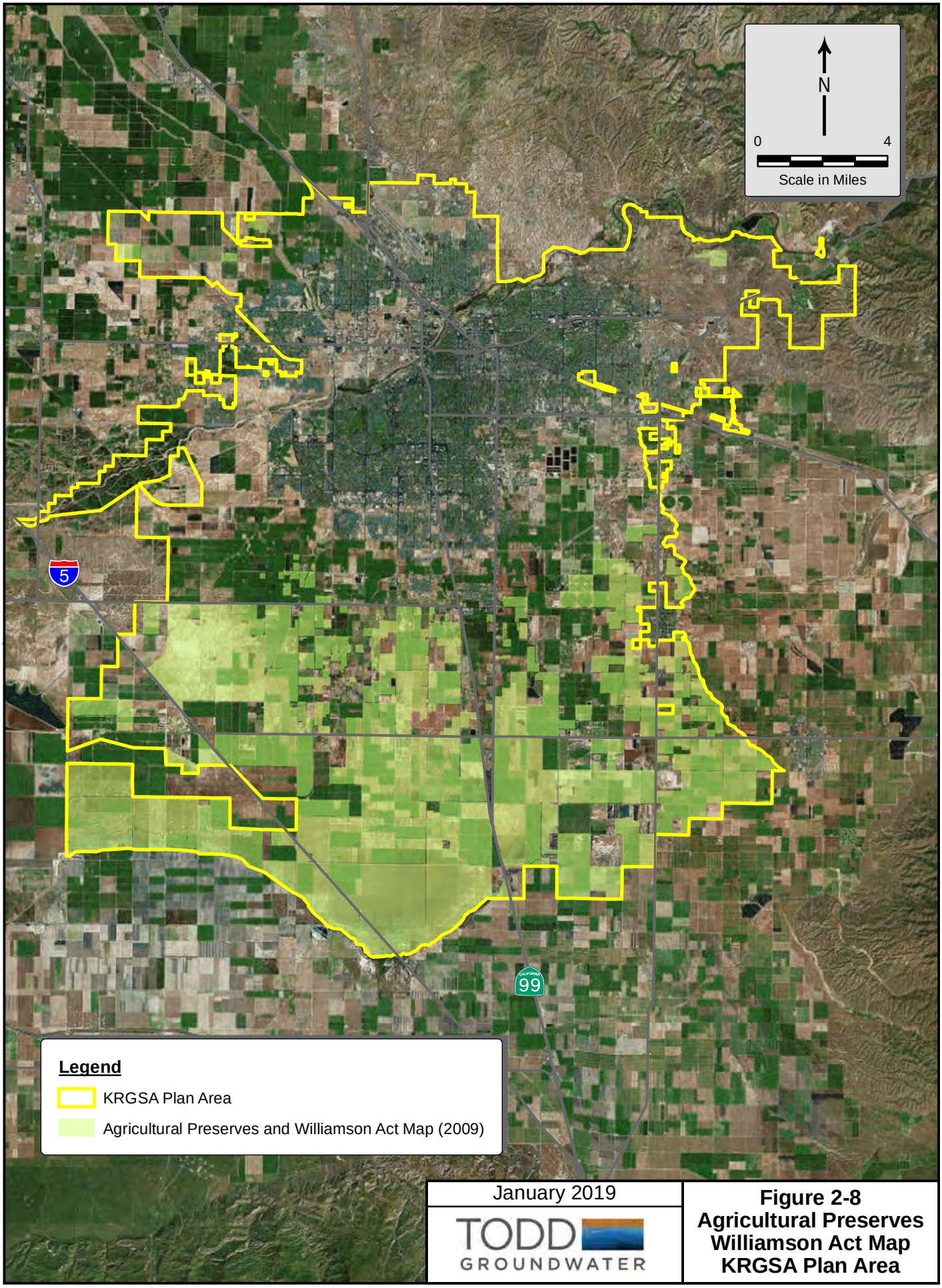
Figure 2-6
Metropolitan Bakersfield General Plan, City of Bakersfield and Kern County



January 2019

TODD GROUNDWATER

Figure 2-7
Important Farmland in the KRGSA



January 2019

TODD GROUNDWATER

Figure 2-8
Agricultural Preserves Williamson Act Map
KRGSA Plan Area

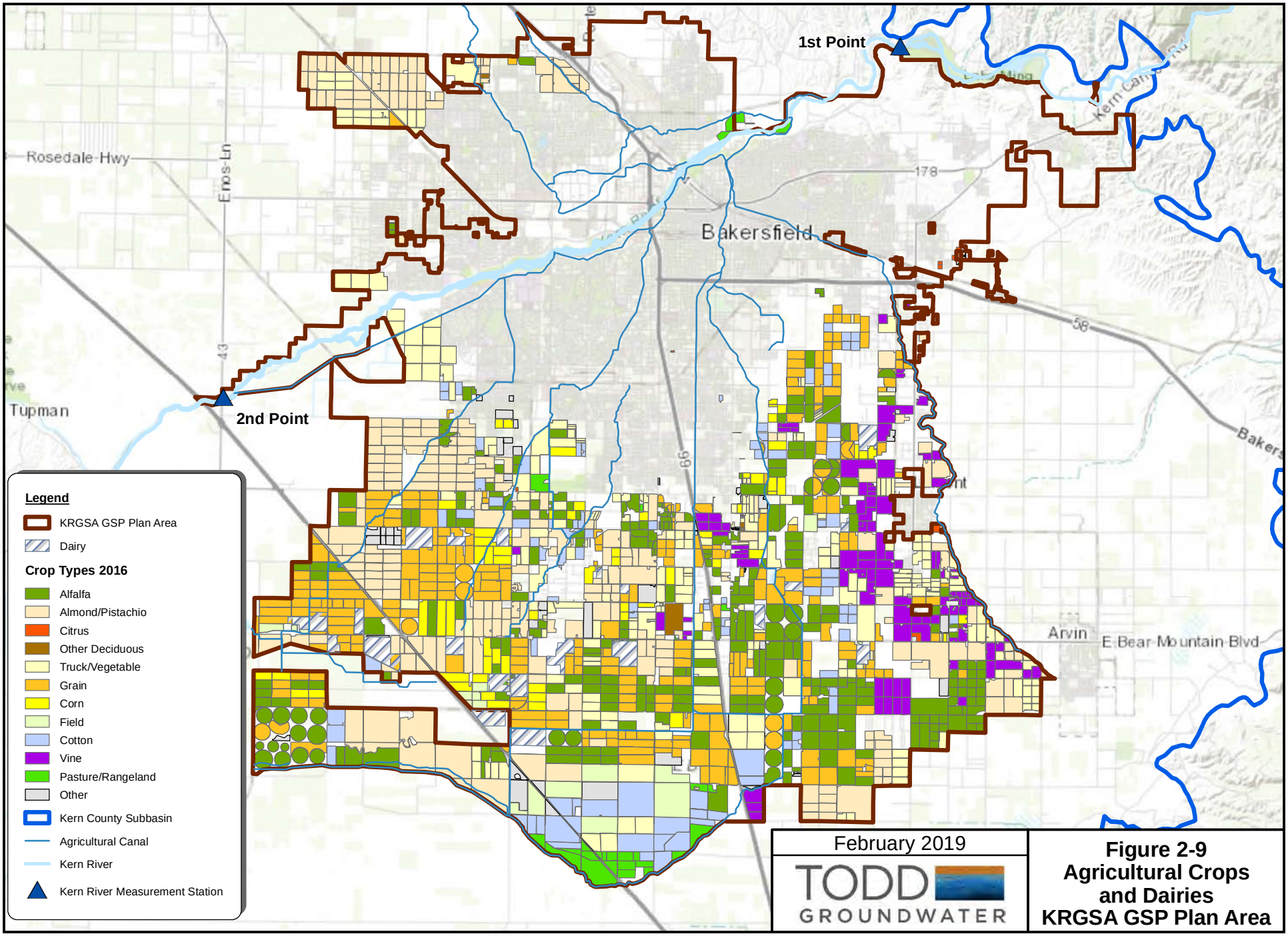
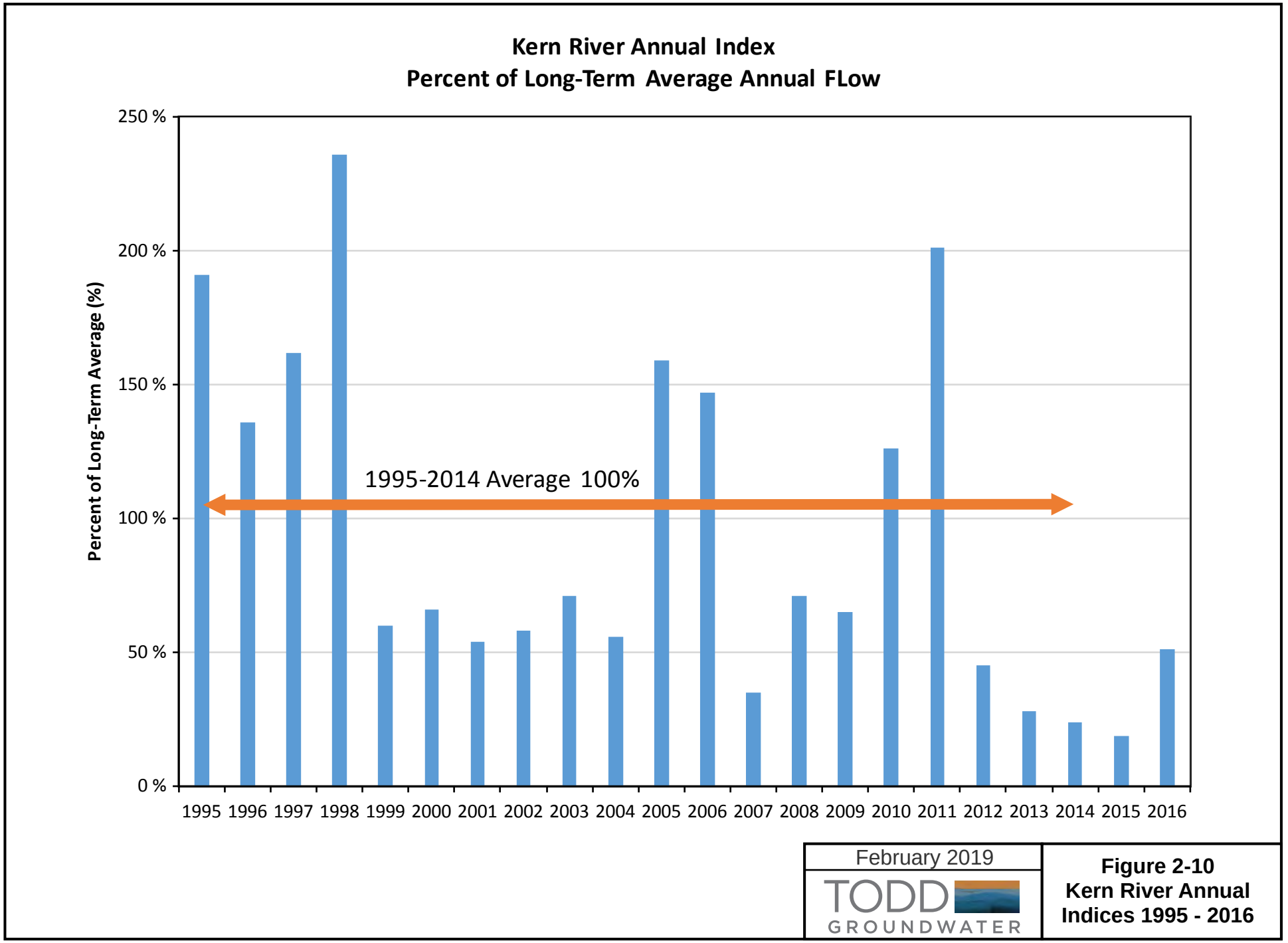
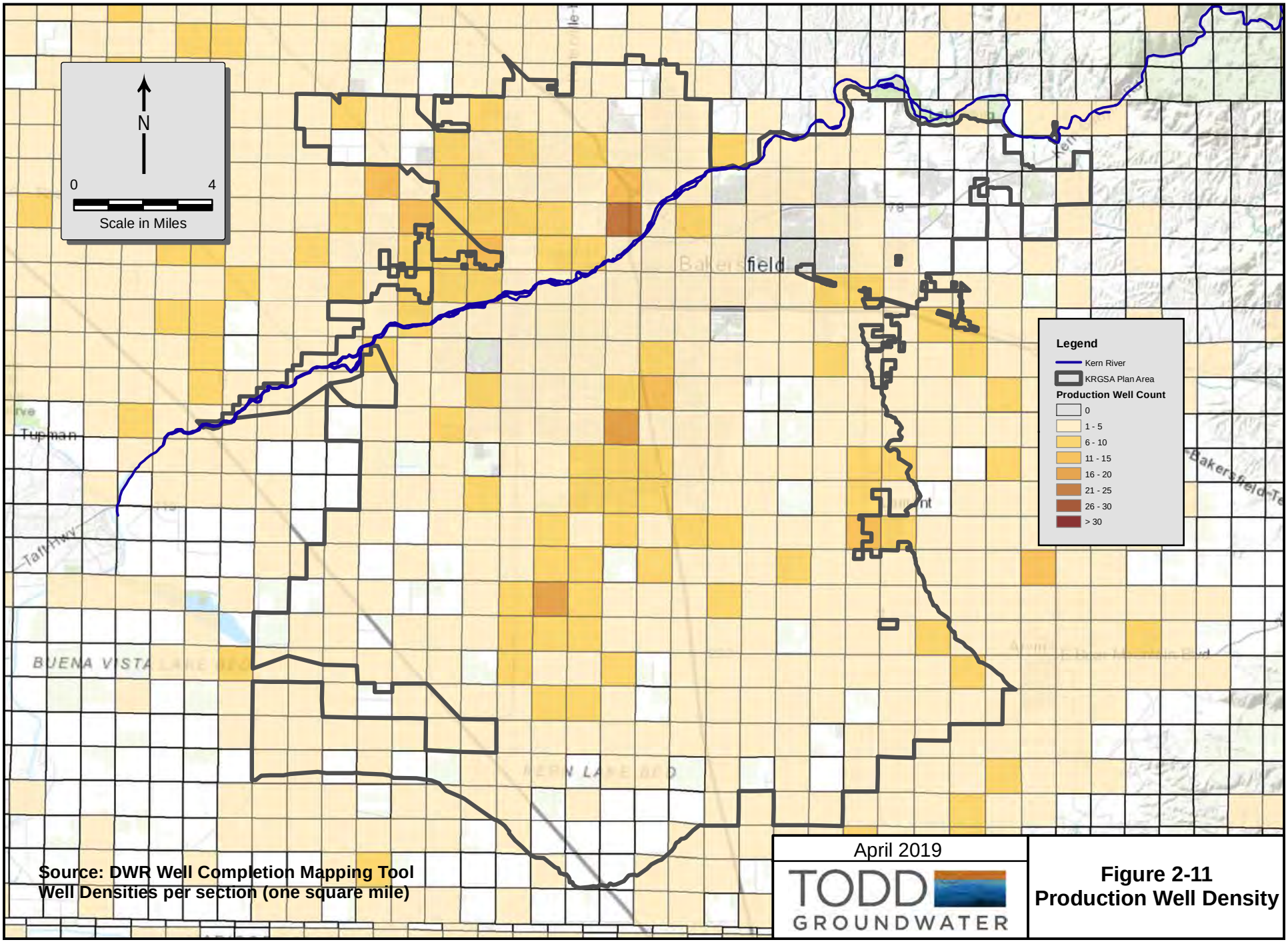
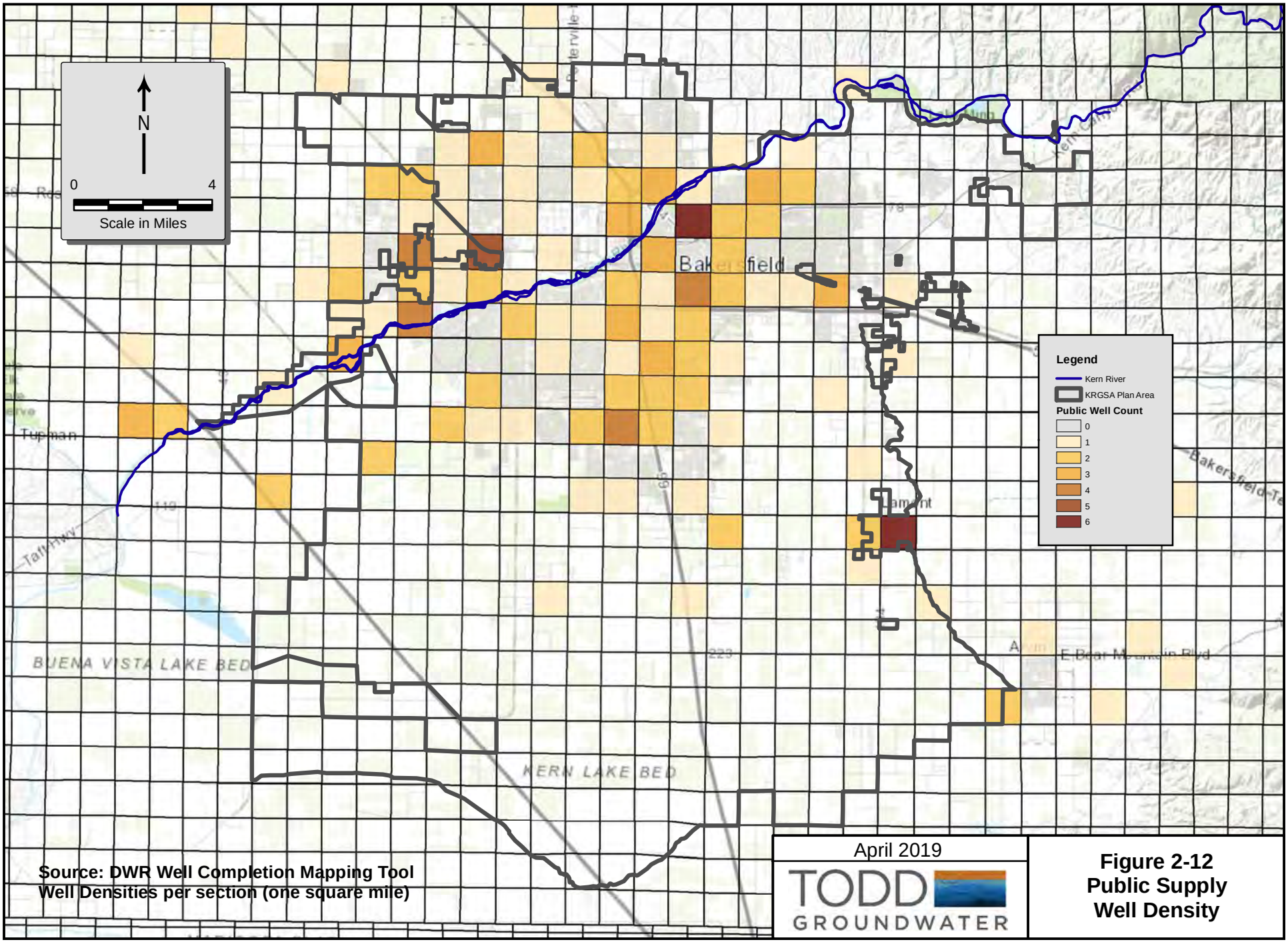
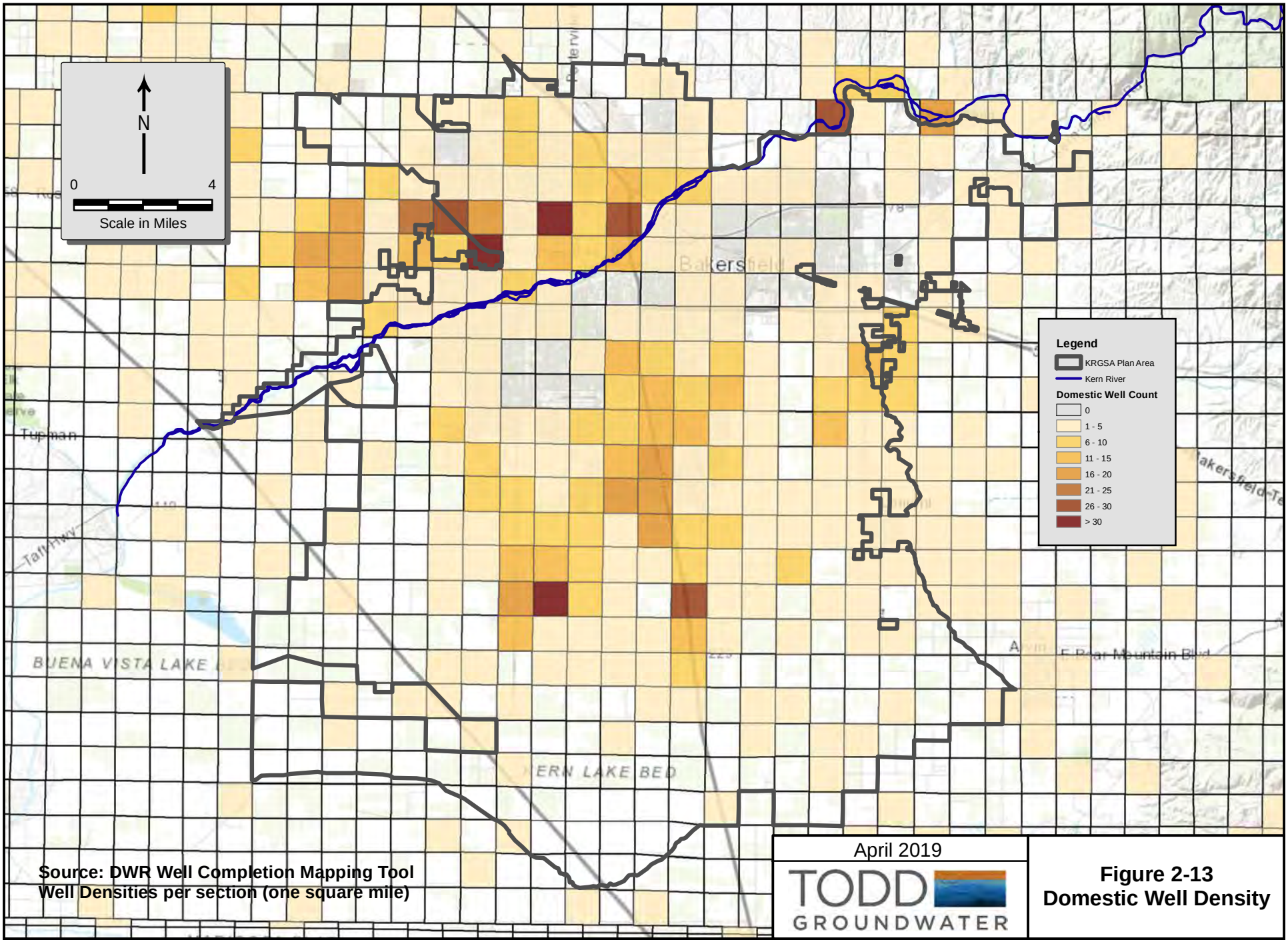


Figure 2-9
Agricultural Crops and Dairies
KRGSA GSP Plan Area


Kern River Annual Index
Percent of Long-Term Average Annual FLow
Percent of Long-Term Average (%)
250 %
200 %
150 %
100 %
50 %
0 %
1995-2014 Average 100%
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
February 2019
TODD GROUNDWATER
Figure 2-10
Kern River Annual
Indices 1995 - 2016


N
0
4
Scale in Miles
Legend
Kern River
KRGSA Plan Area
Production Well Count
0
1 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
> 30
Source: DWR Well Completion Mapping Tool
Well Densities per section (one square mile)
April 2019
TODD GROUNDWATER
Figure 2-11
Production Well Density


N
0
4
Scale in Miles
Legend
Kern River
KRGSA Plan Area
Public Well Count
0
1
2
3
4
5
6
Bakersfield
Tupman
BUENA VISTA LAKE BED
KERN LAKE BED
Source: DWR Well Completion Mapping Tool
Well Densities per section (one square mile)
April 2019
TODD GROUNDWATER
Figure 2-12
Public Supply
Well Density


N
0
4
Scale in Miles
Legend
KRGSA Plan Area
Kern River
Domestic Well Count
0
1 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
> 30
Bakersfield
Tupman
BUENA VISTA LAKE
ERN LAKE BED
Source: DWR Well Completion Mapping Tool
Well Densities per section (one square mile)
April 2019
TODD GROUNDWATER
Figure 2-13
Domestic Well Density

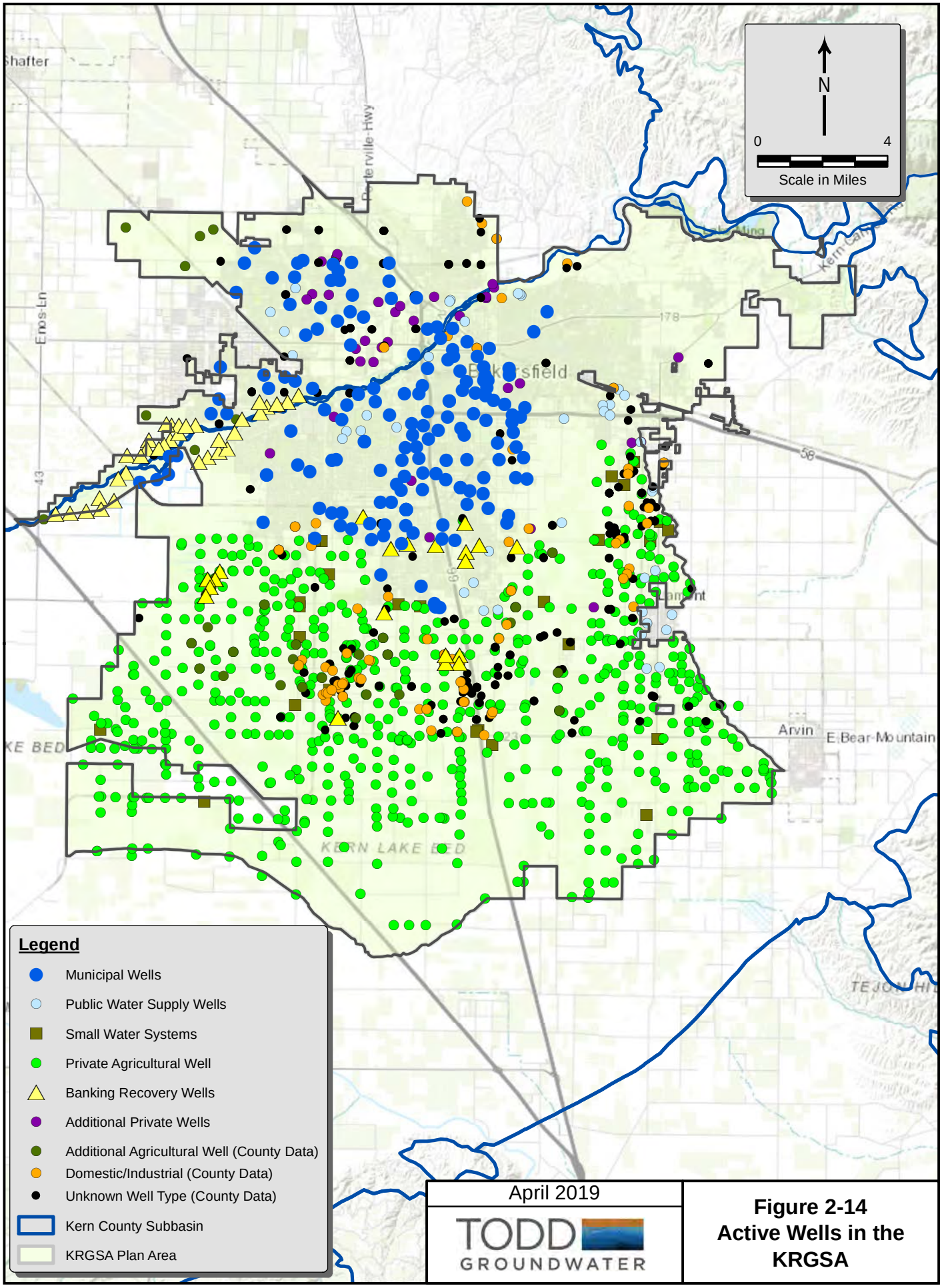
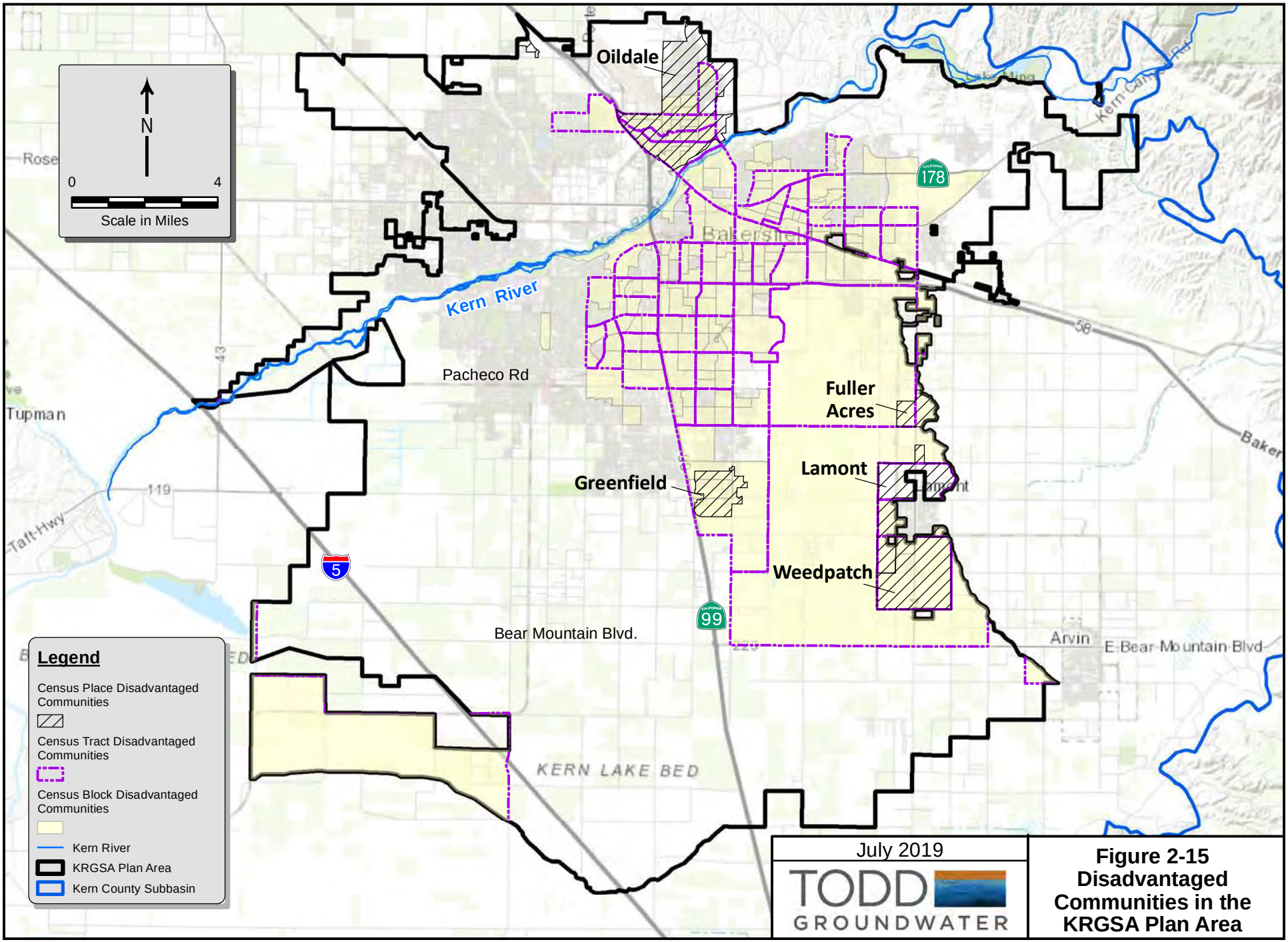


Figure 2-14
Active Wells in the KRGSA


N
0
4
Scale in Miles
Oildale
Kern River
Pacheco Rd
Tupman
Taft Hwy
Bakersfield
Fuller Acres
Lamont
Greenfield
Weedpatch
Bear Mountain Blvd.
Arvin
E Bear Mountain Blvd
KERN LAKE BED
Legend
Census Place Disadvantaged Communities
Census Tract Disadvantaged Communities
Census Block Disadvantaged Communities
Kern River
KRGSA Plan Area
Kern County Subbasin
July 2019
TODD GROUNDWATER
Figure 2-15
Disadvantaged Communities in the KRGSA Plan Area