APPENDIX F

GROUNDWATER MANAGEMENT PLAN

TULARE IRRIGATION DISTRICT

SEPTEMBER 2010

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List of Abbreviations

AB	Assembly Bill
ACWA	Association of California Water Agencies
AF	Acre-feet
AWEP	Agricultural Water Enhancement Project
bgs	below ground surface
CVP	Central Valley Project
DBCP	dibromochloropropane
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ET	evapotranspiration
F	Fahrenheit
FKC	Friant-Kern Canal
FWA	Friant Water Authority
FWUA	Friant Water Users Authority
GAC	Groundwater Advisory Committee
GMP	Groundwater Management Plan
GPM	gallons per minute
GPS	Global Positioning System
ID	Irrigation District
IRWMP	Integrated Regional Water Management Plan
KDWCD	Kaweah Delta Water Conservation District
KSJRA	Kaweah and St. Johns River Association
MOU	Memorandum of Understanding
NRCS	Natural Resources Conservation Service
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SOR	Systems Optimization Review
TID	Tulare Irrigation District
TDS	total dissolved solids
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
WHPA	Wellhead protection area
WRI	Water Resources Investigation of the Kaweah Delta Water Conservation District

1 – INTRODUCTION

This Groundwater Management Plan (GMP or Plan) is an update of a Plan that was adopted by the Tulare Irrigation District in October 1992. The original Plan was prepared in accordance with the requirements prescribed in Assembly Bill No. 255 (California Water Code Section 10750 et seq.).

This GMP is a revision that satisfies the new requirements for GMPs created by the September 2002 California State Senate Bill No. 1938, which amended Sections 10753 and 10795 of the California Water Code. This Plan also addresses recommended components for a Groundwater Management Plan described in Appendix C of Department of Water Resources Bulletin 118 (2003 Update). **Table 1.1** shows the required and recommended components (See Section 1.4).

This plan outlines the framework for TID's groundwater management efforts. General categories that are addressed include a description of the District's geology and hydrogeology, basin management objectives, stakeholder involvement, groundwater monitoring, groundwater resources protection, groundwater sustainability, groundwater operations, and groundwater planning and management. Within these categories, specific groundwater management elements are described including existing activities and planned actions to expand and improve groundwater management.

1.1 - Area Covered by Groundwater Management Plan

This GMP covers the entire area served by TID, which includes about 72,000 acres (see **Attachment 1**). TID also owns and operates some facilities outside of their service area boundaries, and has determined that adjacent areas could impact their groundwater resources. As a result, the GMP discusses the physiography, geology, hydrogeology and groundwater issues in neighboring lands. Specifically, a 'Buffer Zone' has been defined (see **Attachment 8**), which is bounded by several hydrologic features (i.e. rivers and creeks). Groundwater investigations and studies suggest that groundwater management activities in this buffer zone influence the groundwater in TID. The buffer zone primarily covers lands in the Kaweah Delta Water Conservation District, but also includes several other water agencies and municipalities. TID can manage groundwater in these water agencies if they give TID permission to do so.

The KDWCD is a regional water management agency covering 340,000 acres, including all of TID. KDWCD also has a GMP, and recognizing their common interests and overlapping areas, TID and KDWCD signed a MOU regarding groundwater management in areas the two plans overlap, as well as adjacent zones and facility areas. TID interprets these 'adjacent zones and facilities areas' as the Buffer Zone lands within KDWCD. This agreement is informally called the 'Overlap MOU'. In the MOU, KDWCD and TID agreed to allow both agencies to manage groundwater in the

overlap areas and adjacent zones, unless there is a disagreement, in which case TID will have sole authority to manage groundwater in TID and the City of Tulare, but not in the buffer zone lands of KDWCD. If necessary in the future, TID may seek permission from other agencies in the buffer zone to manage their groundwater according to this GMP.

1.2 - Background Information on Tulare Irrigation District

Below is a brief description of the origin, physiography, geology, water supplies and facilities of the District.

History

TID is a political subdivision of the State of California – an independent agency operating under the California Water Code. TID is a conjunctive use district, formed in 1889 for the purpose of managing, supplying and delivering water to growers within TID. The District has conjunctively utilized Kaweah River waters and groundwater since at least the early 1940's. TID's original water service contract with the USBR was signed in 1950 for water delivery from the Friant Unit of the CVP. This imported contract supply was also designed around TID's conjunctive use capabilities. The contract includes a large quantity of Class 2 entitlement, a supplemental supply made available by USBR largely for groundwater recharge within the Friant Unit service area.

Geography

TID is located in western Tulare County on the eastern part of the San Joaquin Valley, about 20 miles west of the Sierra Nevada foothills, approximately 50 miles southeast of the City of Fresno and approximately 65 miles northwest of the City of Bakersfield (see **Attachment 1** for a vicinity map). The District surrounds, but does not contain, the City of Tulare. State Highways 63, 99 and 137 traverse the District. Adjacent agricultural water agencies include Corcoran Irrigation District, Kaweah Delta Water Conservation District, Kings County Water District, Consolidated Peoples Ditch Company, and Farmers Ditch Company. Refer to **Attachment 2a** for a map of neighboring surface water delivery districts, **Attachment 2b** for a map of neighboring municipal water delivery districts, and **Attachment 3** for a map of neighboring ditch and irrigation companies. The District covers about 77,000 acres (120.3 square miles). The topography slopes generally from northeast to southwest at an average of 6.2 feet per mile.

Climate

The District is characterized as having hot and very dry summers, with relatively mild winters. Average annual precipitation and temperature are 10.15 inches and 63° F, respectively. With the long, hot summers that normally occur in the valley, there is a potential for about five feet of evaporation per year, with the majority occurring from April through October. Rainfall in the District occurs primarily in the winter months, with

virtually no rainfall in the summer months. Annual crop use per acre averages several times the amount of average precipitation. As a result, agricultural crops grown within the District are heavily dependent upon irrigation from surface water deliveries and groundwater pumping, with water needs only partially satisfied by rainfall.

Soils and Agronomy

Refer to **Attachment 4** for a NRCS soils map of TID. Soils in the district are primarily loam and sandy loam. About 59,000 acres, or 77% of the total District area, is cropped. The major crops include corn, alfalfa, cotton, pistachios and wheat; with a total of over 20 different crops grown (2009 data). According to the District's most recent Water Management Plan, the irrigation methods include drip and micro (4%), gravity (96%), and sprinkler (<1%). The combined average irrigation efficiency is estimated to be between 75 and 85%.

Geology

TID is located in the Kaweah Groundwater Sub-basin (see **Attachment 5**). The geological sequences of permeable, water bearing sediments within TID, from youngest to oldest, are: Topsoil, Young Alluvium and the Kern River Series. Recent standing groundwater levels average about 135 feet bgs. TID cooperates with the USBR in monitoring groundwater levels. The number of groundwater wells within the District is unknown as they are private facilities owned and controlled by landowners. Refer to Section 2 for more details on the geology in TID.

Water Demands

The agricultural demand within the District was estimated to be approximately 221,500 AF/year in the District's 2002 Agricultural Water Management Plan. However, in recent years, the District has experienced a significant shift in cropped acreage away from cotton and towards crops that support the dairy industry. These plantings are more often double cropped and so the average annual water demand within the District may be increasing.

Groundwater Supply

The District does not operate any groundwater wells and therefore does not supply groundwater to District landowners. Each individual landowner must provide his own well(s) to sustain irrigation during periods when the District is not diverting surface water into its system. See **Attachment 6** for a map of private wells in the District that are monitored by TID. It has previously been estimated that TID growers pump approximately 100,000 AF/year (CH2MHill, 2000), on average, from private groundwater wells to supplement District supplies. The District tracks depths to groundwater in the area through a network of private irrigation wells shown on **Attachment 6**.

Surface Water Supplies

The District's average annual surface water supply from 1988 to 2008 was approximately 163,400 AF, from water rights on Kaweah River and Friant Unit entitlement imported from the San Joaquin River. TID's Kaweah rights yield is, on average, about 75,000 AF annually. TID has a CVP Friant Unit water supply contract for up to 30,000 AF of Class 1 water and up to 141,000 AF of Class 2 water annually. In addition, the District enters into annual contracts for Section 215 water (surplus CVP water).

Facilities

The vast majority of the District's distribution system consists of unlined earthen channels with reinforced concrete control structures and road crossings. Collectively, the District owns and operates approximately 300 miles of earthen canals and ditches. The District also owns approximately 30 miles of pipeline. The District's distribution system begins in the Friant-Kern Canal. Diversions into the distribution system are also utilized further downstream from the St. Johns River and Lower Kaweah River. There are a few other channels (Cameron and Packwood Creeks) that flow from the Kaweah River that terminate in or near the District. Once the Main Intake Canal reaches the District boundary, it bifurcates into the Main Canal, which extends southwesterly to serve a major portion of the District and the North Branch Canal which serves the northwesterly portion of the District. The District's distribution system is currently built out and can deliver surface water to the vast majority of the landowners. The District has approximately 968 farm service turnouts. Additionally, the District maintains and operates 11 regulation and recharge basins covering approximately 1,110 acres. The recharge basins and canals in the District are shown on **Attachment 7**. Although the District owns a few production wells, it does not use them for groundwater extraction to supplement its surface water supplies.

1.3 - Goals and Objectives of Groundwater Management Plan

This GMP documents the existing groundwater management efforts in TID and planned efforts to improve groundwater management. The purpose of the GMP is to help TID meet the following objectives:

1. Address potential changes in local hydrology brought about by surface water losses (i.e. San Joaquin River Restoration), urban development and drought.
2. Preclude surface water or groundwater exports that would reduce the long-term reliability of groundwater.
3. Coordinate groundwater management efforts between regional water users.
4. Maintain local management of the groundwater resources.
5. Implement a groundwater-monitoring program to provide an "early warning" system to future problems.
6. Stabilize groundwater levels in order to minimize pumping costs and energy use, and provide groundwater reserves for use in droughts.

7. Develop groundwater storage facilities to reduce stress on local groundwater reserves during droughts.
8. Maximize the use of all surface water sources, including available flood water, for beneficial use and groundwater recharge, and thus reduce stress on groundwater resources.
9. Increase knowledge of the local geology and hydrogeology to better understand threats to groundwater quality and quantity.
10. Minimize future land subsidence caused by groundwater pumping through in-lieu groundwater recharge, and wise and conservative use of pumped groundwater.
11. Prevent groundwater degradation by protecting groundwater quality, importing clean surface water, and preventing intrusion of poor quality groundwater from neighboring areas.

In addition, the District will take a proactive role in the legislative process. TID will participate in development of sound legislation concerning groundwater management if it becomes necessary. TID will also take an active role in opposing any legislation that is detrimental to local groundwater management efforts, or prevents the local management of groundwater. In furtherance of this effort, District staff are active in the Groundwater Committee of ACWA, in which groundwater legislation and implementation strategies are regularly discussed.

1.4 - Statutory Authority for Groundwater Management

The District, under the authority of AB 255 passed by the state legislature in 1991, adopted a groundwater management plan in 1992. The District was one of the first in the state to adopt such a plan and groundwater management program. The District, like others in the San Joaquin Valley, felt it best to adopt a plan locally as a means to demonstrate its commitment to local conjunctive use management and embrace the authorities afforded therein to further that commitment. AB 255 essentially empowered districts with the authorities of groundwater replenishment districts. These powers include the ability to impose charges and levy taxes for the purposes of acquiring and recharging surface water.

Under subsequent legislation, namely AB 3030 which passed in 1992, Kaweah Delta WCD also adopted a groundwater management plan in 1995. The KDWCD's Plan was regional in extent and overlaps the service area of TID and twelve other water agencies. The newer legislation provided for many of the same authorities and powers as did AB 255; however, one additional management power was the ability to regulate (reduce) groundwater pumping should other measures first prove inadequate to address overdraft issues.

The authorities in AB255 and AB3030 remained unchanged with the amendments to the law provided by 2002 California Senate Bill 1938 (SB 1938), which also identified

new requirements for GMPs. The GMP represents an updated version, and includes the additional components listed in California SB 1938.

The powers granted to an agency adopting a Groundwater Management Plan include:

1. The District may take any actions needed to replenish the groundwater within the District, including buying and selling water, delivering water in-lieu of groundwater pumping, and spreading water for recharge.

2. The District has the authority to limit or suspend groundwater extractions, but only if they determine through study and investigation that groundwater replenishment programs, or other alternative sources of water supply, have proved insufficient or infeasible to lessen the demand for groundwater.

3. The District may take actions needed to protect or prevent interference with water, water quality, or water rights within the District.

4. The District may take any actions necessary to put water under its control to beneficial use.

5. Using water quality goals, the District may take any action needed to preserve the water within the District for beneficial uses. These actions include preventing contaminants from entering District groundwater supplies, removing contaminants, locating and characterizing contaminants within the District, identifying parties responsible for contamination of groundwater, and performing studies relative to the listed water quality goals.

6. The District may enter into agreements with other local agencies or private parties to manage mutual groundwater supplies, including those existing in overlapping areas.

7. The District may levy and collect general groundwater replenishment assessments, as well as water extraction fees based on the amount of groundwater extracted from the aquifer. However, these fees must be "ratified" by a majority vote in an election, according to the election rules applicable to the District.

8. The District may sue to recover the amount of District expenditures for protection of groundwater quality protection from parties responsible for the contamination.

9. The District is granted additional powers of a Replenishment District, which allows it to:
   a) Acquire and operate facilities, waters and rights needed to replenish

the groundwater supplies.

b) Store water in groundwater basins, acquire water rights, import water into the District, and conserve water.
c) Participate in legal proceedings as required to defend water rights, and water supplies, and to prevent unlawful exportation of water from the District.
d) Under certain conditions, to exercise the right of eminent domain.
e) Act jointly with other entities in order to economically perform required activities.
f) Carry out investigations required to implement programs.
g) Fix rates for water for replenishment purposes.
h) Fix the terms and conditions of contracts for use of surface water in-lieu of groundwater.

The District's overall strategy in using these powers is to limit their control over private groundwater facilities, and, through a combination of grower education, water conservation efforts, groundwater recharge, and groundwater banking, to reduce the rate of groundwater level decline, and, if possible, stabilize groundwater levels to help ensure that groundwater resources are sustainable and economically accessible.

1.5 - Groundwater Management Plan Components

This GMP includes the required and voluntary components for a GMP as identified in California Water Code Section 10753, et. seq. This Plan is also consistent with the recommended elements for a GMP as identified in DWR Bulletin 118 (2003), Appendix C. **Table 1.1** identifies the appropriate section of the GMP where each component is addressed.

Table 1.1 - Location of Groundwater Management Plan Components

	Description	Plan Section(s)
	California Water Code Mandatory Requirements (10750 *et seq.*)	
1.	Documentation of public involvement	1.6, Appendix A
2.	Groundwater basin management objectives	1.3, 3
3.	Monitoring and management of groundwater elevations, groundwater quality, land subsidence, and surface water	5
4.	Plan to involve other agencies located in the groundwater basin	4.3
5.	Monitoring protocols	5.3
6.	Map of groundwater basin and agencies overlying the basin	Att. 2,3 and 5
	California Water Code Voluntary Components (10750 *et seq.*)	
7.	Control of saline water intrusion	6.3
8.	Identification and management of wellhead protection areas and recharge areas	6.2, 7.2
9.	Regulation of the migration of contaminated groundwater	6.3, 6.4
10.	Administration of well abandonment and well destruction program	6.1
11.	Mitigation of overdraft conditions	7.1, 7.2
12.	Replenishment of groundwater extracted by water users	7.2
13.	Monitoring of groundwater levels and storage	5.1, 9.3
14.	Facilitating conjunctive use operations	7.3
15.	Identification of well construction policies	8.1
16.	Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	6.4, 7, 8.2
17.	Development of relationships with state and federal regulatory agencies	4.2, 4.3
18.	Review of land use plans and coordination with land use planning agencies	9.1
	Additional Components Recommended by DWR (App. C of Bulletin 118)	
19.	Advisory committee of stakeholders	4.1
20.	Description of the area to be managed under the Plan	1.1, 1.2, 2
21.	Descriptions of actions to meet management objectives and how they will improve water reliability	4 - 9
22.	Periodic groundwater reports	9.3
23.	Periodic re-evaluation of Groundwater Management Plan	9.5

1.6 - Adoption of Plan

Refer to **Appendix A** for documentation on the adoption of the GMP and the public process that was followed.

Public Participation in Plan Development
The public was invited to participate in the development of the updated GMP through newspaper notices and public hearings. The City of Visalia, City of Tulare and Kaweah Delta Water Conservation District were also sent copies of the Draft GMP for their review and comments.

Groundwater Advisory Committee
A Groundwater Advisory Committee was formed comprising the District Manager, District Engineer and TID Board of Directors. The TID Board of Directors is comprised of local farmers and represents the local community. They are familiar with the local and regional water issues and are best suited to serve as the primary voice on the GAC. The general public was informed of the GMP update through a series of public notices and meetings.

Public Notice of Intention to Update the Groundwater Management Plan
As required by the California Water Code, a public hearing was duly noticed consistent with Code §10753.2(a) and held on August 11, 2009, to discuss updating TID's existing GMP. No public comments beyond those offered by the GAC were received at this meeting.

Resolution of Intention to Update the Groundwater Management Plan
TID adopted a Resolution of Intention to Update the Groundwater Management Plan on August 11, 2009. This resolution was then published on July 27 and August 3, 2009 consistent with Code §10753.2(a).

Resolution of Intention to Adopt the Updated Groundwater Management Plan
TID adopted a Resolution of Intention to Adopt the Groundwater Management Plan on May 11, 2010, consistent with Code §10753.2(a).

Resolution Adopting the Updated Groundwater Management Plan
TID adopted a Resolution to Adopt the Updated Groundwater Management Plan on September 14, 2010. This resolution was then published on September 23, 2010 and September 30, 2010 consistent with Code §10753.2(a).

1.7 - Kaweah Delta Water Conservation District Groundwater Management Plan

TID is a cooperating agency in the KDWCD GMP, which was updated in November 2006. KDWCD's original plan was prepared in 1995 in accordance with the requirements prescribed in Assembly Bill No. 3030. The 2006 Plan was revised to satisfy the new requirements for GMPs created by the September 2002 Senate Bill No. 1938. Refer to Section 4.2 for more information on KDWCD and **Attachment 8** for a map showing the border of KDWCD in relation to TID.

The Plan officially recognizes stakeholders through the execution of a MOU. The

purpose of the MOU is to document the interests and responsibilities of participants. The MOU also promotes the sharing of information, the development of a course of action, and the resolving of differences that may arise regarding the Plan. Since the Plan's inception in 1995, thirteen stakeholders have signed the MOU. A list of the stakeholders is provided in Section 4.2 – Relationships with Other Agencies.

In 1996, TID and KDWCD executed an additional MOU referred to as the "Overlap MOU" for the purpose of coordinating the implementation of their respective Plans (see **Appendix B**). From the District's perspective, the two principle features of the MOU as stated therein are that (1) each agency will coordinate its groundwater management activities in the overlap area with the other, and (2) should there be unresolved disputes, TID's plan will govern within its prescribed area, including the City of Tulare.

The two groundwater management plans share common goals and themes. This GMP focuses on groundwater issues unique to TID and its surrounding area, while the KDWCD GMP focuses on regional groundwater issues. TID considers both GMPs important resources in their groundwater management program. While the KDWCD and several other agencies within the Kaweah sub-basin currently maintain individual GMP's, TID will continue to maintain and implement its own Plan given its historic and leading role in the basin of importing large quantities of surface water from the Friant Unit, a practice that has and will serve as one of the most significant measures in combating local and regional overdraft.

2 - GEOLOGY AND HYDROGEOLOGY

This section discusses the geology and hydrogeology of TID and the surrounding area. The purpose of this section is to provide general background information on the local hydrogeology that will aid in selecting and implementing groundwater management programs. Most of the information on the local geology was derived from reports prepared by USBR (February, March 1949), and Fugro West (2007). Regional geologic information is documented in Bertoldi et al (1991), Page (1986), and Croft (1968).

The following sections include technical discussions on the District's groundwater. These are intended to provide geologists, engineers, and water managers a greater understanding of the area's stratigraphy, groundwater conditions, and hydrogeologic parameters. The content of this chapter requires a basic understanding of some geologic principles and terminology. Less technical discussions on groundwater management programs can be found in Sections 3-9.

2.1 - Regional Geology

The District is located entirely within the confines of the San Joaquin Valley. The San Joaquin Valley is a large asymmetric structural trough that has been receiving sediments from the Sierra-Nevada Mountains to the east and from the Coast Ranges to the west. In the area of TID, these sediments and corresponding structures control the direction of groundwater flow and the quality of groundwater available to wells. In general, TID is underlain by (oldest to youngest) basement rocks, unconsolidated deposits, and topsoil.

Groundwater Basin

TID is located in the Tulare Lake Hydrologic Region, which covers 10.9 million acres (17,000 square miles) and includes all of Kings and Tulare Counties and most of Fresno and Kern Counties. The Tulare Lake Hydrologic Region has 12 distinct groundwater basins and 7 sub-basins. TID is located in the Kaweah sub-basin of the San Joaquin Valley Groundwater Basin (**Attachment 5**). The San Joaquin Valley Groundwater Basin is surrounded on the west by the Coast Range, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada Mountains and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. General information on the San Joaquin Valley Basin and Kaweah sub-basin can be found in the California Department of Water Resources Groundwater Bulletin (2003 update).

The Kaweah sub-basin lies between the Kings Groundwater sub-basin on the north, the Tule Groundwater sub-basin on the south, the crystalline bedrock of the Sierra Nevada foothills on the east and the Tulare Lake sub-basin on the west. The Kaweah sub-basin boundaries are similar to those for the KDWCD. Major rivers and streams in

the sub-basin include the Lower Kaweah and St. Johns Rivers. The Kaweah River is considered a primary surface water source for groundwater recharge to the area. In the 1980 California Groundwater Bulletin 118 (DWR, 1980), DWR classified the Kaweah sub-basin as being critically overdrafted. This designation was not re-evaluated by DWR when Bulletin 118 was updated in 2003. (However, recent analysis by Fugro (2007) still shows the basin to be in a state of overdraft). DWR has assigned the sub-basin a 'Type B' groundwater budget, which means that enough data are available to estimate the groundwater extraction to meet the local water needs, but not enough data is available to characterize the groundwater budget.

According to DWR (2003), well yields in the Kaweah sub-basin are 1,000 to 2,000 gpm, with a maximum of 2,500 gpm. The total dissolved solids in the groundwater ranges from 35-580 mg/L with an average of 189 mg/L.

Previous Studies

In December 2003, Fugro West, Inc. prepared a report for KDWCD entitled "*Water Resources Investigation of the Kaweah Delta Water Conservation District*". The report was revised in July 2007. The purpose of the study was to conduct a detailed geologic and hydrogeologic analysis to evaluate and assess the safe yield within the District. The overall purpose of the study was to provide the District, overlying water purveyors, and Tulare County planning agencies with foundational data to help plan future water supply projects. Although the investigation does not address specific planning or water management issues, it provides a foundation for agencies to continue and to optimize their water resource planning efforts. The results of the study are discussed throughout this GMP.

The KDWCD was divided into 5 separate Hydrologic Units for the study (see **Attachment 9**). TID is located in Hydrologic Unit No. 5, which essentially covers the District, as well as the City of Tulare and a small overlapping portion of the Elk Bayou Ditch Company. Hydrologic Unit No. 5 covers 81,500 acres in comparison to TID which covers 77,000 acres. For general purposes, these two areas are assumed to be the same. The most important results from the study include detailed figures for hydrologic balance parameters, and an estimated safe yield for Hydrologic Unit No. 5.

2.2 - Physiography of the District

The San Joaquin Valley, which is the southerly part of the great Central Valley of California, extends from the Sacramento-San Joaquin Delta area on the north about 250 miles to the Tehachapi Mountains on the south. In the vicinity of the District, it is approximately 65 miles wide. The Valley is bordered on the east by the Sierra Nevada Mountains, which range in elevation from about 1,000 feet or less to more than 14,000 feet above sea level. The Coast Range Mountains, which borders the Valley on the west, rises to about 6,000 feet above sea level.

The southern end of the San Joaquin Valley, also known as the Tulare Basin, is a closed feature, with water flowing out of the basin only in extreme wet periods. Tributary streams drain to depressions, the largest of which is Tulare Lake bed located to the west of the District's boundary. The Kings River, Kaweah River, Tule River, White River, Deer Creek, Lewis Creek and Poso Creek, and, on occasion, the Kern River, discharge into Tulare Lake at times when flows exceed the capacity of foothill reservoirs and of the irrigation and recharge diversion systems.

Water level fluctuations in the Tulare Lake waters have been common, and it is reasonable to assume that the process has been taking place for many centuries. During years of heavy precipitation and run-off, before levees were constructed, large volumes of water accumulated in Tulare Lake, and as the relief is very low, the area of the lake fluctuated widely with slight changes in depth of water. Through the years, very little water has escaped from the lake by overflow; most has evaporated or been absorbed by the sands and silts of the lake bottom. Dissolved salts brought in by tributary streams have, in this way, been concentrated. Currently, much less water accumulates in the Lake from runoff due to the construction of several dams and numerous irrigation diversions, and much of the land in the Lakebed is now cropped.

2.3 - Stratigraphy

The following discussion focuses on significant hydrogeologic units that could have an impact on the groundwater resources within the District. Stratigraphy in the District is documented in several reports. The description below is based primarily on the information provided in *Technical Studies in Support of the Factual Report – Tulare Irrigation District* (USBR, February 1949). The generalized stratigraphic sequence of the District includes topsoil, a water bearing series and a non-water bearing series.

Topsoil

Soils in the District are generally favorable for irrigated agriculture with regards to depth, texture and freedom from gravel, stones, or hardpan. According to the Natural Resources Conservation Service Soil Survey for Western Tulare County (2007), most of the District is comprised of loam or sandy loam. The primary soil types include Colpien loam, Nord fine sandy loam, and Gambogy loam. According to the TID Factual Report (March 1949), about 80 percent of the District's land is affected by varying concentrations of alkali, which has resulted from former high water table conditions.

Water Bearing Series

The water-bearing series consists of alluvial fans and lake beds of late Tertiary and Quaternary geologic age which form the groundwater reservoir of the District and adjacent areas. They consist generally of the Delano beds, the Kern River formation, and Young Alluvium. For the purpose of this study, the Kern River Series has been divided into the lower "Kern River formation", and an upper portion, the "Delano beds".

Clay beds apparently formed in relatively still lakes are included within the latter. The water-bearing sediments form a huge wedge, thickest near the western edge of the San Joaquin Valley and thinnest along the mountain front to the east.

Kern River Series. The Kern River formation, in this discussion, includes all known or suspected local sediments older than the Delano beds. Sediments of the Kern River Formation crop out south of Tule River where they disappear northerly beneath the Delano beds. Aquifers in this formation presumably contribute water to the deeper wells. The lithology is similar to the Delano Beds described below.

The Delano Beds consist of fluvial sands, silts, sandy clays, and clays, in part lacustrine, with a few thin lenses of gravel. They crop out east of the District in the area of Lindsay. The sands are generally arkosic, angular to subangular, friable to loose, poorly sorted, and of various shades of reddish-brown, tan and gray.

Young Alluvium. This material forms the fans, floodplains, and channels of the present streams. It resembles the Delano beds, but being younger is not so deeply weathered.

Soils developed in Young Alluvium are generally open and porous, but on the outer fringes of the fans of Tule and Kaweah Rivers and in interfan areas between distributaries of the Kaweah Branch, dense sub soils correspond to areas formerly having a high water table and restricted surface drainage.

Younger alluvium consists of gravelly sand, silty sand, silt, and clay deposited along stream channels and laterally away from the channels in the westerly portion of the District. Younger alluvium is relatively thin locally, reaching a maximum depth below ground surface of perhaps 100 feet. The Young Alluvium is generally above the water table and does not constitute a major water-bearing unit.

Soils developed on the Young Alluvium do not show multiple soil horizons (layers) and are generally free of underlying clay subsoil or hardpan. Because percolation rates through the Young Alluvium are moderate to high, this deposit serves as a permeable conveyance system for recharge to underlying water-bearing materials.

Clay Layers. The westerly two-thirds of the District is largely underlain by the so-called Corcoran Clay or E-Clay, which separates a generally unconfined aquifer system above and a confined aquifer system below. Irrigation wells in the District's area are generally perforated in both systems.

Although as many as six laterally continuous clay zones have locally been defined in the southern San Joaquin Valley, only the most prominent of these E-Clay zones known as the E-Clay (or Corcoran Clay member) is found within the District. The E-Clay is one of

the largest confining bodies in the area and underlies about 1,000 square miles of the San Joaquin Valley. The beds were deposited in a lake that occupied the San Joaquin Valley trough and which varied from 10 to 40 miles in width and was more than 200 miles in length (Davis et al., 1957).

The E-Clay extends from Tulare Lake Bed to U.S. Highway 99 and is vertically bifurcated near Goshen. It is about 140 feet thick near Corcoran and the average thickness is about 75 feet. The deposits near the City of Corcoran are probably the thickest section in the San Joaquin Valley. The Corcoran Clay is generally used to differentiate between a lower confined aquifer and an upper unconfined aquifer west of its eastern extent.

As mapped by Page (1986), the E-Clay (or Corcoran Clay) underlies the majority of the District. Pages' mapping extends the eastern limit of the Corcoran Clay in the vicinity of the plan area from earlier studies by Davis et. al. (1957), and Croft (1968). Later mapping of the Corcoran Clay by R. S. Brown (1981) of the California Department of Water Resources, is in large part similar to Pages (1986) mapping, and as such his description is used here. All of the sources consulted for this study agree that the Corcoran Clay dips and thickens southwest beneath the District. The depth to the top is questionable in the northeast portion of the plan area, but appears to be between 200 to 300 feet deep there, dipping to depths of 400 feet beneath the southwest part of the District. While information on thickness is incomplete in the District, it does show that the Corcoran Clay thickens from about 20 feet thick in the northeast to about 40 feet thick in the southwest portion of the District, and locally maybe as much as 60 feet thick.

Alluvial Fans. TID is located on the recent and still growing alluvial fan of the Kaweah and St. Johns Rivers. The Tule River alluvial fan approaches to about two miles southeast of the District. The alluvial fan slopes generally southwesterly at 7 to 8 feet per mile in the northeastern half of the district. Land classification studies show the soils in this area to be generally light-textured. The southwestern half of the District slopes southwesterly about 5 feet per mile, with prevailingly medium-textured soils. Change in slope and in soil texture reflects the change from the active portion of the fan to the outer, largely inactive, portion.

The Kaweah alluvial fan was built by deposition from Kaweah River and its distributaries. Original slopes of the fan were gentle, and deposition was sufficiently slow to allow deep weathering and break down of coarser materials. The aquifers are lenticular (composed of lenses) in character and are separated from each other by less permeable deposits, permitting a slow, steady migration of ground water from sand lens to sand lens.

Basement Complex (Non-water bearing series)
The non-water bearing series is the Basement Complex, which crops out throughout the mountains and foothills, 10 miles or so east of the District. The Basement Complex consists of ancient sedimentary and volcanic rocks, now greatly metamorphosed, and of the granitic rocks which intrude them. These were involved in the late Jurassic deformation and form a unit that underlies the valley fill at varying depths—probably not less than 5,300 feet below TID. The Basement Complex is relatively impervious and inhibits groundwater recharge. Streams flowing through the Basement Complex lose little or none of their original flow by influent seepage. In the District the basement is assumed to be deep enough to have no significant effect on ground-water supply and conditions.

2.4 - Aquifer Characteristics

In TID, aquifers occur in unconfined, semi-confined, and confined states. Water levels in an unconfined aquifer system coincide with the top of the zone of saturation, where hydrostatic pressure is equal to atmospheric pressure. Seasonal water level variations in such systems are typically subdued. In confined or artesian aquifers, water bearing materials are completely saturated and are overlain by confining materials of low permeability, such as clay and fine silt, and water within the aquifer is under hydrostatic pressure. The hydrostatic head, or pressure, in such an aquifer is reflected by the height above the confining stratum to which water will rise in a well drilled into the aquifer.

Because the alluvial and continental deposits in the District are characteristically heterogeneous in composition, containing individual strata of low permeability that generally exhibit little or no continuity, most aquifer systems are, in fact, semi-confined, becoming increasingly confined with depth. Such aquifers respond to pressure changes over short periods of time, however hydrostatic heads reach equilibrium with unconfined water tables only over extended periods of static, non-pumping conditions.

Specific Yield
Specific yield is defined as the volume of water that will drain by gravity from sediments within a designated storage unit if the regional water table were lowered. Conversely, it is also defined as the volume of water to re-saturate the deposits after they are drained (as long as the sediments do not collapse i.e., subsidence).

Average estimated specific yield of sediments underlying TID is 10 percent (USBR, February 1949). This figure was derived from studies of 477 water wells, in which the material evaluated was, in most cases, between 20 and 70 feet below the surface (USBR, February 1949). The specific yield of the ground water reservoir was estimated by segregating sediments recorded in driller's water well logs into the following classifications:

Table 2.1 – Specific Yield of Various Sediments

Sediment	Relative Permeability	Specific Yield
Clay and silt	Impermeable	2.9%
Very find sand, silt and clay	Relatively impermeable	4.2%
Fine sandy silt	Poor permeability	5.8%
Sandy silt, slightly cemented sand	Relatively permeable	7.5%
Medium and fine sand	Permeable	24.2%
Gravel and coarse sand	Very permeable	34.8%

Note that the estimated specific yield of 10% is for a zone (20 to 70 feet depth) that has been mostly dewatered. Average groundwater depths in TID were approximately 135 feet in Fall of 2009.

Fugro (2007) also estimated specific yield for the entire KDCWD area. Considered in an overall picture, the contours of equal specific yield percentage in the Kaweah area follow a fairly uniform pattern. High percentages are centered around the present main channel of Kaweah River. Decreasing percentages are found north into the Ivanhoe area and as the topographic low in the interfan area between the Kaweah and Tule Rivers is approached. These details can be seen on a specific yield map (Fugro, 2007, Plate 23). The map shows a specific yield of 10 percent in most of TID and slightly lower specific yield in the northern part of District. The extreme southwest corner of TID is higher, with some areas having an estimated 13% specific yield. The specific yields were estimated for depths from 0 to 200 feet below ground surface.

Transmissivity

Transmissivity data for the TID area from available literature is sparse. A study by Davis et al., (1964) summarized numerous specific capacity values from Pacific Gas & Electric pump tests performed across the San Joaquin Valley. Using data from field tests in the TID area, they calculated specific capacities ranging from 42 to 60 gpm per foot. Driscoll (1986) provides an approximate relationship between specific capacity data and transmissivitiy. Using this method, transmissivity values for the District and immediately surrounding areas range from 63,000 to 90,000 gpd/ft. These values of specific capacity and transmissivity are probably valid for the unconfined aquifer, as at the time of the report most wells drilled in the area were most likely completed above the E-Clay.

Wells Yields and Depths

Usable groundwater in the District occurs both above and below the Corcoran Clay, and many water wells perforate zones both above and below the E-Clay. These wells allow significant amounts of inter-aquifer flow between the upper unconfined aquifer and lower confined aquifer, thereby equalizing piezometric (head) differences.

According to USBR (February, 1949), pump tests gave no indication of any particularly favorable pumping areas in the District from the viewpoint of specific capacity or yield. Well yields throughout the district averaged approximately 700 gallons per minute and specific capacity averaged 55 gallons per minute per foot of drawdown. However, this data is over 50 years old and conditions and well construction methods have changed substantially over time.

The California DWR (2003) states that well yields in the Kaweah groundwater sub-basin range from 1,000 to 2,000 gpm, with a maximum of 2,500 gpm.

The City of Tulare Urban Water Management Plan includes attributes for 30 City production wells (Table 3-2 in Urban Water Management Plan). The well depths range from 200 to 780 feet, and capacities range from 230 to 1,500 gpm.

Safe Yield

The safe or perennial yield of a groundwater basin is typically defined as the volume of groundwater that can be pumped year after year without producing an undesirable result. Any withdrawal in excess of safe yield is considered overdraft. The "undesirable results" mentioned in the definition are recognized to include not only the depletion of groundwater reserves, but also deterioration in water quality, unreasonable and uneconomic pumping lifts, creation of conflicts in water rights, land subsidence, and depletion of stream flow by induced infiltration. It should also be recognized that the concepts of safe yield and overdraft imply conditions of water supply and use over a long-term period.

The supplemental supply to be furnished from the Friant-Kern Canal was intended to maintain water levels approximating those during 1921-1946, or during a similar cycle of normal runoff. Therefore, with full utilization of the surface water supplies, then groundwater pumping should match the safe yield. However, several factors have contributed to the current condition of overdraft, including: 1) Planting of high water use crops; 2) Double cropping; 3) Dairy development; 4) Urban development and attendant pumping and land use impacts; 5) High groundwater pumping in neighboring areas; and 6) Endangered species issues that result in less surface water diversions to water agencies in the region. In addition, the San Joaquin River Restoration project will reduce TID's surface water deliveries and create a greater disparity between groundwater pumping and the safe yield.

Fugro provided a 'Practical Rate of Withdrawal' for Hydrologic Unit No. 5 (Table 78), which is considered to be the estimated safe yield. This value ranges from 126,000 to 141,000 AF/year for Hydrologic Unit No. 5. Fugro (2007) estimated that the overdraft in the KDWCD ranges from 21,700 to 36,000 AF/year, and the overdraft in Hydrologic Unit No. 5, which is roughly equivalent to the TID service area, is 6,800 AF/year. Within

KDWCD, the greatest overdraft is occurring west of TID, which includes distinctive pumping depressions according to groundwater contour maps.

Groundwater Storage

The area of the District is 72,000 acres and the average specific yield is about 10 percent. With an assumed average groundwater depth of about 135 feet, there is 8.9 million AF of storage capacity between the groundwater table and a depth of 20 feet below the ground surface.

Groundwater Flow

In general, a characteristic regional northeast to southwest pattern of groundwater flow occurred during the 1980's and 1990's. Areas of pumpage depressions are persistently present north of Corcoran, west of Visalia, and northwest of Exeter. Groundwater also flows into TID from the Tule River area into the southern portion of TID. Fugro (2007) estimated groundwater inflow and outflow in Hydrologic Unit No. 5 to average 22,200 AF/year and 16,200 AF/year, respectively, between 1981 and 1999. This equates to a net groundwater inflow of 22,200 – 16,200 = 6,000 AF/year.

Recharge

The estimated specific yield and soil permeabilities resulting from land classification studies indicate that conditions in TID favor artificial water spreading (USBR, February 1949). The northeast quarter of the District is the most suitable for this purpose and the southwest quarter is fairly suitable. The northwest and southeast quarters are generally unfavorable, although there are some areas of moderate permeability in each. The Young Alluvium that overlies all of the TID varies widely in porosity and texture. This variation is noticeable, particularly in the small interfan areas between the natural distributaries of the Kaweah River.

Regionally, most of the KDWCD is underlain by soils with "moderate" rates of water infiltration. Geologically, these correspond to areas of Holocene alluvium. Areas of slow infiltration are also common; these areas correspond to areas of Pleistocene alluvium. Scattered pockets of high infiltration soils appear to be associated with stream channels and associated deposits.

2.5 - Groundwater Levels

In the early 1900's, groundwater levels were high in TID and many wells experienced artesian flow. Since the early 1950's, the District has observed declining groundwater levels and the Kaweah sub-basin has been identified by the DWR as a sub-basin subject to critical conditions of overdraft. Critical conditions of overdraft are defined as a groundwater basin in which continuation of present practices would probably result in significant adverse overdraft-related environmental, social or economic impacts.

Throughout the years the KDWCD has accomplished various studies that examined

groundwater supplies. The most recent study, "*The Water Resources Investigation of the Kaweah Delta Water Conservation District*", was completed in 2003 and updated in 2007. The study once again confirmed the Basin was in a state of overdraft. The study was a comprehensive review of the elements required to determine safe yield for the aquifers within the District. The final conclusion was that annual groundwater supplies in KDWCD were insufficient for water demands not met by surface water in the range of 20,000 to 36,000 AF annually.

TID has been monitoring groundwater levels within and adjacent to its service area since the 1940's. This is accomplished through groundwater level measurements taken in the late fall and early spring. This data is provided to USBR as part of that agency's assessment of groundwater trends within the Friant Unit service area. The KDWCD also measures depths to groundwater basin-wide. Based on historical water level readings by these and other entities, there is an overall trend of declining groundwater levels within the Sub basin. It is important to note that the Basin does have the ability to respond to positive conditions and this is demonstrated during years of above-average precipitation when the decline has been periodically interrupted by short-term groundwater recovery, as a result of reduced groundwater pumping and increased surface water imports. The most severe water level declines within the Basin from 1950 to 2000 occurred in the extreme western end, which is westerly of TID.

The groundwater levels (elevation and depth) in TID and the KDWCD are shown on **Attachments 10** and **11**. Between 1950 and 2000, groundwater levels fluctuated seasonally and according to climatic conditions. Fugro (2007, Plate 30) shows 18 hydrographs for wells throughout TID. Almost all of the hydrographs show a precipitous drop in groundwater levels from 1987 to 1995, a 7-year drought. The water level drops ranged from 50 to 120 feet, with most wells seeing about an 80-foot drop in water levels. From 1995 to 2000 the hydrographs show that water levels recovered and in some cases were slightly higher than in 1950.

USBR (February 1949) notes that TID may lose water by groundwater outflow in years when they take large quantities of Friant Unit CVP Class 2 water. They suggest that this could be avoided by recharging or using some of the water in areas outside of TID. TID is doing this through their various water sales and transfer agreements, discussed in Sections 4.2 and Chapter 7.

2.6 - Land Subsidence

According to Ireland et al. (1984), land subsidence from 1926 to 1970 in the KDWCD has likely been no more than several feet and restricted to the extreme west side of the KDWCD. Subsequent work by Swanson (1998) indicates that with the availability of new surface water supplies in the San Joaquin Valley in about 1970, rates of subsidence were substantially reduced. From 1925 to 1995, such subsidence occurred only in drought years and in local areas where historic low water levels were exceeded.

Ireland (1984) indicates land subsidence of up to 4 to 5 feet in the southern and western portion of the Kaweah sub-basin.

2.7 - Groundwater Quality

Groundwater quality in TID is known only from limited testing. However, the chemical quality of both surface water and groundwater in the District is generally excellent for irrigation, and satisfactory for municipal and industrial use, although there may be some localized problems. The quality of groundwater is expected to remain satisfactory in view of the excellent quality of the replenishment water. The quality of runoff from the Kaweah River and San Joaquin River, which furnishes most ground and surface supply to the District, is very good to excellent quality.

Generally, water is considered suitable for agriculture if the total dissolved solids (TDS) is less than 700 mg/L (Cherry, 1979). According to DWR (2003), TDS in the Kaweah Groundwater sub-basin averages 189 mg/L with a range from 35 to 580 mg/L.

The TID Factual Report (USBR, March 1949) mentions deep brackish water zones within the District. The reports states that they may not be extensive, but should not be ignored, and caution should be used when deep well drilling (greater than 650 feet) is being considered.

The City of Tulare 2008 Consumer Confidence Report also includes information on the local groundwater quality. Between 2006 and 2008 the City did not have any water quality violations. Ranges in water quality parameters included the following:

- Total dissolved solids: 86-220 ppm
- Specific conductance: 130-340 uS/cm
- Arsenic: 2.1-10 ppb

3 - BASIN MANAGEMENT OBJECTIVES

The District's Basin Management Objectives are listed below:

1. **Stabilize Groundwater Levels.** Stabilize average long-term groundwater levels to prevent the loss of groundwater reserves, and prevent the need for well deepening or the installation of new wells. This would be achieved through a combination of water conservation measures, direct groundwater recharge, in-lieu groundwater recharge (importing surface water) and groundwater banking.

2. **Increase Groundwater in Storage.** Increase groundwater storage through the development of groundwater banking projects in areas that have geologic conditions conducive to groundwater recharge and recovery.

3. **Prevent Further Land Subsidence.** Prevent further land subsidence that can cause a reduction in groundwater storage space and damage water delivery infrastructure through efficient use of groundwater supplies and full utilization of surface supplies.

4. **Prevent Groundwater Degradation.** Prevent groundwater degradation by protecting groundwater through proper well construction and abandonment, proper use of agricultural amendments, importing clean high quality surface water, and preventing intrusion of poor quality groundwater from neighboring areas.

5. **Maintain Good Groundwater Quality for Agricultural Irrigation.** Maintain suitable groundwater quality for agricultural irrigation according to published guidelines for crops grown in the District.

6. **Increase Knowledge of Local Geology and Hydrogeology.** Increase knowledge of the local geology and hydrogeology through technical studies, subsurface investigations, water quality testing, water level monitoring, and land subsidence monitoring. Gain a better understanding of regional groundwater quality, groundwater overdraft, and groundwater flow conditions. Seek funding for these investigations through State and Federal grant programs.

7. **Solidify District's Claim to Local Groundwater Management.** Solidify the District's position and authority as the manager of the local groundwater, provide better representation for the District growers on groundwater issues, and develop

a relationship with the State that fosters local assistance and decision-making to assist in promulgating state goals and objectives.

Existing Activities

- All existing and on-going activities described in Sections 4-9 will be maintained, unless stated otherwise. (In Sections 4-9 the Existing Activities are not repeated under Planned Actions, even though they will be continued in the future).

Planned Actions

- All new policies and projects described in Sections 4-9 will be pursued, but their implementation will be subject to available funding and staff time.
- Manage local groundwater resources with an emphasis on meeting the GMPs Basin Management Objectives.

4 - STAKEHOLDER INVOLVEMENT

4.1 - Groundwater Advisory Committee

A Groundwater Advisory Committee (GAC) was formed in 2009 to assist with the development of this GMP. The GAC is comprised of the District Manager, District Engineer and TID Board of Directors. The TID Board of Directors is comprised of local farmers and represents the local community. They are familiar with the local and regional water issues and are best suited to serve as the primary voice on the GAC. However, no members of the general public have presently expressed any interest in serving on the GAC, although with an indication of interest in the future public members may be added by the Board. The GAC offered several useful and insightful comments that were incorporated into this GMP. The GAC will also monitor and evaluate the technical progress made in achieving the goals of this GMP.

Existing Activities

Assisted with the development of this GMP.

Planned Actions

The Committee will attempt to hold special groundwater sessions at regular Board meetings once each year, or more frequently if deemed appropriate, and said Committee will have the following responsibilities:

- Review trends in groundwater levels and available information on groundwater quality.
- Evaluate the effectiveness of current groundwater management policies, programs and facilities.
- Discuss the need for new groundwater supply/enhancement facilities.
- Determine the sufficiency of revenue sources to fund the District's conjunctive use operations.
- Educate landowners on groundwater management issues.
- Assess the overall progress in implementing the programs outlined in the GMP.
- Recommend updates or amendments to the GMP.
- Identify regional and multi-party groundwater projects.
- Review and comment on the Annual Groundwater Report.
- If needed, form special committees or task forces to undertake special groundwater management tasks.

4.2 - Relationships with Other Agencies

The District is located in the Kaweah groundwater sub-basin, which extends beyond many political boundaries and includes other municipalities, irrigation districts, water districts, private water companies, and individual water users (see **Attachments 2 and 3**). This emphasizes the importance of inter-agency cooperation, and the District has

historically made efforts to work conjunctively with many other water management agencies.

Below is a list of some agencies that the District has and is working with in managing the local groundwater:

- Kaweah Delta Water Conservation District
- Consolidated Peoples Ditch Company/Farmers Ditch Company
- Member Units of the Friant Water Authority
- Friant Water Users Authority
- United States Bureau of Reclamation
- California Department of Water Resources
- Association of California Water Agencies
- City of Tulare
- City of Visalia
- Southern San Joaquin Valley Water Quality Coalition
- County of Tulare
- Kaweah River Basin IRWMP
- Tulare County

A description of each agency and their role in managing groundwater within TID is provided below.

Kaweah Delta Water Conservation District

The Kaweah Delta Water Conservation District was formed in 1927 under provisions of the Water Conservation District Act of 1927 for the purpose of conserving and storing waters of the Kaweah River and for conserving and protecting the underground waters of the Kaweah Delta. The District includes lands in both Tulare County and Kings County (see **Attachment 8**). The total area of the District is approximately 340,000 acres.

KDWCD's Plan Area contains multiple local agencies that provide various types of water services. Those local agencies have been included as stakeholders through the execution of a (MOU). Signatories to this stakeholder MOU are as listed below:

- California Water Service Company
- City of Farmersville
- City of Lindsay
- City of Tulare
- City of Visalia
- City of Woodlake
- Consolidated Peoples Ditch Company
- Kings County Water District

- Lakeside Ditch Company
- Lakeside Irrigation Water District
- St. Johns Water District
- Stone Coral Irrigation District
- Ivanhoe Irrigation District

TID also prepared a special MOU (the "Overlap MOU") with KDWCD regarding groundwater management in areas where their two GMPs overlap (see **Appendix B**). TID has cooperated with the KDWCD on many projects, including the KDWCD GMP (see Section 1.6), KDWCD Numerical Groundwater Model (see Section 9.2), and the Kaweah River Basin IRWMP (in process). TID also meets with KDWCD on a regular basis to discuss their respective groundwater management objectives as called for in the MOU.. TID has worked with KDWCD on numerous occasions to maximize the importation of surplus CVP water into the Kaweah sub-basin.

Ditch Companies

TID developed an exchange agreement with Consolidated Peoples and Farmers Ditch Companies which provides for delivery of imported water thereto in exchange for Kaweah water in storage in Lake Kaweah. Such exchanges are planned at times when more diversion capacity for imported CVP water is needed beyond what TID may have available. This practice in accordance with the agreement allows for the maximization of imported surface supplies into the basin.

Member Units of the Friant Water Authority

The Friant Water Authority is a joint powers authority comprised of 22 member districts located in Fresno, Tulare, and Kern Counties. In addition to its primary mission of operating and maintaining the Friant-Kern Canal, FWA also addresses various water supply, financial, legislative, legal and other policy issues on behalf of its members. As a member of FWA, TID is often involved in water management projects which involve transfer and exchange arrangements with other FWA members. TID's goal in such arrangements is to increase the net deliveries of imported water into the District.

Friant Water Users Authority

The Friant Water Users Authority is a joint powers authority that has member districts in Madera, Fresno, Tulare, and Kern Counties. The FWUA is staffed by employees of the Friant Water Authority under an agreement between the two organizations. FWUA is maintained to work on projects and legal matters that preceded the formation of the Friant Water Authority. The FWUA is further charged in working with USBR and others in advancing the needs of its members with respect to maximizing the availability of CVP water deliveries to the Friant Service area, much of which is in a state of overdraft.

USBR/DWR

TID currently participates in the Semi-annual Groundwater Measurement Program administered by the USBR. This program requires TID to take water level measurements from specified wells two times a year and share the data with USBR. USBR then shares this data with the DWR. TID has also historically applied for and received grants from the DWR and USBR that fund water management studies and construction of water infrastructure.

Association of California Water Agencies

TID is an active member of the Association of California Water Agencies. ACWA fosters cooperation among all interest groups concerned with stewardship of the State's water resources. TID staff attends the ACWA semi-annual meetings, selected committee meetings, and benefits from the educational and informational services that ACWA offers.

City of Tulare

In May 2005, the District and the City of Tulare renewed a long-standing agreement which provides for the City's use of certain District-owned canal and ditch facilities for disposing of storm drainage, payments by the City in-lieu of District assessments, a process to develop joint policies related to impacts of new urban development on District facilities, and also to consider and enter into various joint projects of mutual benefit. The outcome of this agreement was evaluating various joint projects and the eventual development of a water importation agreement to maximize groundwater levels in and around the City. The "City Groundwater Augmentation Program" was developed by the City/District Joint Operations Committee in early 2006. This program outlines the basis for District/City cooperation, the groundwater recharge locations, the water sources, fee collection mechanisms, and the fund accounting to carry out programs purposes. The District prepares an annual report for the City to document the accomplishments of the program in accordance with the agreement.

City of Visalia

TID is holding discussions with the City of Visalia on groundwater recharge projects and the use of City wastewater effluent for crop irrigation in exchange for an expansion of TID's conjunctive use operations in ways to benefit the City.

Southern San Joaquin Valley Water Quality Coalition

TID is a member of the Southern San Joaquin Valley Water Quality Coalition (Coalition) through their association with the Kaweah and St. Johns River Association. The Coalition encompasses the entire Tulare Lake Basin (4.4 million acres) and is comprised of four sub watershed groups (Kings, Kaweah, Tule and Kern). TID is a member of the Kaweah River sub watershed group. The Coalition is organized under a MOU, adopted in 2002, to jointly and cooperatively address water quality issues. The

Coalition monitors surface water (irrigation and storm water) and prepares annual reports.

Tulare County
TID stays apprised of water issues with the County of Tulare through the Tulare County Water Commission. The Water Commission serves as an advisory body to the Tulare County Board of Supervisors. The Commission is made up of local water experts including engineers, water district managers, elected officials and community activists. The Commission meets monthly to discuss regional water issues. TID is indirectly represented through a member belonging to KDWCD. TID staff is actively engaged in the Water Resources Committee of the Water Commission.

Kaweah River Basin IRWMP
TID is a member of the Integrated Regional Water Management Plan for the Kaweah River Basin. The IRWMP is a collaborative process among a number of public entities, non-profit groups and other stakeholders to identify, formulate and advocate surface and groundwater projects for the region. TID intends to coordinate its proposed groundwater management projects within this overall effort to seek grant and loan funds from DWR.

Existing Activities

- On-going agreements, cooperative programs and projects with other agencies as mentioned above.
- Continued involvement in the development of the Kaweah Groundwater Basin Integrated Regional Water Management Plan that is being led by Kaweah Delta Water Conservation District.

Planned Actions

- Implement multi-agency projects identified in the Kaweah River Basin IRWMP that will benefit TID and the region's groundwater resources.
- Implement projects funded as part of the Water Management Goal of the San Joaquin River Restoration Settlement. These are expected to include groundwater recharge projects with 50% funding provided by the Federal government.

4.3 - Plan to Involve the Public and Other Agencies

The District is already involved with many neighboring and regional agencies on groundwater management projects. Nevertheless, TID is always interested in building new relationships with other agencies that share the same groundwater basins. TID will also strive to involve the public in groundwater management decisions. Additional cooperative relationships can be achieved through the sharing of data, inter-agency committees, interagency meetings, memorandums of understandings, formal agreements, and collaborations on groundwater projects.

Existing Activities

- Conducted public hearings to discuss the content of this GMP prior to its adoption.

Planned Actions

- Hold annual Groundwater Advisory Committee meetings that are open to the public.
- Provide copies of the annual groundwater reports to the public at their request. Notify the public of the availability of the annual reports on the TID website and District newsletter.
- Publish information on groundwater management accomplishments on the TID website and quarterly newsletter.

5 - MONITORING PROGRAM

Optimal use of the groundwater resource is dependent on obtaining good basic data respecting both geology and hydrology. The purpose of this element of the Program is to characterize the conditions within the groundwater basin, both to document the accomplishments of the Management Program and to identify and implement specific programs, as needed, to reflect changing conditions in the basin.

This section discusses monitoring of groundwater levels, groundwater quality, land surface subsidence, and surface water. Monitoring is considered critical to future management decisions, and the District's monitoring program is intended to:

1. Provide warning of potential future problems.
2. Use data gathered to generate information for water resources evaluations.
3. Develop meaningful long-term trends in groundwater characteristics.
4. Provide data comparable from place to place in the District.

5.1 - Groundwater Level Monitoring

The District began routinely measuring groundwater levels in the late 1940's. The District now measures groundwater levels in about 100 wells each spring and fall. **Attachment 6** illustrates the location of private wells that are monitored by TID. **Attachment 12** includes a list of attributes for these wells. TID plans to collect more detailed well attribute information (such as well depth, screened interval, type of well, precise coordinates, etc.) in the future, if landowners are willing to share the data with the District. Pending the availability of grant funding, TID plans to install dedicated piezometer wells to better determine depth to groundwater in both the unconfined and confined (below the E-Clay) zones.

Groundwater Level Data

TID maintains the groundwater level data in a spreadsheet database. Electronic data is available as far back as the 1940's in some wells. Occasionally, TID has used the data to generate groundwater contour maps. TID plans to prepare annual groundwater reports documenting groundwater levels, groundwater contour maps, well hydrographs, and change in groundwater storage. Refer to Section 9.3 for more detail on these reports. An annual report is currently being prepared as referenced in Section 4.2 for submittal to the City of Tulare to document localized groundwater recharge accomplishments.

Sharing of Groundwater Level Data

TID currently participates in the Semi-annual Groundwater Measurement Program administered by the USBR. This program requires TID to take water level measurements from specified wells two times a year and share the data with USBR. In

compliance with SB7X-6, the District intends to comply with state requirements to furnish groundwater level data to DWR under the provisions prescribed therein.

KDWCD Monitoring

KDWCD performs groundwater level monitoring on a regional scale. KDWCD has an extensive monitoring network that was initially established in the 1950's. This network has been maintained and improved in a continuing effort to provide reliable information for annual and long-term assessment of groundwater conditions. The KDWCD prepares semi-annual maps of groundwater depth, groundwater elevations, and annual change in groundwater depth. This data is useful to TID for assessing groundwater inflow and outflow, and assessing the health of regional groundwater supplies. The groundwater contour maps use a lower density well network than TID uses, and therefore TID still sees value in generating their own groundwater contour maps.

Existing Activities

- Measurement of groundwater levels each spring and fall.
- Review regional groundwater contour maps and hydrographs prepared by KDWCD each year.

Planned Actions

- Periodically review the monitoring network to determine if it provides sufficient aerial coverage to evaluate groundwater levels.
- Protect wells in monitoring program from being abandoned.
- Encourage landowners and developers to convert unused wells to monitoring wells. Inform them through the District website and newsletter that their abandoned well could be useful to TID.
- Install data loggers in a select number of wells to collect groundwater level data more frequently than twice a year.
- Collect more detailed information on the attributes of each monitoring well.
- Determine the perforated interval for each monitoring well so the groundwater level in confined and unconfined aquifers can be differentiated.
- Prepare annual groundwater reports, which will include detailed evaluations of groundwater level trends and estimated changes in groundwater storage (see Section 9.3).
- Maintain at least the same number of wells in the monitoring network by constructing monitoring wells, or adding new private wells to the network, when existing wells are taken out of the monitoring network due to lack of landowner cooperation or well failure.
- Coordinate data collection with the City of Tulare to better integrate trends in depths to water under the City boundaries and outer agricultural areas.
- Seek grant funds to install dedicated monitoring wells, including nested wells that measure groundwater levels above and below the Corcoran Clay.

- Convert groundwater well data and associated contouring efforts from a computer-aided drafting process to a Geographic Information System process.

5.2 - Groundwater Quality Monitoring

Groundwater quality monitoring is an important aspect of groundwater management in TID. Groundwater monitoring efforts serve the following purposes:

1) Spatially characterize water quality according to soils, geology (above and below the Corcoran Clay), surface water quality, and land use.
2) Establish a baseline for future monitoring.
3) Work with the City of Tulare with respect to its assessment of water quality for potable use purposes and its abilities in meeting federal and state requirements.
4) Compare constituent levels at a specific well over time (i.e. years and decades).
5) Determine the extent of groundwater quality problems in specific areas.
6) Identify groundwater quality protection and enhancement needs.
7) Determine water treatment needs.
8) Identify impacts of recharge and banking projects on water quality.
9) Identify suitable crop types that are compatible with the water characteristics.
10) Monitor the migration of contaminant plumes.

The District has only performed limited groundwater quality monitoring in the past, and has relied on private landowners and other agencies for groundwater quality data. As there are very few water quality concerns in the District, this approach has generally provided adequate information to monitor and manage the groundwater quality. Furthermore, the groundwater quality in TID has generally been of good quality for irrigation, so extensive monitoring does not appear to be necessary. A discussion on groundwater quality monitoring by the District, landowners, and other agencies is provided below.

TID Monitoring

TID currently collects groundwater samples each year on about five agricultural wells. The landowners have given TID permission to collect samples and review the test results, but have requested that the information be kept confidential. An effort is made to sample different wells on a year-to-year basis and resample the same wells after 5 years for a comparison analysis. In addition, the District will begin to measure electrical conductivity in a larger number of wells each year to serve as a general long-term indicator of groundwater quality. If TID develops a groundwater bank in the future, they may perform detailed monitoring in the vicinity of the bank.

Landowner Monitoring

Many landowners test the water quality of their domestic and irrigation wells on a regular basis. Some landowners will provide the test results to TID, however, the

results are proprietary, and the landowners typically ask that TID use the data for their information only and not release it to the general public.

Other Agency Monitoring
Numerous other agencies play important roles in the monitoring and maintenance of groundwater quality. These agencies include the Regional Water Quality Control Board, state and federal Environmental Protection Agency, Department of Toxic Substances Control, Tulare County Environmental Health Department, USGS, State Water Resources Control Board, City of Tulare, and neighboring irrigation and water districts. TID makes an effort to collect and review pertinent water quality data published by these agencies. The Tulare County Environmental Health Department is currently developing a Groundwater Data Management System, which will help to consolidate much of the data into a single database.

Existing Activities

- Test the groundwater quality in a select number of agricultural wells each year.
- Regularly collect new water quality information from other agencies and review it to identify any impending groundwater quality problems from an agricultural standpoint.

Planned Actions

- Protect wells in monitoring program from being abandoned.
- Measure electrical conductivity at all monitoring wells every five years in conjunction with groundwater management plan updates.
- Assess the adequacy of the groundwater quality monitoring network annually.
- Install dedicated nested monitoring wells, with the ability to sample groundwater above and below the Corcoran Clay.

5.3 - Groundwater Monitoring Protocols

Monitoring protocols are necessary to ensure consistency in monitoring efforts and are required for monitoring evaluations to be valid. Consistency should be reflected in factors such as location of sample points, sampling procedures, testing procedures, and the time of year when the samples were taken. Without such common ground, comparisons between reports must be carefully considered and used with considerable caution. Consequently, uniform data gathering procedures are practiced by the District. The District has developed new water level and water quality monitoring protocols, which can be found in **Appendix C**. These protocols will be cross-referenced against any monitoring guidelines promulgated by DWR as called for in SB7X-6.

Existing Activities
None

Planned Actions

- Use the District's new protocols when performing groundwater level and groundwater quality monitoring.
- Perform annual calibration of water level sounder devices or confirmation of tape measurement elevation reference points.

5.4 - Surface Water Monitoring

Several minor surface streams pass through TID including Cameron Creek, Packwood Creek and Deep Creek. TID also uses surface water from sources that originate and flow through other areas, namely the San Joaquin River and Kaweah River. Detailed monitoring of these water supplies is performed by other agencies.

San Joaquin River. San Joaquin River Water is stored in Millerton Lake and impounded behind Friant Dam. The USBR operates Friant Dam and monitors water releases, reservoir levels, and water quality. San Joaquin River Water is made available to TID from the Friant-Kern Canal, which is operated by the FWA. FWA monitors flow rates in the Friant-Kern Canal, diversions to TID and others, and canal water quality.

Kaweah River. Kaweah River water is monitored by the Kaweah & St. Johns River Association. The KSJRA monitors river flows, river stage, deliveries to TID, and water quality.

Due to the efforts of these other agencies, TID has not had a need to monitor the quality of their surface water sources. However, TID regularly reviews the data and monitoring reports prepared by FWA, USBR and the KSJRA with the primary goals of understanding the long-term hydrology and water availability, and monitoring changes in water quality that could affect crop irrigation or groundwater quality.

Existing Activities

- Regularly review hydrologic and water quality data for the San Joaquin and Kaweah Rivers.
- Cooperate with the Southern San Joaquin Valley Water Quality Coalition in monitoring surface waters.

Planned Actions

- Monitor changes to surface water quality that could directly affect groundwater quality.

5.5 - Land Surface Subsidence Monitoring

Subsidence in the San Joaquin Valley has been characterized as the largest human alteration of the earth's surface. The reason behind this statement comes from inelastic land surface subsidence that has occurred principally from aquifer-system compaction.

The lowering of groundwater levels through sustained groundwater overdraft causes this type of subsidence. The impact to groundwater from such subsidence is the reduction in available aquifer storage capacity caused by the compaction of soil void space that retains groundwater. Studies performed by the DWR and the USGS have identified an area of subsidence in the western portion of the District that correlates with the Corcoran Clay. The magnitude of subsidence within this portion of the District was on the order of four feet for a study period extending from 1926 to 1970 (USGS Professional Paper 437-H).

In addition, Lofgren and Klausing (1969) reported that:

> *"Intensive pumping of groundwater has caused more than 800 square miles of irrigable land to subside in the Tulare-Wasco area. In the southeastern part of the Tulare-Wasco area [in the Tulare ID area], subsidence was arrested in the late fifties, when water levels recovered as much as 130 feet in response to reduced pumping and increased recharge resulting from importation of water through the Friant-Kern Canal."*

Studies performed since these findings have revealed a dramatic decrease in the rate of subsidence. It is likely that some of the land subsidence has been arrested with the importation of large volumes of surface water since the 1950's.

A return to higher groundwater pumping rates could result in land subsidence across a broad area, result in aquifer compaction and irrecoverable loss of storage capacity, and cause adverse effects to surface features such as canals, flood control systems, and water supply pipelines which rely on gravity flow.

Currently, land subsidence does not appear to be a major problem in TID. TID staff and landowners have not observed any obvious signs of subsidence to irrigation facilities and structures. However, as access to surface water rights are reduced and demand from groundwater grows commensurately, there is a real threat of a return to major land subsidence. If subsidence is occurring, then some unstoppable residual subsidence will continue to occur for several years. Lands within the District will be observed for land subsidence, and, if land subsidence becomes a problem, this Plan will be amended to include preventative and mitigative measures.

Existing Activities
None

Planned Actions

- Periodic resurvey of control points, local benchmarks, water control structures and wells to check for land subsidence. The control points and local benchmarks will be checked relative to High Precision Geodetic Network benchmarks.
- Participate in any regional efforts to monitor and evaluate land subsidence.
- Pursue funding to construct and operate an extensometer within the District boundary.
- Educate local growers on the potential for land subsidence and visual indicators of possible subsidence.
- Review published information by others such as the DWR, USBR and CalTrans on local subsidence findings.

6 - GROUNDWATER RESOURCES PROTECTION

6.1 - Well Abandonment

Proper destruction of abandoned wells is necessary to protect groundwater resources and public safety. Abandoned or improperly destroyed wells can result in contamination from surface sources, or undesired mixing of water of different chemical qualities from different strata. This is especially important in TID because part of the District has a confined aquifer, and there may be some isolated perched aquifers.

The administration of a well construction, abandonment and destruction program has been delegated to the counties by the state legislature. Many counties have adopted a permitting program consistent with Department of Water Resources Bulletin 74-81 for well construction, abandonment, and destruction.

The County of Tulare has adopted a Well Ordinance that addresses well destruction and establishes requirements for destroying or abandoning wells. The ordinance has provisions which stipulate that impairment of the quality of water within the well or groundwater encountered by the well is not allowed. Those wells that are defective require correction of the defective conditions or destruction of the well. In all cases, the primary responsibility for remedying defective or abandoned wells falls on the landowner and in those cases of non-compliance, the County has the authority to take necessary action to abate unsatisfactory conditions.

The District will properly abandon their own wells when they are no longer useful. In addition, the District will encourage landowners and developers to properly abandon their own wells, or preferably, convert unusable wells to monitor wells so that they can become a part of the District's groundwater monitoring program.

Before abandoned wells are converted to monitoring wells they will be evaluated for suitability, including their condition, depth, peroration interval, etc.

Existing Activities

None

Planned Actions

- When no longer in use, destroy any District owned wells according to County and State standards.
- Educate landowners, through the District website and newsletter, on well abandonment standards, and that abandoned wells could be useful to TID as monitoring wells.
- When possible, convert unusable production wells to monitoring wells.

- Meet with the County of Tulare to discuss a partnership whereby TID would be informed of any landowner that has filed a permit to abandon a well, so TID can ask them if the well can be converted into a monitoring well.

6.2 - Wellhead Protection

Need for Wellhead Protection

Contaminants from the surface can enter an improperly designed or constructed well along the outside edge of the well casing or directly through openings in the well head. A well is also the direct supply source to the customer, and such contaminants entering the well could then be pumped out and discharged directly into the distribution system. Therefore, essential to any wellhead protection program are proper well design, construction, and site grading to prevent intrusion of contaminants into the well from surface sources.

Furthermore, since wells can be a direct conduit to the aquifer, they must be properly destroyed and abandoned or they will provide an unimpaired route for pollutants to enter the groundwater, particularly if pumping equipment is removed from the well and the casing is left uncapped. Well Abandonment is discussed in Section 6.1.

In the past, wells were commonly contaminated from chemigation systems that allowed the chemicals to flow back into the pump column. This potential contamination can be reduced by installing a check valve on all piping systems that include a chemigation system.

Wellhead Protection Policy

Any wells constructed by the District will be designed and constructed in accordance with DWR Bulletins 74-81 and 74-90 and Tulare County standards. In addition, the District will encourage landowners to follow the same standards for privately owned wells. The DWR bulletins and County standards provide specifications for the following:

- Methods for sealing the well from intrusion of surface contaminants.
- Covering or protecting the boring at the end of each day from potential pollution sources or vandalism.
- Site grading to assure drainage is away from the well head.
- Set-back requirements from known pollution sources.

Wellhead Protection Area

As defined in the Federal Safe Drinking Water Act Amendments of 1986, a wellhead protection area is "the surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field." The WHPA may also be the recharge area that provides the water to a well or well field. Unlike surface

watersheds that can be easily determined from topography, WHPAs can vary in size and shape depending on geology, pumping rates, and well construction. Private agricultural wells are randomly and fairly closely spaced throughout the District. The District encourages growers to treat land within 200 feet of any well as a wellhead protection area.

Existing Activities
None

Planned Actions

- Provide wellhead protection on all newly constructed TID wells according to County and State standards.
- Through landowner education efforts (newsletters, website, meetings, etc.) encourage local growers to incorporate proper wellhead protection into all new wells, and retrofit old wells with proper wellhead protection.

6.3 - Saline Water Intrusion

Salt accumulation in surface water and groundwater in the Central Valley is a natural process inherent to lands with semi-arid to arid climates, enclosed basins, or reduced or impeded drainage. Salt accumulation in surface water and groundwater can impact and eventually eliminate most beneficial uses. Salt accumulation can be exacerbated by a wide variety of human activities including irrigation, importation of surface water, application of fertilizer (including manure and biosolids) and pesticides, land disposal of wastes including those from food processing facilities, wineries, municipal wastewater treatment plants, discharge of urban storm water runoff, and use of recycled wastewater. Groundwater inflow of saline water is also a problem in some regions of the Central Valley.

Currently, there are no known saline groundwater problems in TID. The District will review available water quality data on a periodic basis. Should saline intrusion become a problem in the future, a GMP amendment will be prepared to address the issue. Currently, the District strives to prevent the importation of saline surface waters that could ultimately degrade the groundwater. When alternative water sources are available for importation, the District considers not only the cost but also the quality, including salinity, of the water. The District will evaluate all possible alternatives, and, when practical and feasible, select water sources with low levels of salinity that will not substantially degrade their soils or groundwater.

Existing Activities

- Review available water quality data to identify areas with the potential for saline water intrusion.

Planned Actions

- Map and track the progression of any saline water bodies in the District which may be identified in the future.

6.4 - Migration of Contaminated Groundwater

Groundwater contamination can be human induced or caused by naturally occurring processes and chemicals. Human induced sources of groundwater contamination can include irrigation, confined animal facilities, improper application of agricultural chemicals, septic tanks, industrial sources, storm water runoff, and disposal sites.

The groundwater quality in TID has been good for agricultural irrigation. However, there are areas of concern in TID and in neighboring agencies. These areas include dairies, milk processing plants, Medford Field Airport, and the City of Tulare Wastewater Treatment Plant. The District will continue to review groundwater quality data from other sources and remain cognizant of the possibility of contaminated groundwater migration into TID. However, the management and remediation of contaminant plumes generally falls under the responsibility of other agencies such as the Tulare County Environmental Health Department, California Regional Water Quality Control Board, California Environmental Protection Agency and the U.S. Environmental Protection Agency. The degree to which each agency participates depends on the nature and magnitude of the problem.

Existing Activities

- Regularly review data and reports from regulatory agencies on contaminant plumes to provide warning of potential future problems.

Planned Actions

- Seek to locate recharge basins next to areas with water quality problems to blend water supplies and create a hydraulic barrier to impede movement of contaminant plumes.
- Collect and consolidate maps from other agencies identifying the contaminant plumes in the District.
- If necessary, alter groundwater pumping patterns to change the hydraulic gradient and reduce contaminant migration, or reduce the pumping of contaminated groundwater.

6.5 - Groundwater Quality Protection

The District's surface water supplies cannot fully support the crop demand within the District, and therefore some groundwater will always be necessary. The groundwater, however, will have limited or no use if it has poor quality. Therefore, protecting the quality of the groundwater is a cardinal component of this GMP. Groundwater quality can be protected through proper use of pesticides, herbicides

and fertilizers, storm water quality management, septic system management, and water vulnerability planning and management. Some of these tasks are the responsibility of cities and communities, but TID will support their efforts whenever possible.

Existing Activities

- Cooperate with water quality monitoring as a member of the Southern San Joaquin Valley Water Quality Coalition.
- Discussions with the County of Tulare on water quality issues that are identified by the County within the District or in the area.
- Review of information made public by the County of Tulare Water Commission.
- Educate growers on the proper use of pesticides, herbicides and fertilizers in the District newsletter.

Planned Actions

- Seek funding to improve security at TID water facilities (i.e. wells, recharge basins, etc.) and reduce the potential for contamination from acts of vandalism or terrorism.
- Follow State and Tulare County well construction standards for wellhead protection to protect groundwater quality.

7 - GROUNDWATER SUSTAINABILITY

On average, groundwater comprises about 25-50% of the water used in TID, but can comprise up to 100% of water supplies in an extreme drought. During years with low surface water allocations, groundwater is essential to prevent the loss of permanent crops and agricultural businesses. Groundwater is the most dependable water supply for the District's growers and the local domestic water users. Therefore, preserving the sustainability of groundwater is essential for the economic well being of the District and its growers.

A decline in groundwater levels reduces groundwater reserves, increases pumping lifts, and could require deepening or abandonment of wells. Therefore, maintaining stable groundwater levels is a high priority for TID.

7.1 - Issues Impacting Groundwater Sustainability

Issues of concern for groundwater sustainability in TID are discussed below:

San Joaquin River Settlement. Friant Division CVP supplies have been recently curtailed due to the Settlement Agreement of Natural Resources Defense Council v. Rodgers on the San Joaquin River. Based on the Agreement, Friant Division water contractors will be impacted by about 200,000 AF per year. One estimate shows that deliveries to TID would be reduced by an average of 1,800 AF/year of Class I water and 12,600 AF/year of Class II water and 4,300 AF/year of surplus water on the system (Section 215). However, total losses could be as high as 32,000 AF/year in some years. This would represent about 20% of the District's average surface water supplies. Interim releases to the river began in 2009, with full restoration flows potentially beginning in 2014. TID has a goal of fully recovering the lost contract supplies, primarily through conservation and groundwater conjunctive-use recharge projects, as well as Water Management Goal provisions as called for in the Settlement.

Surface Storage. Millerton Lake provides the primary surface storage element for the Friant Unit of the CVP. The District is capable of storing some of its allocated CVP entitlement behind Friant Dam at Millerton Lake, but this storage is subject to the flood operations criteria of the facility and the management of USBR, and TID can only store water for a limited period. In addition, Millerton Lake lacks sufficient carry-over storage capacity to balance the wet and dry year needs for conservation storage. Similarly, Lake Kaweah, which stores Kaweah River water behind Terminus Dam, has similar limitations and could benefit from expanded storage.

Delta Pumping Restrictions. Due to problems with the California Delta smelt, there have been incremental reductions over time in export pumping allowed from the Delta, which is affecting numerous water users throughout the San Joaquin Valley. Cross

Valley Canal water users in the area of TID may be impacted. This loss of surface water is being offset in part by increased groundwater pumping from the common groundwater basin. The first priority for Delta exports is to meet the demands of the lower San Joaquin River Exchange Contractors (EC). These entities receive Delta export supplies in trade for their river water right supplies to be dedicated to the Friant system as delivered from Millerton Lake. Should the Delta exchange supply be limited, USBR will likely call on Millerton water to meet the EC demands. This has never happened in the 60 plus years of Friant operations; however, with the Delta export constraints that currently in place, there is a chance that the Friant contractors could loose some of their imported supplies, which will result in further adverse impacts to groundwater conditions as the lost surface supply will likely be offset by increased pumping.

Drought and Groundwater Level Declines. Depths to groundwater within the District have continued to increase over the last several years. Not being deep enough to reach lowered water levels, many local wells have gone dry over the last two years. With another year or more of drought, more wells can be expected to go dry in the future. Additional conservation and groundwater recharge projects are essential to maintain the District's groundwater resources so that they are as reliable as possible during times of drought and reduced surface water availability.

Cropping Patterns. In recent years, the District has experienced a significant shift in cropped acreage. Plantings are more often double cropped than in the past so the general understanding is that the average annual agricultural demand within the District has been increasing.

Population Growth. The San Joaquin Valley is one of the fastest growing regions in California. Although TID primarily provides agricultural water, significant population growth will increase water demands and tensions over limited water supplies in the region.

System Optimization Review Study. To address water supply sustainability, in 2009 TID sought funding to perform a System Optimization Review study. Funding was awarded by the USBR in August 2009. The SOR Study will evaluate: (1) the District's historic surface diversion versus the District's currently-available supplies, (2) the existing capacity of the District's surface water source diversion and end user delivery system, (3) the District's historic and current agricultural demands, (4) the estimated amount of agricultural and municipal groundwater pumped versus the estimated safe yield, (5) potential groundwater recharge or banking projects near the District's delivery system and (6) new projects or programs to address specific limiting issues identified through the SOR through preliminary design, estimated yield and project cost estimates. The SOR will also develop a strategic plan to address the pressing issues the District

faces of the next several years. The overall goal of the SOR is to address the aforementioned issues regarding water supply sustainability in TID, and develop a plan and vision for the future to address these problems.

7.2 - Overdraft Mitigation

Groundwater overdraft has been a concern since the early 1900's, and was one of the reasons the District sought a CVP contract for surface water. The District's groundwater levels are sensitive to drought conditions and significant declines have been observed during prolonged droughts. Moreover, the District is concerned that reductions in surface water supplies as a result of the San Joaquin River Restoration plan may lead to greater groundwater overdraft.

Groundwater recharge can help reduce overdraft and is discussed in Section 7.3. The following groundwater management practices and policies are also followed to help reduce groundwater overdraft:

Limitations on Pumping

The California Water Code gives local agencies with an adopted GMP the power to limit or suspend groundwater extractions. However, such limits can only be implemented if the District determines through study and investigation that groundwater replenishment programs, or other alternative sources of water supply, have proved insufficient or infeasible to lessen impacts to groundwater. In the unlikely event that it becomes necessary to reduce groundwater extractions, the District intends to accomplish such reductions under a voluntary program, which would include suitable incentives to compensate users for reducing their groundwater pumping. Generally, only as a last resort will the District restrict or interfere with any landowner or water user exercising a valid property right to pump and utilize groundwater.

Limitations on the Exportation of Water Supplies

The District generally does not support groundwater pumping for export out of the District unless it involves a transfer or exchange of water that will not reduce the total water supply available to the District. In addition, the District usually opposes surface water transfers that are accompanied with increased groundwater pumping used to replace the transferred surface water. Exceptions could apply to growers that own land on both the TID border and just outside of the border, since they will be using the groundwater in the vicinity of TID and in the same groundwater basin. Other groundwater exports will be reviewed on a case-by-case basis and will be permitted if they are approved by the Board of Directors. Under some circumstances, an exchange involving a net loss in water may be considered. This could occur, for instance, if TID exchanges poor quality water for good quality water, or if TID exchanges floodwater for dry year water.

The KSJRA has also adopted a policy that forbids the exportation of groundwater that results in a net loss to KSJRA's total water supplies. The KSJRA Board of Directors has the authority to institute any measures proposed to prevent such net loss in the furtherance of this policy.

Water Transfers

Under certain conditions (for example, during wet years), the District has facilities that transfer/convey surface water to other San Joaquin Valley areas. Conversely, the District has been the recipient of wet-year water from neighboring areas. Water exchanges, in various forms, are also a part of the District's conjunctive use portfolio. Groundwater benefits can accrue to the District through such arrangements.

In critically-dry years, the District has had insufficient surface water supplies available to make efficient delivery thereof for irrigation because of excessive seepage losses. Arrangements have been made in recent critically-dry years, through exchange agreements, to deliver this water to other agencies (primarily other Friant contractors) for their immediate use. In exchange, the District may be paid back in additional water, generally during "normal" years, historically at ratios of up to four to one, i.e., the District receives four acre-feet for every acre-foot so exchanged. The District may also be paid back monetarily, an such additional funds are placed in a groundwater replenishment reserve funds and are later used to purchase water in wet years at a reduced cost. These transfers benefit both parties and in particular provide significant volumes of water, either directly or indirectly, for direct or in-lieu recharge within TID.

Economic Inducements

The District recognizes that management of water supplies should reflect water conservation and the protection of groundwater resources. The District currently provides an indirect economic inducement by establishing water rates high enough to promote water conservation yet low enough to compete with groundwater pumping costs. This pricing system encourages the use of surface water to meet irrigation demands when available, thereby preserving the underlying groundwater resource.

In addition, the Code provides those agencies with an adopted GMP the ability to tax or otherwise place fees or assessments to cover the cost of groundwater management activities or for groundwater extractions. However, such taxing ability cannot be imposed unless brought to a landowner vote. Like extraction restrictions, this step is to be considered only as a last resort in the overall management of groundwater in the District.

Existing Activities

- Restrict groundwater exports from the District.

- Set surface water sale rates to remain competitive with groundwater pumping costs.
- Continued development of the McKay Point Reservoir Project to provide off-stream storage for surplus river system water to provide the District with additional in-lieu recharge capabilities.

Planned Actions

- Develop a water marketing plan to sell surplus waters to other water agencies and entities within the same groundwater basin. The program will outline the basis for evaluating the effectiveness of the District's existing water marketing commitments in light of other available opportunities.
- Periodically, such as every 5 years, perform a hydrologic balance to estimate the amount of groundwater overdraft, if any.
- Evaluate annual groundwater contour maps for evidence of pumping well interference from neighboring agencies.
- Establish groundwater banking goals (total storage capacity and annual recovery capacity) as part of a Systems Optimization Review (SOR) study.
- Distribute awarded Drought Relief grant funds from USBR to growers within the District for groundwater well projects.

7.3 - Groundwater Replenishment

Replenishment of groundwater underlying the District occurs both naturally and through deliberate, controlled means (artificial). The various forms of groundwater replenishment in TID are discussed below:

Groundwater Inflow to District Area. In general, a characteristic regional northeast to southwest pattern of groundwater flow occurred during the 1980's and 1990's. Areas of pumpage depressions are persistently present north of Corcoran, west of Visalia, and northwest of Exeter. Groundwater also flows into TID from the Tule River area into the southern portion of TID. Fugro (2007) estimated groundwater inflow and outflow in Hydrologic Unit No. 5 to average 22,200 AF/year and 16,200 AF/year, respectively, during the period 1981 through 1999. This equates to a net groundwater inflow of 22,200 – 16,200 = 6,000 AF/year.

Deep percolation from precipitation. The WRI Report (Fugro, 2007) estimates that deep percolation from precipitation in TID averages about 20,600 AF/year (0.3 feet/acre).

Artificial recharge. The District operates 11 groundwater recharge basins located throughout the District. These basins are show on **Attachment 7** and listed in **Table 7.1** below.

Table 7.1 - Groundwater Recharge Basins

Basin Name	T, R and Sec	Area (acres)
Abercrombie	20 24 23	20
Anderson	20 23 6	167
Creamline	19 25 20	153
Doris	21 23 6	21
Enterprise	19 24 29	20
Guinn	19 23 30	162
Tagus	19 24 15	120
Watte	20 23 34	19
KDWCD #3	19 23 22	155
KDWCD #6	19 23 35	155
KDWCD #8	20 23 10	118
	Total	1,110

The WRI Report (2007) estimated recharge basin deliveries in TID to range from 0 to 141,000 AF/year, with an average of 30,000 AF/year. TID also has an agreement to allow KDWCD to recharge water in these basins when they are not being used by TID.

The individual recharge capacities in each basin are currently unknown. The District is in the process of implementing a program to measure inflows and infiltration rates to determine the rates of recharge.

Groundwater banking. TID does not currently operate groundwater banks in their service area. Although the purpose of groundwater banks is to store and later recover water, groundwater banking can result in some long-term groundwater replenishment. Water that is recovered from groundwater banks serves as in-lieu groundwater recharge, by providing a dry-year water supply that would normally be obtained from groundwater. Also, groundwater banking agreements often require that a portion of the banked water, e.g. 10%, be left in the aquifer as a payment to the banking agency (i.e. TID) to account for unavoidable losses and groundwater migration. In addition, often some water that is banked is for various reasons never recovered.

The City of Tulare and the District jointly developed a "City Groundwater Augmentation Program" in early 2006. This program was developed through the understanding that the City of Tulare depends on groundwater resources for all its municipal supplies and wanted to assist the District to bring as much surplus surface water into the area as possible. The mutual goal in this endeavor is to make the shared groundwater resources as reliable as possible. Generally the program sets up an arrangement for the

City to fund surplus water procurement by the District that is conveyed to recharge facilities in areas beneficial to the City's groundwater recovery wells.

In an outgrowth of the joint program, the District and the City of Tulare entered into an agreement in 2007 providing for the joint purchase of property known as the "Plum Property," for the purpose of developing such property for groundwater, recharge and surface water regulation. This purchase agreement between the two entities establishes joint rights in the Plum Property and the mutual intent to develop the property into a water recharge/regulation facility. After execution of the agreement the property was successfully purchased. The 154 acre project will include three basins and associated control structures. The project will allow for a long-term average recharge of about 3,700 AF/year.

In May 2008 the City of Tulare and TID signed an agreement regarding the delivery of water to groundwater banking facilities (**Appendix D**). In this agreement the parties determined where recharge would occur under their on-going program, to continue the joint operations committee which evaluates projects of mutual benefit, and evaluate the development of additional groundwater recharge facilities. The agreement also provides guidelines for determining the average annual quantity of water delivered by TID to the City. This quantity was initially 10,000 AF/year, but will vary depending on the area of the City, City groundwater pumping, and the cost of imported surplus water supplies available to the District. The delivery of TID water to City basins will directly benefit City wells, and indirectly benefit TID by reducing stress on the local groundwater supply.

In-lieu deliveries. The District views in-lieu deliveries as a practical and effective means of groundwater replenishment. In-lieu deliveries, also called indirect deliveries, involve the delivery of surface water to landowners and water users who would otherwise have pumped groundwater, thus leaving water in the aquifer for future use. With the diversion of around 100,000 AF of surface water annually which is sold to District water users (CH2MHill, 2000), TID is performing a significant amount of in-lieu recharge.

TID plays a significant role in importing water and providing in-lieu deliveries in the area, primarily because TID has extensive water rights that they attempt to fully utilize each year. In comparison, other districts in the area have less surface water rights, and must rely more on groundwater to meet their irrigation water needs.

Streambed infiltration. Three creeks flow into TID, namely Cameron Creek, Packwood Creek and Deep Creek. These creeks operate more as irrigation conveyance facilities than natural creeks and have, in certain reaches, each been modified and realigned over the years. Little to no seepage from natural creek flow

occurs. There is some seepage from storm water inflows which are directed under agreements into such creeks. Seepage from irrigation flows is discussed below under 'Seepage from distribution facilities'.

Deep percolation from irrigation. Deep percolation occurs when some of the water applied for irrigation percolates beyond the crop root zone and accumulates in the aquifer. The extent of deep percolation varies with the irrigation method, irrigation efficiency, and antecedent moisture condition. The WRI Report (2007) estimated that deep percolation from irrigation in TID averages 44,400 AF/year.

Seepage from distribution facilities. Collectively, the District owns and operates approximately 300 miles of earthen canal and approximately 30 miles of pipeline. The unlined canals cover approximately 450 acres. The average transport loss through the District's system is estimated to be 60,000 to 70,000 AF per year. This is a large percentage of the District's average available surface water supply; however, this "loss" provides recharge to the common underground basin supply both up-gradient of and within the District, from which TID water users later pump for on-farm irrigation. This loss averages about 40 percent of total diversions and consists of a 10 percent loss largely in the unlined canals and ditches providing service to TID water users. The District has worked with regional partners to be financially reimbursed in part for these losses as they are considered significant groundwater recharge through the region.

Existing Activities

- Groundwater recharge in eleven existing recharge basins.
- Construction of new multi-purpose basin behind the new TID office location.
- Construction of a new multi-purpose basin at Mooney's Grove in cooperation with Tulare County.
- Feasibility evaluation of a potential groundwater banking project with several other Kaweah River districts at Rancho de Kaweah.
- Allow KDWCD to use TID recharge facilities when they are available.
- Measure the volume of water delivered to groundwater recharge basins.
- Periodically remove sediment and rip the soils in recharge basins to maintain infiltration rates.
- Maintain existing unlined canals in an unlined condition in those locations where it is determined that canal seepage is a significant source of recharge and does not create detrimental side effects.
- Regular meetings with the City of Tulare regarding the City Groundwater Augmentation Program, the joint Plum Basin project, and other on-going cooperative efforts.
- Discussions with the City of Visalia on scenarios where recharge can be facilitated in the local creeks in above average water years.

- Evaluate potential arrangements and projects with existing and potential partners to cooperatively improve groundwater recharge within the District.
- Continue practice of acknowledging seepage through Main Intake Canal as a benefit to the regional area in return for financial reimbursement from KDWCD.
- Apply for grants or participate in grant applications in conjunction with partners to construct new groundwater monitoring wells within the District and the surrounding area.
- Apply for grants or participate in grant applications with partners to improve the operation of groundwater recharge basins or the development of new basins.
- Work with regional partners (both Kaweah River water rights holders and Friant Unit CVP) to acquire available excess surface waters to recharge within the District boundaries when recharge capacity in the District's basins is available.

Planned Actions

- Procure lands for more groundwater recharge basins when property is available and is affordable to the District at market value.
- Investigate the feasibility of constructing additional recharge basin capacity on the western end of the District.
- Monitor the rates of infiltration in basins, natural channels and ditches, and, when feasible use the facility that offers the greatest recharge rate in order to maximize recharge potential.
- Produce a Five Year Strategic Plan for TID that addresses water policy, surface water supply, groundwater resources, groundwater banking, water exchanges, District staffing, and establishes short-term and long-term water management goals.
- Evaluate potential groundwater banking opportunities for the District and for others to improve groundwater conditions within the District.
- Work cooperatively to minimize development on lands that are favorable for artificial recharge.
- Develop and maintain an inventory of sites in the District that are suitable for recharge.
- Estimate the infiltration rate in each basin by monitoring inflows, outflows and water levels.

7.4 - Conjunctive Use of Water Resources

Conjunctive use of water is defined as the coordinated use of both subsurface and surface water sources so that the combination will result in optimum water supplies. Groundwater management in California is rooted in the conjunctive use of surface and groundwater resources. In this regard, the District has two primary sources of surface water supply; local Kaweah River water through water right holdings and imported CVP water (originating in Millerton Lake on the San Joaquin River) under a long-term contract with the USBR. Also, the District has short-term and year-to-year

arrangements to secure additional CVP and Kaweah River supplies. Kaweah River waters and groundwater have been conjunctively utilized within the District since the early 1900s. In 1950, the District integrated CVP water into its conjunctive use operations. Necessarily, the District operates an extensive system of conveyance, distribution and recharge facilities throughout its service area to make use of the surface supplies as available.

The District's conjunctive use program includes surface water delivery in lieu of groundwater pumping, groundwater recharge, and, when practical, transfers to neighboring areas sharing a common groundwater supply. These are discussed below:

Surface Water Deliveries. The District delivers surface water to District growers through an extensive distribution system. The surface water is a form of in-lieu groundwater recharge, since it reduces the volume of groundwater pumped. TID strives to keep surface water rates low enough that growers choose to fully utilize surface water supplies before resorting to groundwater. Historically, TID has provided, on average, 50% of its surface water directly to District growers.

Groundwater Recharge. TID performs direct groundwater recharge in eleven recharge basins, and through seepage in earthen canals that are left unlined because of their recharge benefit. The amount of recharge varies each year with the availability of water. Having significant recharge capacity is important so that large volumes of water can be captured in wet years to recharge and later extracted by water users in dry years. Refer to Section 7.3 for more details on the Districts recharge facilities. TID desires to construct more recharge facilities and potentially some groundwater banking facilities in the future.

Water Transfers to Agencies within the Same Groundwater Basin. TID sometimes ends up with small amounts of water that cannot be beneficially delivered to growers given the seepage losses in the long delivery system to the District. Also in very wet years the District will have supplies in excess of agricultural demand within the District and available storage behind local reservoirs. With these water supplies TID regularly performs water transfers and exchanges with other water agencies. TID strives to keep any exported or excess water in their region so it benefits the local groundwater supply and groundwater migration out of the District. TID also selects local exchange partners because it can benefit the local economy. The priority of water transfer partners include: 1) neighboring agencies; 2) agencies in the same groundwater sub-basin, 3) agencies within Friant Unit service area; and 4) agencies in the Central Valley.

Existing Activities

- Support and facilitate the delivery of imported water supplies to neighboring agencies for the purposes of reducing groundwater migration out of the District.

- Work with all appropriate public agencies, private organizations, and individuals within and outside of the Plan area to protect existing surface water rights and supplies.
- Participation in Friant Water Authority water supply and managers meetings to facilitate the cooperative operation and efficient use of available resources within the Friant Unit CVP system.
- Participation in KDWCD water supply and board of directors meetings and KSJRA meetings to facilitate the cooperative operation and efficient use of available resources on the Kaweah and St. Johns rivers system.
- Explore additional partnerships with other districts and water supply entities to optimize the collective water assets of each for basin-wide benefits.
- Maintenance and operation of approximately 300 miles of earthen channel to deliver water throughout the District to sustain TID's ability to divert large quantities of water when available, particularly on short notice.

Planned Actions

- Support the development of new surface storage and other water supply projects that would permit the participants to better utilize surface water supplies.
- Investigate additional groundwater banking projects and facilities.
- Investigate additional groundwater recharge facilities and potential partner affiliations.

7.5 - Water Conservation and Education

The District considers water conservation and education important aspects of their overall groundwater management efforts. The District's Rules and Regulations (**Appendix E**) state the following in Rule 10: Waste of Water:

> *"Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land or who shall flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions will be refused the use of water until such conditions are remedied."*

In fact, most District growers use water in a responsible and efficient manner. Many of the District's growers conserve water through the use of highly efficient drip, micro-jet, and micro-sprinkler irrigation system technology. In addition, all water deliveries are measured and billed on a volumetric basis. Therefore, all customers have an incentive to minimize water usage. Despite all these water conservation achievements, TID still provides on-going water conservation education to its growers.

Since about 1993 the District has been submitting an annual Water Conservation Plan with associated updates to USBR in accordance with provisions of the Reclamation

Reform Act and CVP Improvement Act. This plan sets forth water efficiency targets and objectives and documents the District's progress towards their implementation. This plan has been accepted by the Agricultural Water Management Council, a DWR agency established to foster voluntary agricultural water conservation at the district level. The District is a member of the Council and participates in its meetings and workshops.

Existing Activities

- Monthly water statements include water use information for each customer. In addition, the District maintains historic water use by turnout. This data is available to water users on request as it could be beneficial in making on-farm water management decisions.
- The District participates in the KDWCD WRI Study and its updates to analyze the region's water balance and document changing conditions over time.
- The District is conducting a System Optimization Review of District operations, which will identify potential areas for water conservation.
- The District publishes a quarterly newsletter to, among other things, help educate local growers on important issues such as water conservation and water quality protection, as well as several informational articles on recently declining groundwater levels within the District.
- The District volunteers with local grade school classes making presentations on water resources and the importance of water conservation.
- The District is a member of the Association of California Water Agencies.
- The District is a member of the Agricultural Water Management Council.
- The District is positioned to administer up to $4 million in Natural Resources Conservation Service grant funding for the implementation of on-farm water use efficiency projects which should aid in reducing groundwater demands from TID growers.

Planned Actions

- Continue to educate growers on water conservation measures.
- Distribution of awarded Agricultural Water Enhancement Program grant funds from NRCS for on-farm water conservation projects within the District.

7.6 - Water Recycling

TID has held discussions with the cities of Tulare and Visalia on using municipal wastewater effluent for crop irrigation. According to the WRI Report (Fugro, 2007), the City of Tulare generated, on average, 3,900 AF/year of wastewater return flow between 1981 and 1999. The water is currently sent to evaporation ponds. Some farmers adjacent to the ponds use a portion of the water for crop irrigation, but none is delivered directly into the TID distribution system. The water is currently treated using a secondary level treatment process. TID would like to divert the water to its distribution system, but are reluctant to unless the water has received tertiary level treatment

(disinfection) due to concerns about contaminating edible crops and due to the required permitting involved in the arrangement. TID is also exploring a proposal to take delivery of wastewater effluent from the City of Visalia, but that water is likewise treated only to a secondary level. The City of Visalia would have the opportunity to improve treatment as part of a planned treatment plant expansion and is taking steps to implement tertiary treatment as part of its operations. In exchange for receipt of such treated water, TID is considering an expansion of its conjunctive use operations into areas up gradient of the City to enhance groundwater recharge in these areas.

Existing Activities

- Discussions with the Cities of Tulare and Visalia regarding the use of wastewater effluent for irrigation in TID.
  - Continued discussions with the City of Visalia regarding a potential water exchange agreement for tertiary treated waste water after the City's wastewater treatment expansion is completed.

Planned Actions

- Remain cognizant of opportunities to purchase recycled water from other local industrial facilities and municipalities.

8 - GROUNDWATER OPERATIONS

8.1 - Well Construction Policies

The District does not currently own any monitoring wells, but has recently acquired two irrigation wells on the jointly-owned Plum Basin property which are not connected to the District's conveyance system. The District may construct monitoring wells in the near future as part of a phased implementation of a dedicated groundwater monitoring well/piezometer network..

Proper well construction is important to ensure reliability, longevity, and protection of groundwater resources from contamination. DWR Bulletins 74-81 and 74-90 provide useful guidelines for the construction of groundwater wells. Proper wellhead protection is essential to ensure that contaminants do not inadvertently enter a well. Well construction policies that are intended to ensure proper wellhead protection are discussed in Section 6.2 – Wellhead Protection.

In addition, the District will follow the quality assurance procedures listed below when contracting for the construction of new District wells. Landowners are also encouraged to follow these procedures when constructing private wells:

1. Well construction will be performed under contract by a licensed and experienced well driller, in accordance with specifications prepared by a licensed engineer or geologist, and reviewed by legal counsel.
2. A licensed engineer or geologist will oversee construction of the wells.
3. A licensed land surveyor in the State of California will oversee a survey of any newly constructed wells to determine locations for mapping and groundwater depth purposes.

Existing Activities

- Educate landowners on the existing Tulare County well ordinance and State guidelines.

Planned Actions

- Construct wells according to DWR Bulletin 74-81 and 74-90, and Tulare County standards.
- Construct wells using qualified and licensed contractors, engineers, geologists and land surveyors.

8.2 - Operation of Facilities

Groundwater facilities in TID include production wells, monitoring wells, recharge basins, and the distribution system (see **Attachment 6 and 7**). The operation of each of these is discussed below.

Production Wells. The District does not currently own any production wells, but has recently acquired two irrigation wells on the Plum Basin property which are not connected to the District's conveyance system. All other production wells in the District are currently owned by private landowners or the City of Tulare, who are responsible for constructing, operating, maintaining and abandoning the wells.

Monitoring Wells. TID does not currently own any dedicated monitoring wells. Instead, the District has historically used private agricultural wells to monitor groundwater levels. Currently, the monitoring network includes about 100 wells. Groundwater levels are monitored each spring and fall. TID may construct dedicated monitoring wells in the future to fill gaps in their network, and monitor proposed groundwater banking and recharge facilities. TID would also like to construct nested monitoring wells to measure groundwater levels in the different aquifers.

Recharge Basins. TID currently operates eleven groundwater recharge basins. The basins are for the most part owned by KDWCD; however, by agreement TID maintains them. Regular inspection and maintenance of these basins is important to ensure they function properly and maintain good recharge rates.

Distribution System. TID's distribution system is sufficiently built out to cover the entire District service area and does not appear to need any significant expansion. As a result, TID can provide surface water to all parts of the District. Most of the canals in TID are unlined and seepage from the canals recharges the groundwater. TID generally plans to leave these canals unlined. TID has an agreement with KDWCD to be compensated for the imported water that seeps in the upstream diversion channels easterly of the District, and thus TID has no plans to line these upstream diversion channels.

Existing Activities

- Maintenance of recharge facilities including de-vegetation, discing, deep ripping, and de-silting, as necessary to improve recharge potential.
- Leave earthen canals unlined so they can be used for groundwater recharge.
- Expansion of SCADA system for better management and operation of basin facilities when water is being conveyed thereto.

Planned Actions

- When practical and beneficial, develop groundwater recharge facilities as multi-functional facilities that also serve other purposes such as urban storm water runoff, environmental enhancement, aesthetics, and groundwater banking.
  - Investigate partnership with local wildlife groups to see if common goals can be pursued through shared resources in efforts to develop additional recharge areas.

9 - GROUNDWATER PLANNING AND MANAGEMENT

9.1 - Land Use Planning

The intent of this Plan is not to dictate land-use planning policies, but rather to establish some land-use planning goals that can aid in protecting and preserving groundwater resources. TID does not have direct land-use planning authority. However, TID does have the opportunity to comment on environmental documents for land-use related activities and proposed developments as well as proposed Tulare County General Plans and updates. TID will attempt to work cooperatively with other agencies to minimize adverse impacts to groundwater supplies and quality as a result of proposed land-use changes. Some specific land-use planning goals include: (1) preserving areas with high groundwater recharge potential for recharge activities; (2) protecting areas sensitive to groundwater contamination; (3) requiring hydrogeologic investigations, water master plans, and proven and sustainable water supplies for all new developments; and (4) requiring appropriate mitigation for any adverse impacts that land use changes have on groundwater resources.

Existing Activities

- Notify residents and agencies of TID projects that have the potential to impact groundwater within their sphere of influence.
- When appropriate, comment on environmental documents and land-use plans that have the potential to impact groundwater.
- Provide input on City of Visalia, City of Tulare, and County of Tulare General Plans, particularly on issues that impact groundwater resources.
- Stay informed of changes to the City of Tulare's Sphere of Influence, annexations and de-annexations.

Planned Actions

None

9.2 - Numerical Groundwater Model

In 2005, utilizing a cooperative grant from the State Department of Water Resources, the KDWCD developed a groundwater model to calculate future changes in groundwater conditions that could occur based upon major influences such as changes in population growth, water supply and distribution. The model is able to calculate quantifiable changes to groundwater levels and flow conditions. This analytical tool can be applied to assess how existing and proposed groundwater management actions, changes in cultural practices, or changes in hydrologic conditions may influence groundwater sustainability. The knowledge gained from the model will be applied in the development and evaluation of new and existing programs. The expected result will be the progression of programs and policies that will efficiently use available resources to

affect the most beneficial influence to groundwater supplies.

Existing Activities

- Remain abreast of the uses of the groundwater model by local partners for planning purposes and KDWCD's efforts to periodically update the model and it's analysis of the region's groundwater.

Planned Actions

- When appropriate, use the numerical groundwater model to evaluate proposed projects and changes to current groundwater operations, and determine their net impact on groundwater conditions.

9.3 - Groundwater Reports

The District has a goal to prepare groundwater reports every year to document groundwater levels, available groundwater storage, historical trends, and other important groundwater related topics. As a supplement to such reports, TID intends to more explicitly document and disseminate its annual accomplishments in the area of conjunctive use operations and accompanying benefits to the regional groundwater supply. This information will be used to forecast future problems, plan future groundwater projects, and develop new groundwater policies. The annual report will cover the prior calendar year and will be completed each year by April 30th. See **Attachment 13** for a report outline.

Existing Activities

- TID prepares an Agricultural Water Management Plan every five years for the United States Bureau of Reclamation as a requirement to maintain their Central Valley Project water supply. The Water Management Plan focuses on surface water but includes sections on groundwater usage and groundwater projects.
- TID provides crop and groundwater level information to KDWCD for periodic evaluations of groundwater conditions and groundwater reports.
- TID prepares and provides the city of Tulare an annual report documenting its groundwater recharge operations of immediate benefit to the City groundwater supply. The report is prepared in accordance with a groundwater augmentation agreement executed by both agencies in 2008.

Planned Actions

Prepare an annual Groundwater Report that will include the following:

1. Groundwater level data.
2. Groundwater contour maps and groundwater flow directions.
3. Groundwater storage estimates.

4. Evaluation of one-year and five-year historical trends in groundwater levels, contours, and storage, and perceived reasons for any changes.
5. Estimates of deliveries to recharge basins.
6. Estimates of groundwater pumpage by private agricultural well owners based on estimated crop demand minus surface water deliveries.
7. Documentation of groundwater pumpage for municipal supply by the City of Tulare and other local mutual water companies.
8. Summary of important groundwater management actions.
9. Discussion on whether management actions are meeting the associated objectives.
10. Summary of proposed management actions for the future.
11. Summary of groundwater related actions taken by other regional groups.
12. Recommendations for changes in the content or format of the annual report.
13. Recommendations for updates to the GMP.

9.4 - Plan Implementation

Implementation of this updated GMP is expected to result in significant amounts of new knowledge and an achievable improvement in groundwater management in TID. **Attachment 14** includes an implementation schedule for this GMP from 2010-2016. The schedule does not include existing activities that will be continued. TID will maintain all existing programs unless stated otherwise in this GMP. In addition, the schedule does not include proposed actions that are new policies or guidelines, which will be implemented on a continuous basis. Rather, the schedule only includes new tasks and projects.

9.5 - Plan Re-evaluation

The GAC will be responsible for monitoring the progress in implementing the GMP objectives. Refer to Section 4.1 for more information on the membership, policies, and procedures of the Committee. The Committee will attempt to meet at least once a year to review and evaluate groundwater conditions as well as evaluate the effectiveness of the GMP. As new policies, practices, and ordinances become necessary or desirable to enhance the management of the District's groundwater supply, this Plan will be amended as necessary.

Existing Activities

None

Planned Actions

- Update the GMP at least every five years through a formal public process, or more frequently if a sufficient quantity of revisions, updates and additions have been identified.

- Evaluate the effectiveness of the GMP and need for an update at the annual Groundwater Advisory Committee meetings.
- Document recommendations for improving or updating the GMP in each annual Groundwater Report.

9.6 - Dispute Resolution

Groundwater disputes will probably require input from the District General Manager, and possibly an engineering consultant and District Counsel. In resolving these disputes several factors will be considered such as a landowner's right to extract groundwater, beneficial use of water resources, and, if applicable, restrictions on export of groundwater.

Groundwater disputes in TID can fall into three general categories: 1) Landowner versus Landowner; 2) TID versus Landowner; and 3) TID versus another agency.

Landowner versus Landowner

Disputes between landowners are not the responsibility of TID, however, when asked to, TID may choose to help resolve disputes as an impartial mediator. Such efforts are intended to maintain amicable relationships among landowners, educate landowners on groundwater management goals and policies, and avoid a court process which may lead to adjudication.

TID versus Landowner

Disputes with landowners are generally resolved using the general process outlined in the District's Rules and Regulations (**Appendix E**). These state the following under Rule 2: Ditchtenders and Other Employees:

> "*Each ditchtender shall have charge of his respective section and shall be responsible to the Superintendent. From the ditchtender's decision an appeal may be made to the Superintendent. From the Action of the Superintendent, appeal may be made to the Board of Directors*"

The District's current Rules and Regulations deal primarily with surface water; however, in furtherance of this GMP and the authorities contained therein, new rules may be promulgated which could lead to disputes related to groundwater extraction fees, pumping restrictions, and other groundwater issues involving landowners.

TID versus Another Agency

When TID faces a dispute with another agency the dispute will be resolved through the TID Board of Directors. If necessary, the District General Manager may also use legal counsel, technical staff, or technical consultants to assist in addressing any disputes.

If a dispute arises between TID and KDWCD or another district within KDWCD, then it will be handled according to the MOU between TID and KDWCD (**Appendix B**). The MOU discusses coordination of efforts, management of the overlap area, and dispute resolution procedures.

Existing Activities

- Resolve disputes through the District's general dispute resolution procedures.

Planned Actions

- Discuss issues of concern at the annual GAC meetings in an effort to prevent future disputes.

9.7 - Program Funding and Fees

Several alternatives are available to TID for funding groundwater projects, and are described below:

Water Replenishment Fees

Under AB255 and AB3030, local agencies have the authority to limit groundwater extractions and implement water replenishment fees based upon the amount of water extracted (extraction based fees must first be approved by majority vote of impacted landowners). Inherent in these powers is the authority to implement metering of private wells. These are considered measures of last resort and TID will make any and all efforts to ensure the private, non-metered use of groundwater by the local growers. However, if at some point the State were to take steps to initiate regulation or control over groundwater extractions, or if a legal adjudication of the basin pumping rights were to occur, then these fees may be unavoidable.

Capital Improvement Fees

The District has the authority to finance capital improvement projects and collect repayment charges from the benefited parties. This process would require a favorable vote from the constituency, and is considered a realistic alternative for large capital projects, such as groundwater recharge or banking projects.

Grants and Loans

The District will pursue available grants and low-interest loans from the DWR as well as other state and federal agencies like the Bureau of Reclamation. The District realizes that funding from state and federal agencies for groundwater projects will be partially based on their progress in implementing this GMP. Established programs from which grant funding has and may be sought in the future include the USBR Challenge Grant program, Part III funding from the San Joaquin River Settlement Act and the state's IRWMP program.

Other Revenue Sources

Groundwater projects can also be financed through water user fees and assessments that are collected regularly from all District landowners.

Exiting Activities

- Regularly research grant and loan opportunities from the state and federal government and apply for these opportunities when they appear advantageous to the District.
- On-going negotiations with the Bureau of Reclamation to convert its contract from a 9(e) to a 9(d) contract. This would require advance repayment of the District's remaining capital obligations. To raise this capital the District would likely sell bonds, which necessitate modifications to the existing assessments. The District would likely modify assessments by switching the facility repayment costs from water charges to land based assessments in an effort to reduce the interest rate associated with the necessary bond financing.

Planned Actions

- Identify beneficial groundwater projects that become economically feasible when costs are shared among two or more participants.
- Share information on funding opportunities with other agencies that may be potential partners in multi-agency groundwater projects.

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28. Tulare Irrigation District, *The Plum Basin Project, Water Marketing and Efficiency Grant Application*, May 2009.

29. United States Department of the Interior Bureau of Reclamation, *Factual Report – Tulare Irrigation District*, March 1949.

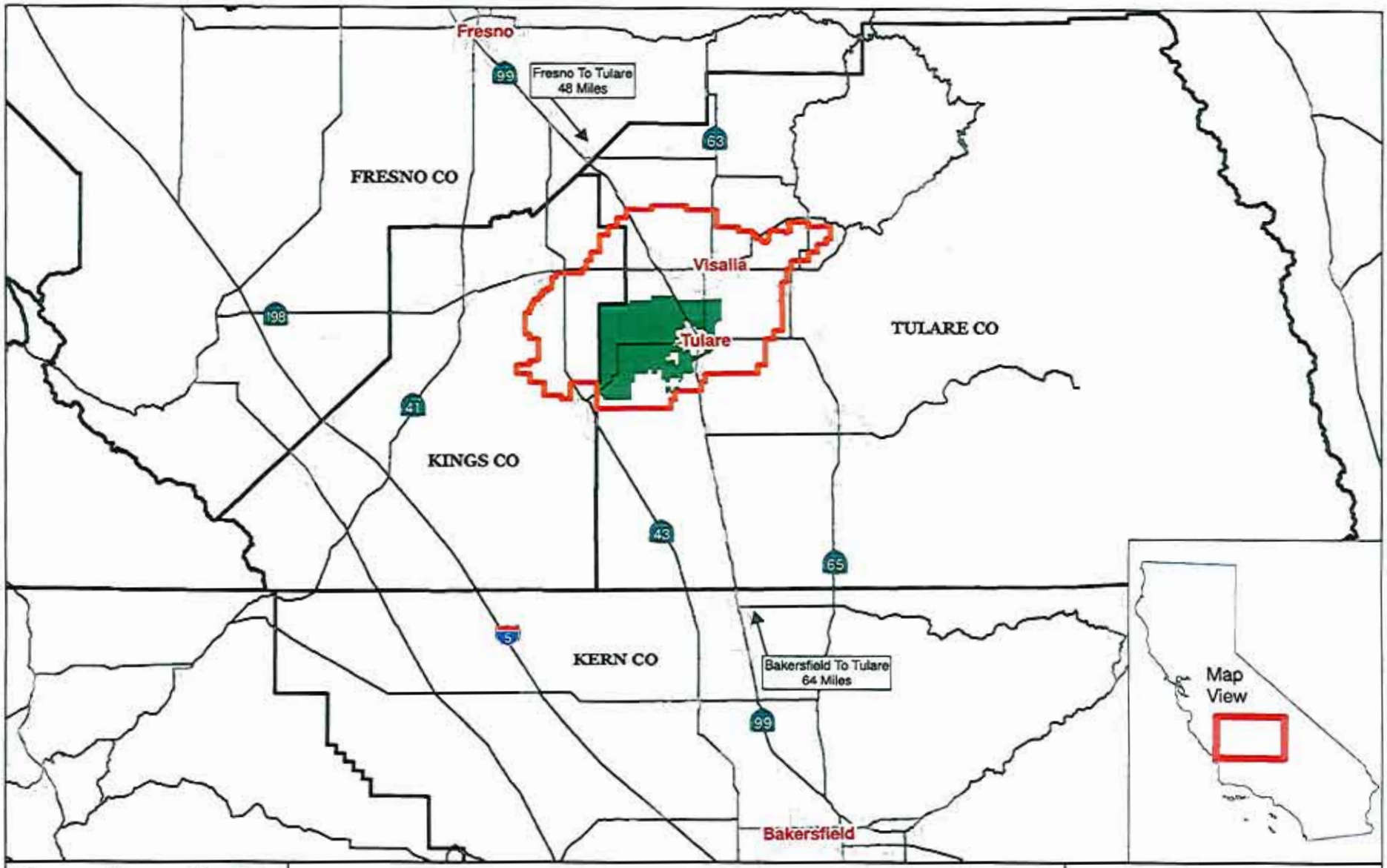
30. United States Department of the Interior Bureau of Reclamation, *Technical Studies in Support of Factual Report – Tulare Irrigation District*, February 1949.

31. URS, *Urban Water Management Plan 2005 – City of Tulare*, December 2007.

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

ATTACHMENTS



0 10 20
Miles

PROVOST& PRITCHARD
130 N. Garden Street
Visalia, CA 93291
(559) 636-5900

Legend

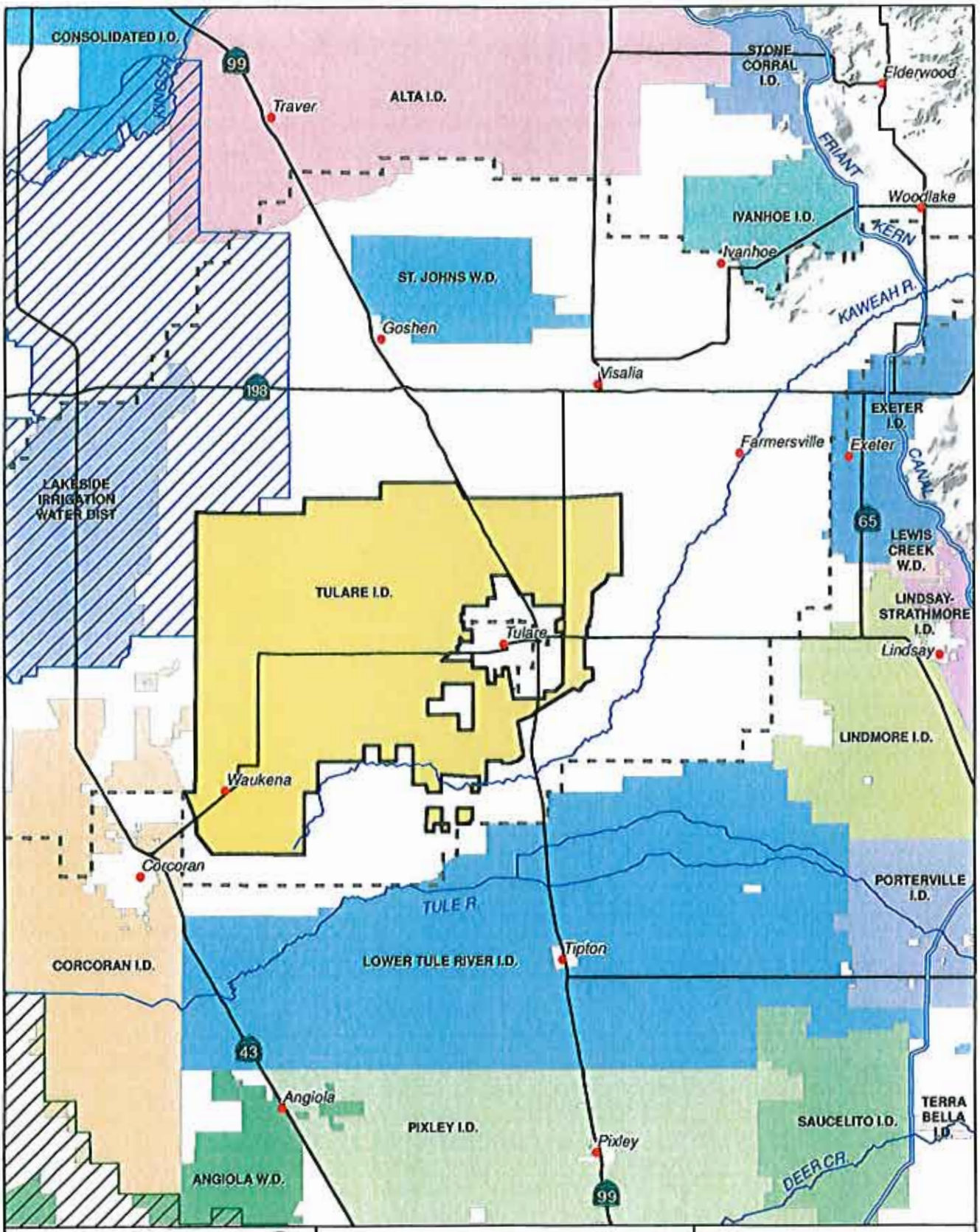
- Tulare ID
- Kaweah Delta WCD
- City
- County
- Major Road

Tulare Irrigation District

Attachment 1

Vicinity Map

11/24/2009 \\goose\vsl_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment1_Vicinity.mxd



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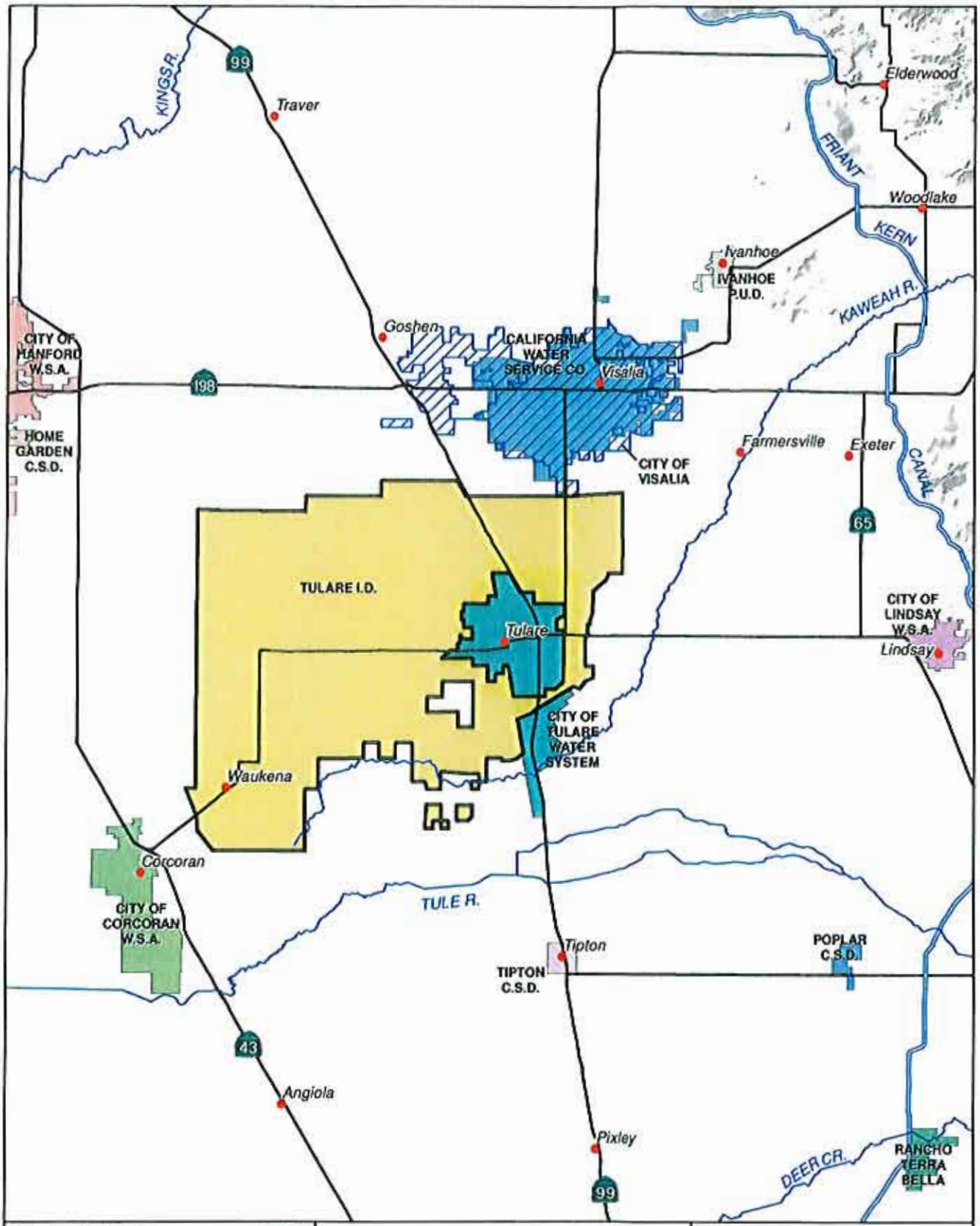

0 1 2 3 4 Miles

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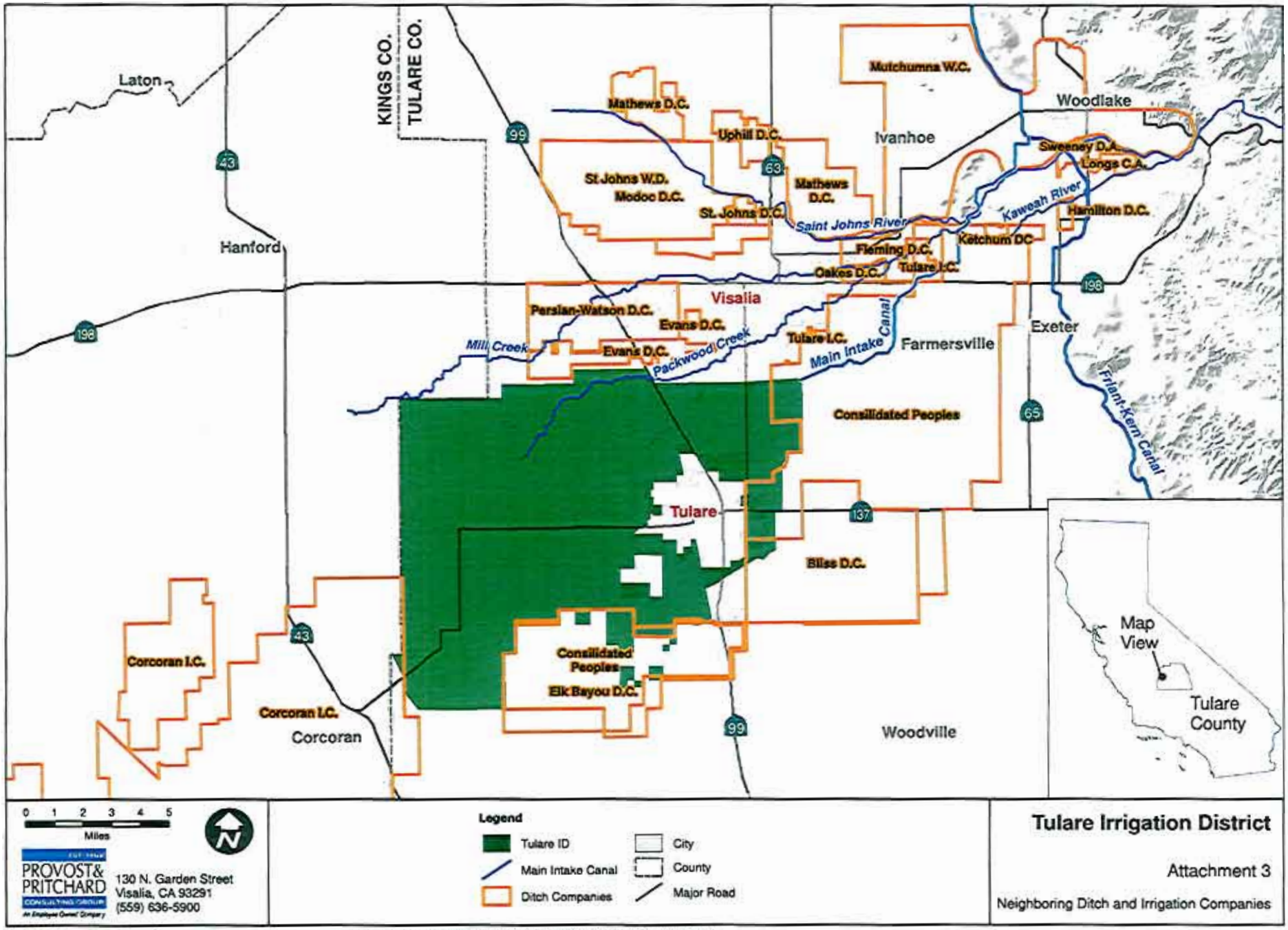
Tulare Irrigation District

Attachment 2b

Neighboring Municipal Water Delivery Districts

12/3/2009 \\goose\vsi_clients\Clients\Tulare ID-1245\124809V1-Update Groundwater Management Plan\GIS\Map Attachment2b_WaterAgenciesMunicipal.mxd



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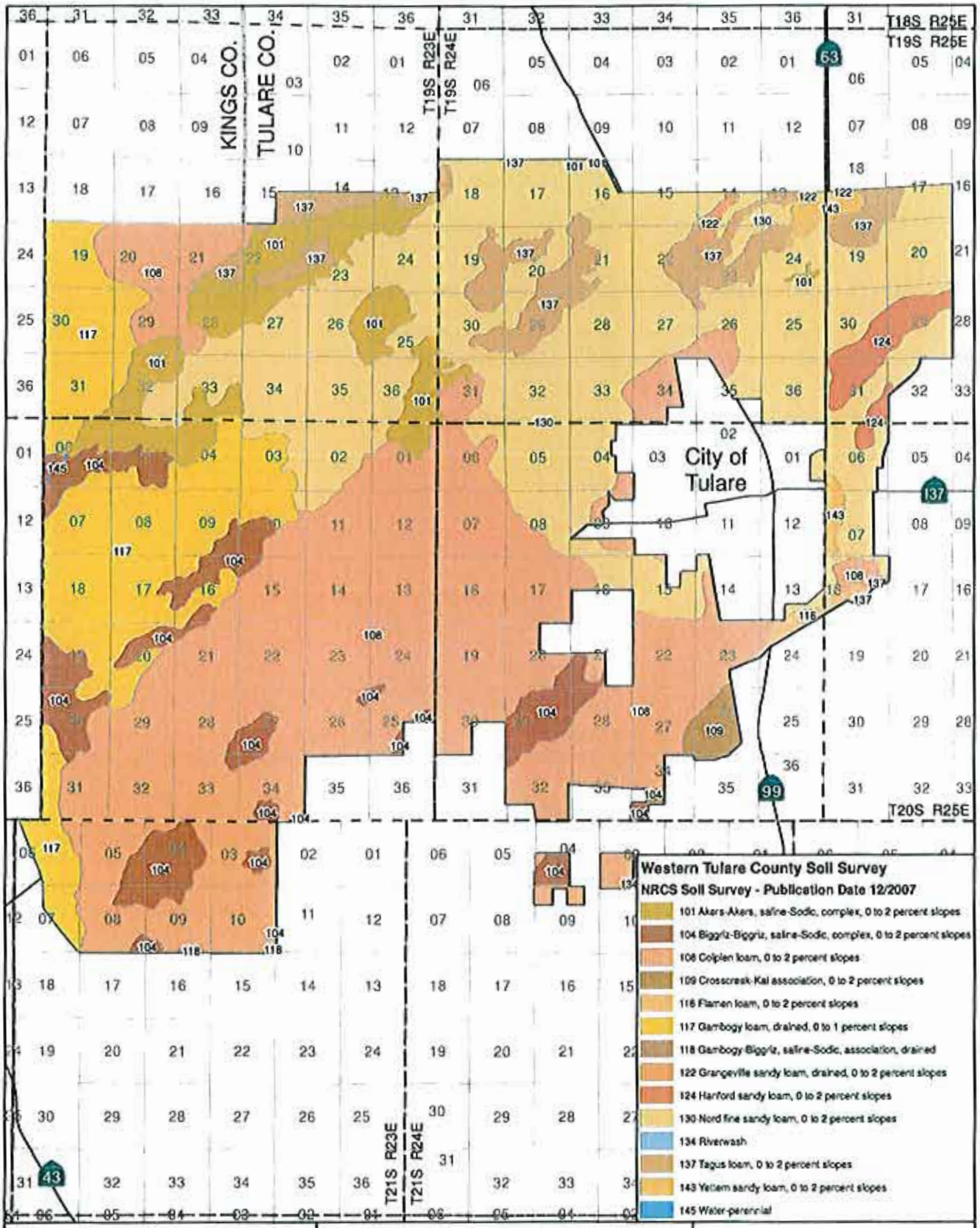

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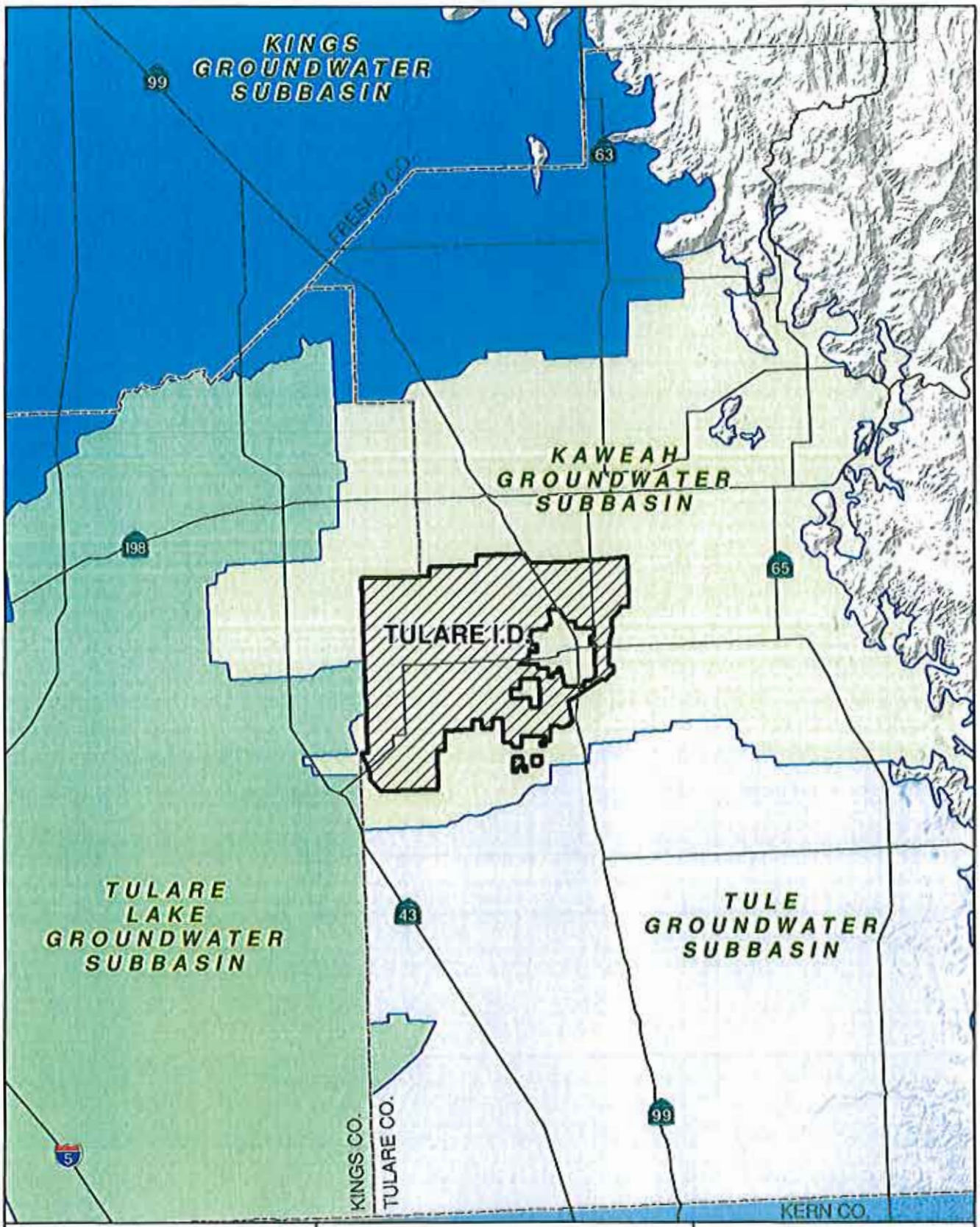
Tulare Irrigation District

Attachment 4

Soils

11/24/2009 \\goose\vsl_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment4_Soils.mxd



0 2 4 6 8 Miles

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Visalia, CA 93291
(559) 636-1166

Groundwater Sub Basin
DWR 118-80 (GIS Oct 2000)

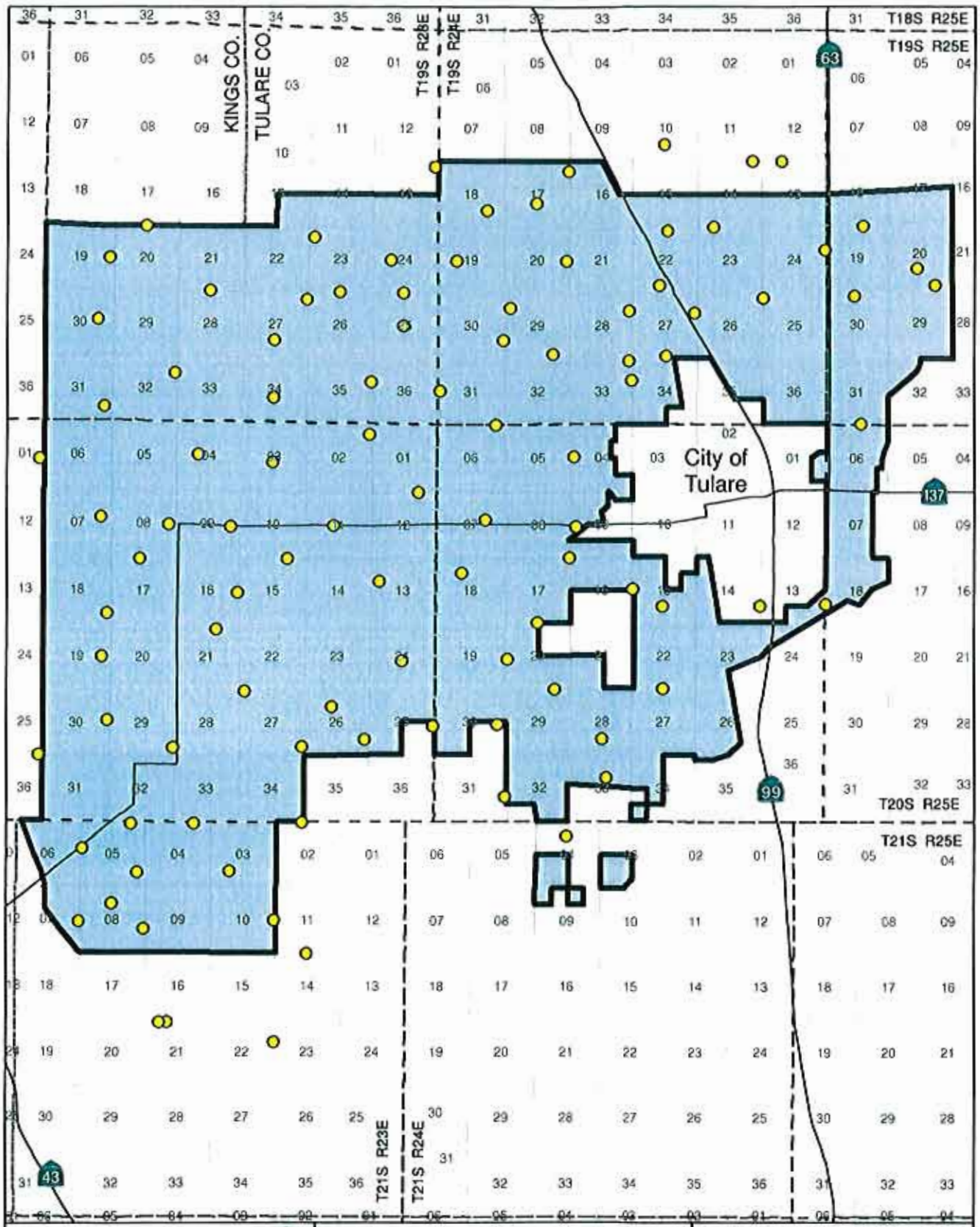
- KAWEAH
- KERN COUNTY
- KINGS
- TULARE LAKE
- TULE

Tulare Irrigation District

Attachment 5

Groundwater Sub Basins

11/24/2009 figoose/vol_clients\Clients\Tulare ID 1245\124609V1-Update Groundwater Management Plan\GIS\Map\Attachment5_GWBasins.mxd



0 1 2 3 Miles

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(559) 636-1166

Legend

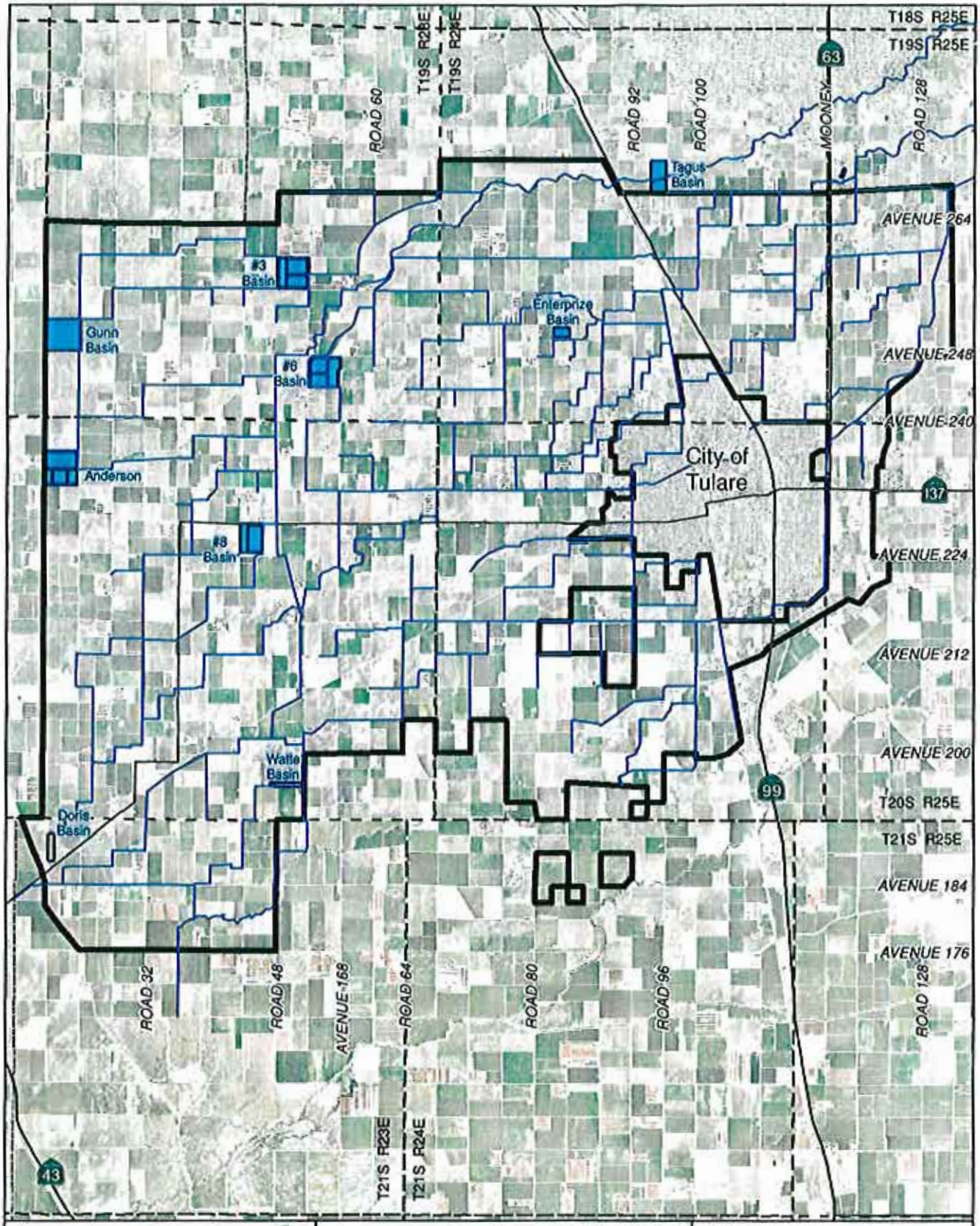
- Wells
- Tulare ID
- County
- Township / Range

Tulare Irrigation District

Attachment 6

Wells

11/30/2009 \\goose\vol_clients\Clients\Tulare ID-1248-124809\1-Update Groundwater Management Plan\GIS\Map\Attachment6_Wells.mxd



0 1 2 3 Miles

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Visalia, CA 93291
(559) 636-1166

Legend

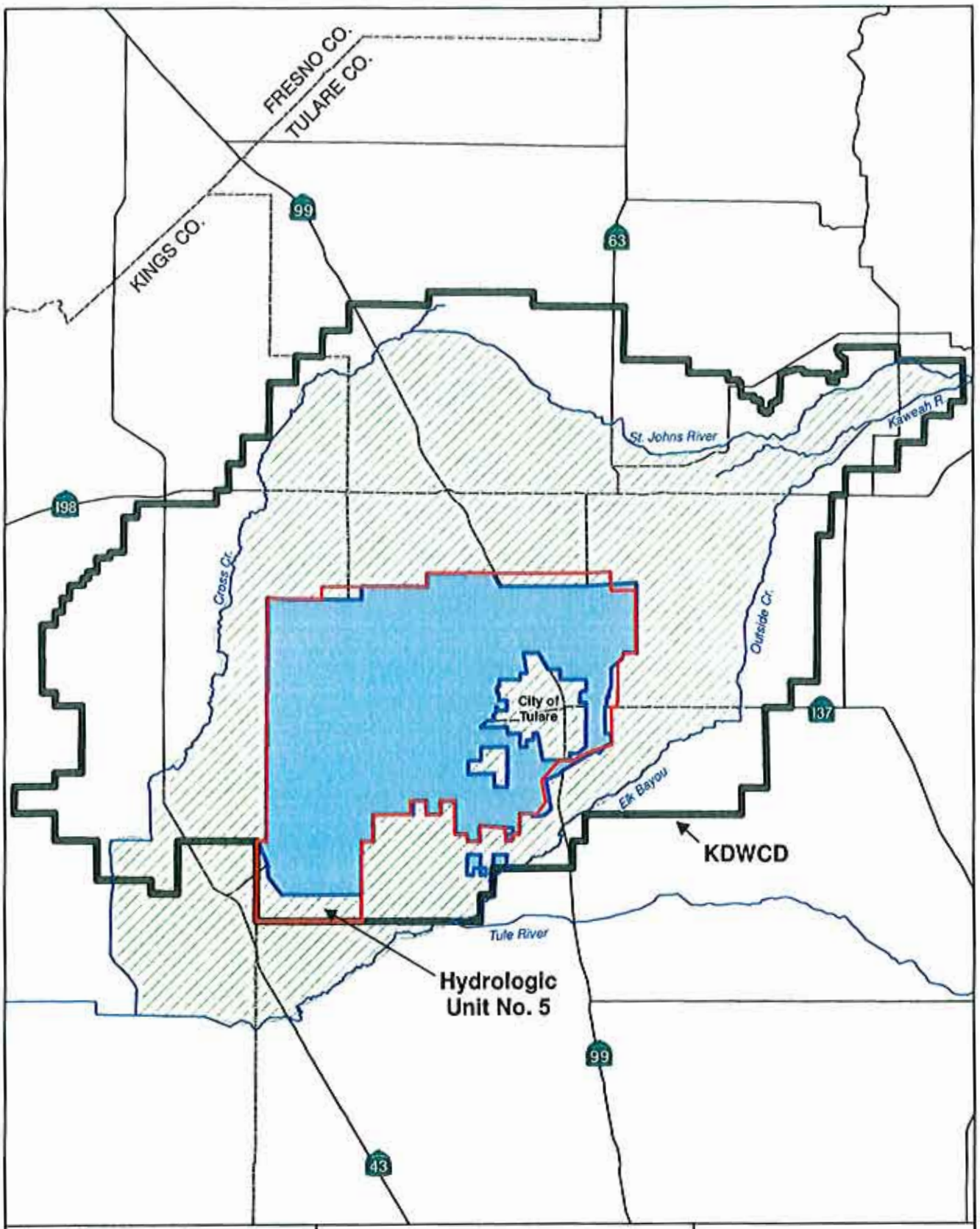
- Ditch / Stream
- Recharge Basin
- Tulare ID
- County
- Township / Range

Tulare Irrigation District

Attachment 7

Conveyance Facilities and Recharge Basins

11/24/2009 \\goose\vol_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment7_Facilities.mxd



0 2 4 6 Miles

PROVOST & PRITCHARD CONSULTING GROUP
EST. 1968
An Employee Owned Company

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Visalia, CA 93291
(559) 636-1166

Legend

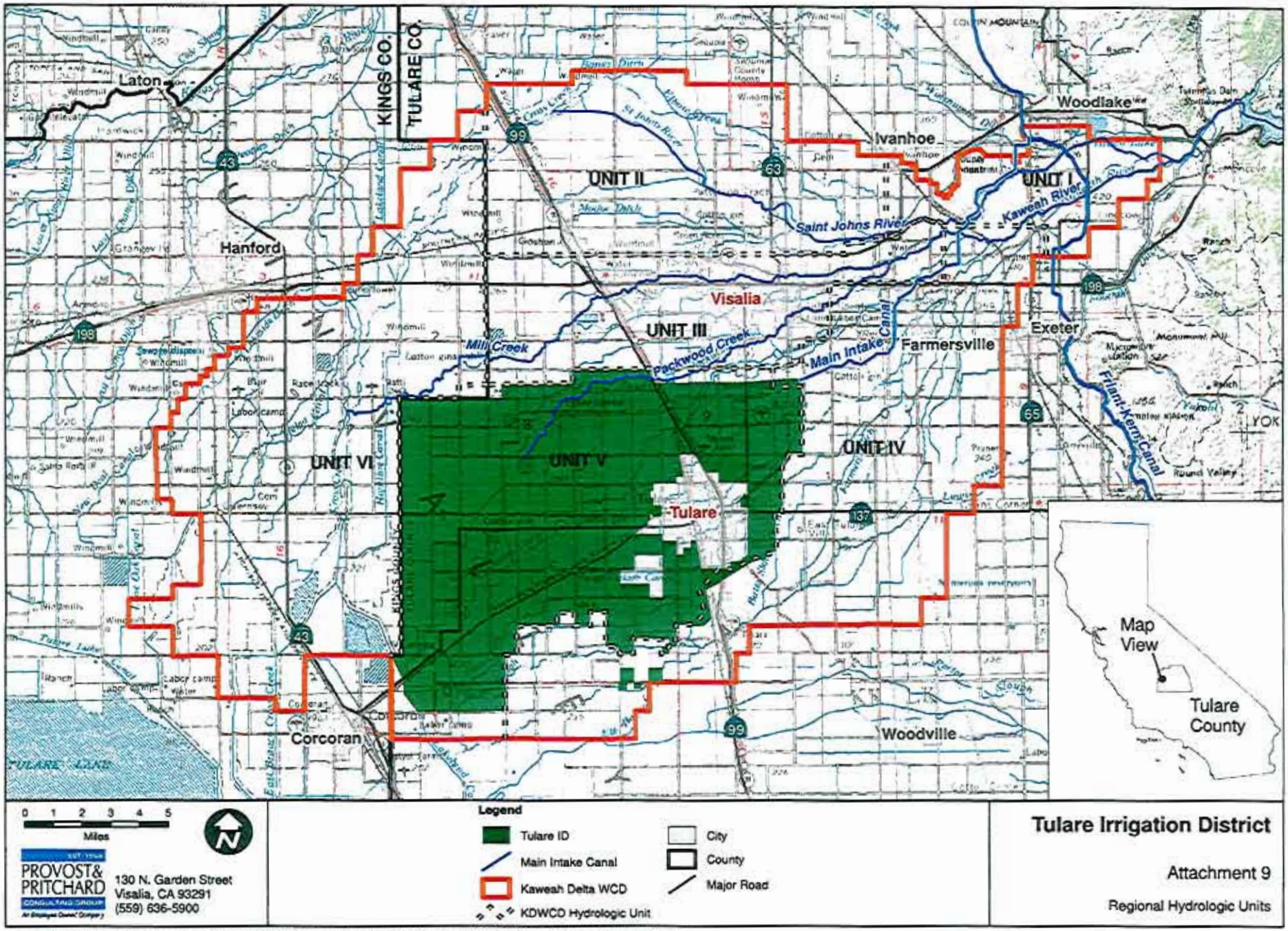
- Tulare ID
- Kaweah Delta WCD
- County
- Hydrologic Unit 5 (Water Resources Investigation 2007)
- Groundwater Management Plan Buffer Zone

Tulare Irrigation Distrtict

Attachment 8

Water Management Boundaries

11/30/2009 \\goose\vsl_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment8_WaterMngmntBoundaries.mxd



PROVOST& PRITCHARD
CONSULTING GROUP
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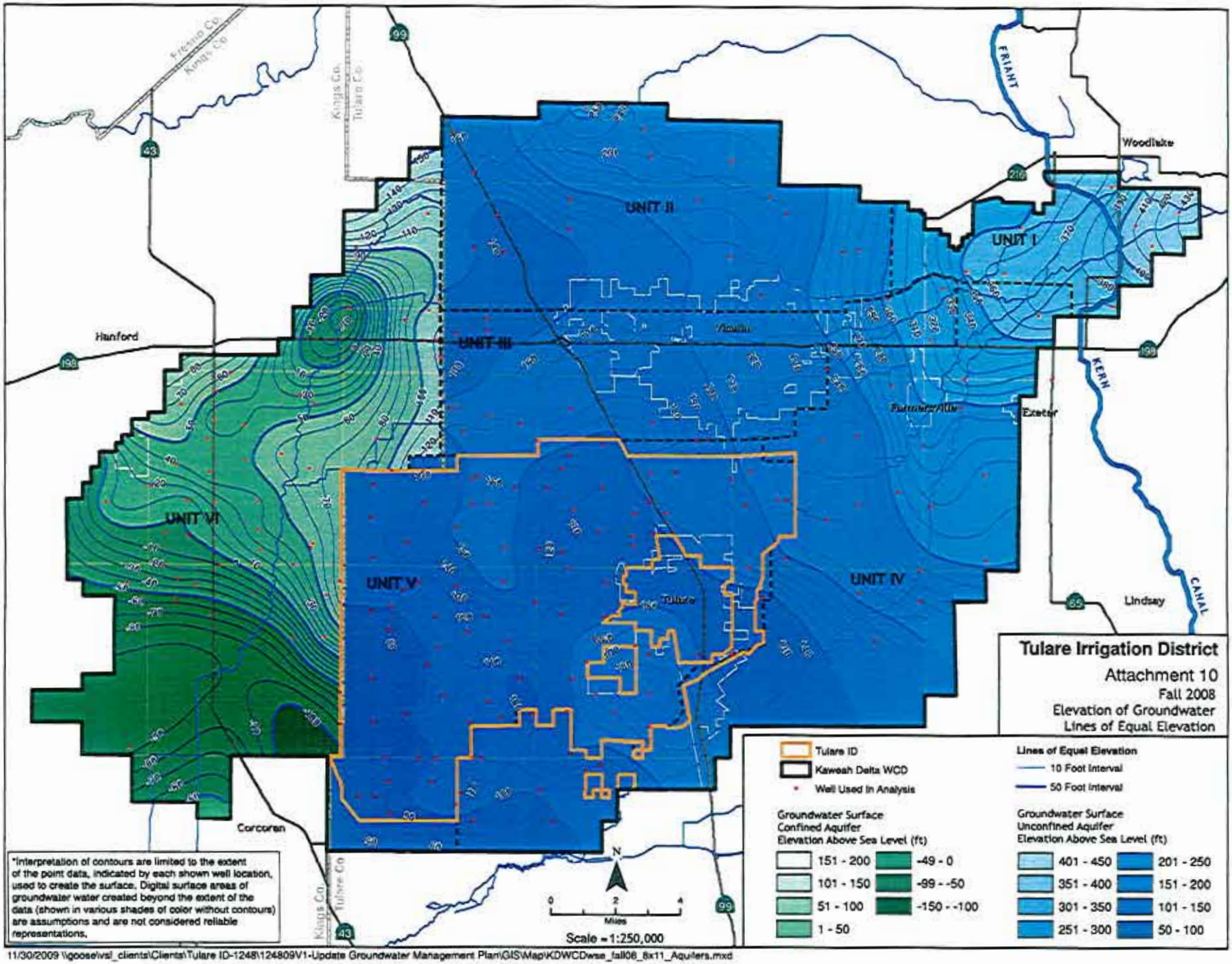
(559) 636-5900

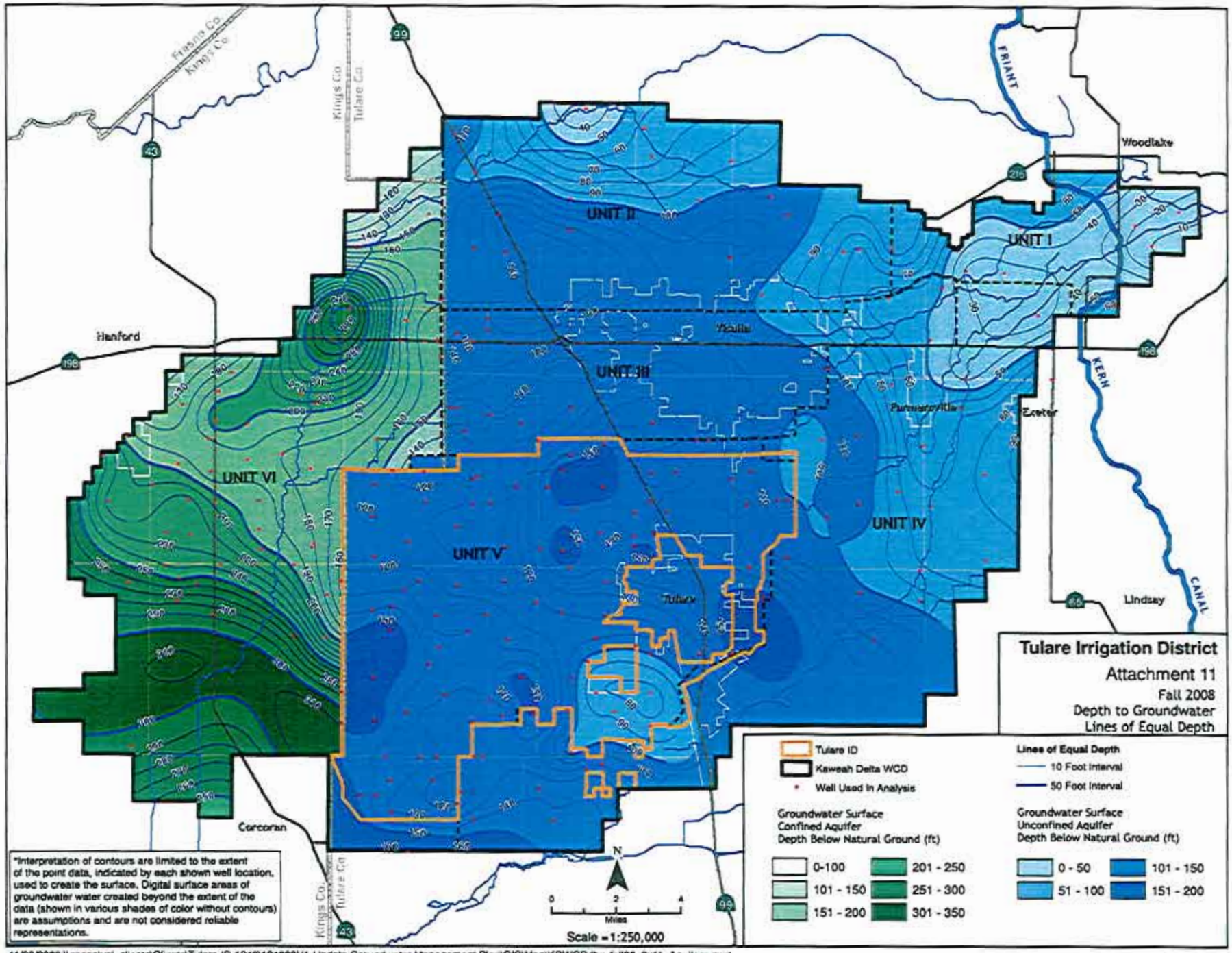
Tulare Irrigation District

Attachment 9

Regional Hydrologic Units

11/24/2009 \\goose\wsl_clients\Clients\Tulare ID-1248\124809\1-Update Groundwater Management Plan\GIS\Map\Attachment9_HydroUnits.mxd


Tulare Irrigation District
Attachment 10
Fall 2008
Elevation of Groundwater
Lines of Equal Elevation
UNIT I
UNIT II
UNIT III
UNIT IV
UNIT V
UNIT VI
Hanford
Corcoran
Woodlake
Exeter
Lindsay
Tulare
Visalia
Farmersville
FRIANT
KERN
CANAL
Fresno Co.
Kings Co.
Tulare Co.
Tulare ID
Kaweah Delta WCD
Well Used In Analysis
Lines of Equal Elevation
10 Foot Interval
50 Foot Interval
Groundwater Surface
Confined Aquifer
Elevation Above Sea Level (ft)
151 - 200
101 - 150
51 - 100
1 - 50
-49 - 0
-99 - -50
-150 - -100
Groundwater Surface
Unconfined Aquifer
Elevation Above Sea Level (ft)
401 - 450
351 - 400
301 - 350
251 - 300
201 - 250
151 - 200
101 - 150
50 - 100
*Interpretation of contours are limited to the extent of the point data, indicated by each shown well location, used to create the surface. Digital surface areas of groundwater water created beyond the extent of the data (shown in various shades of color without contours) are assumptions and are not considered reliable representations.
Miles
Scale = 1:250,000
11/30/2009 \\goose\vsl_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\KDWCDwse_fall08_8x11_Aquifers.mxd


Tulare Irrigation District
Attachment 11
Fall 2008
Depth to Groundwater
Lines of Equal Depth
Tulare ID
Kaweah Delta WCD
Well Used in Analysis
Lines of Equal Depth
10 Foot Interval
50 Foot Interval
Groundwater Surface
Confined Aquifer
Depth Below Natural Ground (ft)
0-100
101 - 150
151 - 200
201 - 250
251 - 300
301 - 350
Groundwater Surface
Unconfined Aquifer
Depth Below Natural Ground (ft)
0 - 50
51 - 100
101 - 150
151 - 200
UNIT I
UNIT II
UNIT III
UNIT IV
UNIT V
UNIT VI
Woodlake
Visalia
Porterville
Exeter
Tulare
Lindsay
Hanford
Corcoran
Fresno Co
Kings Co
Tulare Co
FRIANT
KERN
CANAL
Scale =1:250,000
Miles
*Interpretation of contours are limited to the extent of the point data, indicated by each shown well location, used to create the surface. Digital surface areas of groundwater water created beyond the extent of the data (shown in various shades of color without contours) are assumptions and are not considered reliable representations.
11/30/2009 \\goose\vsi_clients\Clients\Tulare ID-1248\124809\V1-Update Groundwater Management Plan\GIS\Map\KDWCDdtw_fall08_8x11_Aquifers.mxd

Attachement 12 - Table of Well Attributes

Well ID	Township		Range		Section	Tract and Squence	Owner
192313 A03	19	S	23	E	13	A03	Nichols
192319 H01	19	S	23	E	19	H01	Te Velde
192320 C01	19	S	23	E	20	C01	Te Velde
192321 P01	19	S	23	E	21	P01	Westra
192323 D01	19	S	23	E	23	D01	Pacheco
192324 L01	19	S	23	E	24	L01	Fisher
192325 C01	19	S	23	E	25	C01	Mederos
192325 L02	19	S	23	E	25	L02	Gist
192326 B01	19	S	23	E	26	B01	Pacheco
192327 A01	19	S	23	E	27	A01	Bebereia
192327 P01	19	S	23	E	27	P01	Pires
192330 H02	19	S	23	E	30	H02	Te Velde
192331 R01	19	S	23	E	31	R01	Hildebrand
192332 H01	19	S	23	E	32	H01	Lemstra
192334 L01	19	S	23	E	34	L01	Bassett
192335 H01	19	S	23	E	35	H01	Mendonca
192410 G01	19	S	24	E	10	G01	Gordon
192413 C02	19	S	24	E	13	C02	Out of District
192414 A01	19	S	24	E	14	A01	Blain
192417 A01	19	S	24	E	17	A01	Pacheco
192417 N01	19	S	24	E	17	N01	Hamstra
192418 R01	19	S	24	E	18	R01	Hamstra
192419 L01	19	S	24	E	19	L01	Goeman
192420 J01	19	S	24	E	20	J01	Darthelemy
192422 C02	19	S	24	E	22	C02	Nunes
192422 P01	19	S	24	E	22	P01	Royal Farms
192423 D01	19	S	24	E	23	D01	Goins
192424 A03	19	S	24	E	24	A03	Visser
192425 D01	19	S	24	E	25	D01	Thomas
192427 H01	19	S	24	E	27	H01	Thomas
192427 Q01	19	S	24	E	27	Q01	K.D. Gin
192428 H01	19	S	24	E	28	H01	Gist
192429 D01	19	S	24	E	29	D01	Bertao
192429 R01	19	S	24	E	29	R01	Stuhaan
192430 J01	19	S	24	E	30	J01	De Campos
192431 E01	19	S	24	E	31	E01	Oak Valley School
192433 A02	19	S	24	E	33	A02	Fisher
192433 H01	19	S	24	E	33	H01	Fisher
192436 R01	19	S	24	E	36	R01	Lagomarsino
192519 B01	19	S	25	E	19	B01	Rodgers
192520 P01	19	S	25	E	20	P01	Serpa
192529 B01	19	S	25	E	29	B01	Gerawan
192530 C01	19	S	25	E	30	C01	Gerawan
202201 H01	20	S	22	E	1	H01	Out of District
202225 R01	20	S	22	E	25	R01	Out of District
202302 H01	20	S	23	E	2	H01	Hillman

Well ID	Township		Range		Section	Tract and Squence	Owner
202303 L01	20	S	23	E	3	L01	Clark
202304 F01	20	S	23	E	4	F01	Fagundes
202307 H03	20	S	23	E	7	H03	Anderson
202308 H01	20	S	23	E	8	H01	Monteiro
202309 J02	20	S	23	E	9	J02	J.R. Simplot Co.
202311 L01	20	S	23	E	11	L01	Watte
202312 A01	20	S	23	E	12	A01	Kotsier
202313 E02	20	S	23	E	13	E02	Almeida
202315 A01	20	S	23	E	15	A01	Watte
202316 J01	20	S	23	E	16	J01	Terra Linda
202317 C01	20	S	23	E	17	C01	Quinn
202318 R01	20	S	23	E	18	R01	Monteiro
202319 J01	20	S	23	E	19	J01	Harmon
202321 B01	20	S	23	E	21	B01	Watte
202324 L01	20	S	23	E	24	L01	Heiskell
202325 J02	20	S	23	E	25	J02	Jones
202326 C01	20	S	23	E	26	C01	Mederos
202326 R01	20	S	23	E	26	R01	Smith
202327 D01	20	S	23	E	27	D01	VandeVelde
202327 R01	20	S	23	E	27	R01	Watte
202329 J02	20	S	23	E	29	J02	Souza
202330 R01	20	S	23	E	30	R01	Quinn
202404 E01	20	S	24	E	4	E01	Junio
202406 A01	20	S	24	E	6	A01	Royal Crest
202407 G01	20	S	24	E	7	G01	Clarklind
202409 M01	20	S	24	E	9	M01	Soults
202414 R01	20	S	24	E	14	R01	Souza
202415 P01	20	S	24	E	15	P01	Clarklind
202416 H01	20	S	24	E	16	H01	Catron
202417 A02	20	S	24	E	17	A02	Texeira
202417 P01	20	S	24	E	17	P01	Faria
202418 F01	20	S	24	E	18	F01	Koetsier
202420 M02	20	S	24	E	20	M02	Clarklind
202427 C01	20	S	24	E	27	C01	Mello
202428 L01	20	S	24	E	28	L01	Eddy
202429 B01	20	S	24	E	29	B01	Mello
202430 J02	20	S	24	E	30	J02	Silveira
202431 R01	20	S	24	E	31	R01	Cardosa
202433 C01	20	S	24	E	33	C01	Hamilton
202506 C01	20	S	25	E	6	C01	Lagomarsino
202518 M01	20	S	25	E	18	M01	Uchita
212302 C01	21	S	23	E	2	C01	Wilbur
212303 N01	21	S	23	E	3	N01	Martin
212304 A01	21	S	23	E	4	A01	Ribeiro
212305 A02	21	S	23	E	5	A02	Cunha
212305 E02	21	S	23	E	5	E02	Valov

Well ID	Township		Range		Section	Tract and Squence	Owner
212305 R01	21	S	23	E	5	R01	Nunes
212307 H01	21	S	23	E	7	H01	Curti
212308 F02	21	S	23	E	8	F02	Valov
212308 R01	21	S	23	E	8	R01	Curti
212310 J02	21	S	23	E	10	J02	Leyendekker
212314 C01	21	S	23	E	14	C01	Torrez
212321 C03	21	S	23	E	21	C03	Salyer
212404 F01	21	S	24	E	4	F01	Bowles

TULARE IRRIGATION DISTRICT
2010 ANNUAL GROUNDWATER REPORT

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EXECUTIVE SUMMARY

1. INTRODUCTION
- 1.1 - District Overview
- 1.2 - Report Objectives

2. GROUNDWATER MONITORING
- 2.1 - Groundwater Levels
- 2.2 - Groundwater Flow
- 2.3 - Groundwater Storage
- 2.4 - Groundwater Quality
- 2.5 - Monitoring Protocols

3. GROUNDWATER MANAGEMENT
- 3.1 - Groundwater Advisory Committee
- 3.2 - Groundwater Ordinances and Policies
- 3.3 - Groundwater Management Plan
- 3.4 - Groundwater Banking and Recharge
- 3.5 - Groundwater Studies and Investigations

4. CONCLUSIONS AND RECOMMENDATIONS
- 4.1 - Conclusions
- 4.2 - Recommendations

Tables
Groundwater Elevations
Depth to Groundwater

Figures
District Map
Well Location Map
Groundwater Elevation Contours
Depth to Groundwater Contours

APPENDICES
A - Well Hydrographs

Tulare Irrigation District
Groundwater Management Plan
Implementation Schedule

Task No.	Task[1]	2009				2010				2011				2012				2013				2014			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Groundwater Advisory Committee meetings						■				■				■				■				■		
2	Prepare Annual Groundwater Reports					■	■			■	■				■	■			■	■		■	■		
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13	Update Groundwater Management Plan																					■	■		

Notes:
1 - Only proposed new projects are shown in this schedule. Existing and on-going projects are not shown. Also, new policies and guidelines that will be implemented on a continuous basis are not shown.
2 - Implementation of these projects will depend on the results of current feasibility studies and the availability of funding to construct them.

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX A - PUBLIC PARTICIPATION IN PLAN ADOPTION

TULARE IRRIGATION DISTRICT

RESOLUTION NO. 09-12

WHEREAS, the Tulare Irrigation District adopted a Groundwater Management Plan in 1992 in accordance with Assembly Bill 255; and

WHEREAS, the California Water Code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their service areas; and

WHEREAS, updating the District's Groundwater Management Plan is in furtherance of and consistent with the District's goals and objectives and will be in the best interests of the District's landowners and water users; and

WHEREAS, a public hearing was held on August 11, 2009, to discuss updating the Groundwater Management Plan;

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors that it is the intention of the District to update their Groundwater Management Plan in accordance with Senate Bill No. 1938, that this resolution shall be deemed a resolution of intention in accordance with California Water Code § 10753.2, and that the Board hereby authorizes its officers to execute all documents and take any other action necessary or advisable to carry out the purposes of this resolution.

THE FOREGOING RESOLUTION WAS PASSED AND ADOPTED at a regular meeting of the Board of the Tulare Irrigation District held on this 11th day of August, 2009, by the following vote:

Ayes: Directors Bixler, Martin, Rogers and Thomas

Noes: None

Abstain: None

Absent: Director Borges

ATTEST:

David G. Bixler, President

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX B - MEMORANDUM OF UNDERSTANDING BETWEEN KAWEAH DELTA WATER CONSERVATION DISTRICT AND TULARE IRRIGATION DISTRICT

MEMORANDUM OF UNDERSTANDING
BETWEEN
KAWEAH DELTA WATER CONSERVATION DISTRICT
AND
TULARE IRRIGATION DISTRICT

ARTICLE I - AGREEMENT

The articles and provisions contained herein constitute a bilateral and binding agreement by and between KAWEAH DELTA WATER CONSERVATION DISTRICT (hereinafter "Kaweah Delta") and TULARE IRRIGATION DISTRICT (hereinafter "Tulare").

ARTICLE II - RECOGNITION

Tulare developed a Groundwater Management Plan (hereinafter "The Tulare Plan") in 1992 with input from the City of Tulare located within the exterior boundaries of the district. Kaweah Delta has developed a Groundwater Management Plan (hereinafter "the Kaweah Delta Plan") the plan area of which overlaps the entire area of the Tulare Plan (hereinafter "the Overlap Area") and additionally overlaps Tulare facilities outside of the Tulare boundary. (Namely a buffer zone adjacent to the perimeter boundary and additionally areas along its main intake canal facility from Tulare non-tributary source water supply.)

ARTICLE III - PURPOSE

It is the purpose of this Memorandum of Understanding, entered into willingly by the districts, to document the interests and obligations of the districts with respect only to the Overlap Area of the two plans. It is also hoped that this Memorandum of Understanding will promote and provide a means to establish an orderly process to share information, develop a course of action and resolve any misunderstandings or differences that may arise regarding both plans.

ARTICLE IV - COORDINATION

There shall be an annual coordinating meeting (hereinafter "the meeting") between the districts. Kaweah Delta shall give notice to Tulare thirty (30) days prior to the date of the meeting to discuss the manner in which the plans are being implemented and other items relating to the plans. If there are concerns or questions regarding the plans, each district shall transmit its concerns in writing seven (7) days prior to the meeting.

ARTICLE V - MANAGEMENT OF OVERLAP AREA

Subject to the provisions of this Agreement, Tulare Irrigation District and Kaweah Delta Water Conservation District will allow each District to manage both their respective groundwater and their respective tributary and non-tributary source groundwater pursuant to their own Groundwater Management Plans in all areas overlapped by both Districts and adjacent zones and facilities areas.

The districts agree to meet as necessary to attempt to resolve any disputes developed from implementation of their respective plans within the Overlap Area. If differences cannot be resolved acceptable to both districts, Kaweah Delta will immediately cease to manage the Kaweah Delta Plan in any area inside the boundaries of Tulare. Additionally, Tulare will immediately cease to manage The Tulare Plan in any area outside its boundaries, provided such area is also within the boundaries of Kaweah Delta, except the area within the City of Tulare, which will continue to be subject to The Tulare Plan. Thereafter, this Agreement shall be deemed terminated.

ARTICLE VI - TERM

The initial term of this Agreement shall commence on the date hereof and continue for five (5) years, and shall continue from year to year thereafter unless terminated by written notice given at least one year prior to such termination,

or as stated in Article V due to a lack of conflict resolution.

This Memorandum of Understanding is made and entered into this 29th day of April, 1996.

KAWEAH DELTA WATER CONSERVATION DISTRICT	TULARE IRRIGATION DISTRICT
By [signature]	By [signature]
Title Chairman	Title President
By [signature]	By [signature]
Title Secretary	Title General Manager

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TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX C – GROUNDWATER MONITORING PROTOCOLS

GROUNDWATER MONITORING PROTOCOLS

GENERAL SCOPE

The purpose of this document is to insure that the sampling and analytical methods are adequately documented and appropriate for the project scope and purpose by individuals responsible for implementing the monitoring program. Examples of all required forms are presented at the end of this section.

In general, measurements of the static water level will be taken from the top of each casing, and then the monitoring wells will be purged and sampled. A detailed description of these procedures follows.

EQUIPMENT USED DURING SAMPLING

Water level sounding equipment and field meter probes (pH, dissolved oxygen, conductivity, temperature, and turbidity) will be thoroughly rinsed with deionized/distilled water before and after each reading. All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use.

The monitoring wells will be equipped with a dedicated sampling well pump or sampling activities will utilize disposable bailing equipment. All non-dedicated sampling equipment (in contact with sample) shall be thoroughly cleaned prior to each sampling event to prevent cross-contamination between samples and to ensure accurate representation of analytes of interest in each sample. All sample containers and sampling equipment shall be sterilized and transported to the field under conditions to preserve its sterility. Personnel performing decontamination shall wear gloves, eye-protection, and such other safety equipment as needed. The analytical laboratory as part of their agreement shall provide all sample containers, container preparation services, preservatives, and field blanks.

EQUIPMENT DECONTAMINATION PROCEDURES

All equipment that comes into contact with potentially contaminated water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. The following, to be carried out in sequence, is the recommended procedure.

- Non-phosphate detergent and tap water wash, using a brush if necessary;
- Tap water rinse; and
- Deionized/distilled water rinse.

WATER LEVEL MEASUREMENT PROCEDURES

Water levels will be measured in wells that have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

If wellheads are accessible, all wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest +/- 0.01-ft, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1-ft. Depth to water and total well depth will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section.

WELL PURGING

The wells will be sampled no sooner than 48 hours after well development. All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump, if present, or a bailer, hand pump, or submersible pump depending on the diameter and configuration of the well. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. Pumps will be placed 2 to 3 ft from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as $V = \pi r^2 h\ 7.48$ where **V** is the volume of one well casing of water in gallons ($1ft^3 = 7.48$ gallons); $\pi = 3.14$; **r** is the radius of the inner well casing (in ft); and **h** is the total height of the water column in the well (in ft).

It is most important to obtain a representative sample from the well. Stable water quality parameter field measurements (temperature, pH, and specific conductivity [EC]) indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- Temperature range is no more than +1/C;
- pH varies by no more than 0.2 pH units; and
- EC readings are within 10% of the average.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the field notes, and ground water samples will be taken. The depth to water, water quality field measurements, and purge volumes will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section.

If a well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

WATER LEVEL MEASUREMENT AND WELL PURGING RECORDS

During the collection of each sample, the following information will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section:

- Well identification;
- Sampler's name(s);
- Date and time of sample collection;
- Designation of sample as composite or grab, if applicable;
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., conditions in nearby waterways, weather conditions, noticeable odors, colors, etc.);
- Preliminary sample descriptions (e.g., clear with strong ammonia-like odor);
- Time of arrival/entry on site and time of site departure; and
- Deviations from sampling plans.

PURGED WATER DISPOSAL

Purged and excess groundwater collected for sample container filling may be disposed on site or in the sampling area by dispersing onto the ground, or at the owner's direction.

ANALYTICAL METHODS AND REPORTING LIMITS

Requested analytes are provided in the following table. Reporting limits are laboratory specific based on the type of equipment each laboratory uses. Analytical methods and holding times are listed by analyte below.

Analyte	Standard Method	EPA Method	Holding Time
PH	4500H-B	150.1	24 hours
EC	2510B	120.1	28 days
Alkalinity	2320B	310.1	14 days
Ammonium	4500NH4	350.1	28 days
Bicarbonate	2320B	310.1	14 days
Carbonate	2320B	310.1	14 days
Chloride	4500Cl	300.0	28 days
Iron	3120B	200.7	6 months
Magnesium	3120B	200.7	6 months
Manganese	3120B	200.7	6 months
Nitrate as N	4500NO3	353.2; 300.0	48 hours
Nitrite as N	4500NO2	353.2; 300.0	48 hours
Phosphorus	4500P	365	28 days
Potassium	3120B	200.7	6 months
Sodium	3120B	200.7	6 months
Sulfate	4500SO4	300.0	28 days
TDS	2540C	160.1	7 days
TKN	4500-NH3	351	28 days

SAMPLE CONTAINERS AND PRESERVATIVES

Sample containers are generally available directly from the laboratory. All containers will be one-liter polyethylene, precleaned, and analyte specific. Groundwater samples for TKN and ammonia will be collected in containers containing H_2SO_4 as a preservative. The remaining samples need not be preserved. If a preservative is present, the bottle will be capped and lightly shaken to mix in the preservative. Samples from each location that require the same preservative may be placed in the same bottle if being analyzed by the same laboratory. Samples to be analyzed for dissolved metals must be filtered prior to preservation and analysis.

SAMPLING PROCEDURES

Water samples will be collected from each well and placed into laboratory prepared containers, sealed with tight fitting caps, labeled, and stored in a cool ice chest. Water

used for field measurements of temperature, pH, and EC shall not be used as sample water. The following are the recommended sample collection procedures:

- Rinse the tubing with one liter of sample prior to sample collection;
- If no preservative is present, rinse sample bottles three times with a small amount of sample;
- Collect sample directly into the sample bottle;
- Allow sample containers to be open for the shortest time possible to prevent contamination;
- Do not touch the inside of bottles, lids, or tubes. Hold the bottle lid with the inside facing down to prevent contaminating the inside of the lid;
- Allow the sample water to flow into the bottle from above;
- Close bottle tightly,
- Samples will be chilled to 4 C° immediately upon collection; and
- Transport samples to the lab as soon as possible.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis will be filled sequentially before bottles for another analysis are filled.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Every sample, including samples collected from a single location but going to separate laboratories, will be pre-assigned an identifiable, unique sample number. The following is an example sample label:

Sample #:	**Well ID:**
Analytes:	**Date:**
Collected by:	**Time:**

It will be possible to identify each unique sample by recording the following information on the Monitoring Well Purging and Sampling Record:

- Sample identification numbers and any explanatory codes;
- Sample date and time;
- Lot numbers of the sample containers;
- Chain-of-custody form numbers;
- Shipping arrangements (overnight air bill number); and
- Name(s) of recipient laboratory (ies).

CHAIN-OF-CUSTODY

A chain-of-custody (COC) record will be completed and accompany all sample shipments for each laboratory and each shipment. If multiple coolers are sent to a

single laboratory on a single day, COCs will be completed and sent with the samples for each cooler. Generally, the laboratory will supply blank COCs. An example COC is included at the end of this section.

The COC will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. The sampling team leader or designee will sign the COC in the "relinquished by" box and note date, time, and air bill number.

SAMPLE HANDLING AND TRANSPORT

The following outlines the packaging procedures for sample delivery to a California Certified Environmental Laboratory Accreditation Program (ELAP) laboratory:

- Pack ice in zip-locked, double plastic bags. Seal the drain plug of the cooler with tape to prevent melting ice from leaking out;
- Line the bottom of the cooler with bubble wrap to prevent breakage during shipment;
- Check screw caps for tightness;
- Seal all container tops with tape;
- Secure sample labels onto the containers with clear tape;
- Wrap all glass sample containers in bubble wrap to prevent breakage;
- Seal all sample containers in heavy-duty plastic zip-lock bags with the sample numbers written on the outside of the bags with indelible ink;
- Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid;
- Fill empty space in the cooler with bubble wrap or Styrofoam peanuts

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PROVOST& PRITCHARD

CONSULTING GROUP

An Employee Owned Company

Monitoring Well Purging and Sampling Record

Client: _____ Date: _____

Project Name: _____ County: _____

Project Address: _____

Project Manager: _____ Job No: _____ Phase(s): _____

Regulatory Contact: _____ Telephone: _____

Sample Containers: _____ Air Temp (F): _____

Preservatives: _____ Precipitation: _____

Instrumentation: _____ Wind (dir/speed): _____

Date Last Calibrated/By: _____ Sampler Signature: _____

Well Number						
Well Elevation (ft)						
Well Diameter (in)						
Slotted Interval (ft)						
DTW (ft)						
GW Elevation (ft)						
Sounding Depth (ft)						
Well Volumes (gal)						
Notes:						
Well Volume Purged (1st)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Well Volume Purged (2nd)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Well Volume Purged (3rd)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Sample Depth (ft)						
Sample Time						

Equipment used:

Remarks:

2" Well Volume = 0.163 x height of water column 4" Well Volume = 0.653 x height of water column

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX D – GROUNDWATER RECHARGE AGREEMENT WITH THE CITY OF TULARE

AGREEMENT REGARDING DELIVERY OF WATER TO CERTAIN GROUNDWATER RECHARGE FACILITIES

THIS AGREEMENT is made and entered into this 6th day of May, 2008, by and between TULARE IRRIGATION DISTRICT, an Irrigation District organized and existing pursuant to the laws of the State of California (hereinafter referred to as "District"), and the CITY OF TULARE, a Municipal Corporation of the State of California (hereinafter referred to as "City").

WITNESSETH

A. WHEREAS, District is a public entity engaged in the importation and delivery of water for irrigation purposes to landowners within the District; and

B. WHEREAS, City and District entered into an Agreement dated May 10, 2005 (the "Master Agreement"), which provides for the use by City of certain canal and ditch facilities owned and controlled by District for the purpose of disposing of storm drainage; payments by City in lieu of District assessments; an agreement to develop joint policies related to impacts of new urban development on District facilities; and an agreement to consider and enter into various joint projects; and

C. WHEREAS, City has determined that it is in City's interest to acquire water from District and to deliver such water to groundwater recharge basins in locations that will provide a groundwater recharge benefit to areas that serve City; and

D. WHEREAS, in addition to purchasing water, City has the need to acquire basins to which such water can be delivered; and

E. WHEREAS, City and District have entered into an agreement dated December 4, 2007, ("Joint Purchase Agreement") providing for the joint purchase of property located at the corner of Road 132 and Avenue 256, known as the "Plum Property", for the purpose developing such property to a groundwater recharge basin. The Joint Purchase Agreement establishes joint rights in the Plum Property. After execution of the Joint Purchase Agreement, the property has been acquired as envisioned; and

F. WHEREAS, the Joint Purchase Agreement obligates the parties to negotiate and enter into a subsequent agreement providing for the purchase of water by City and the delivery of such water to various City, District and joint City-District facilities; and

G. WHEREAS, the parties now desire to set forth their agreement regarding the obligation of District to deliver water to various facilities, and the obligation of the City to pay the costs of such delivered water.

NOW THEREFORE, the parties hereto covenant and agree as follows:

1. **Definitions.** The following terms, when appearing as capitalized terms elsewhere in this Agreement, shall have the following meanings:

"**Agreed Facilities**" shall mean all of those facilities described in Exhibit A attached hereto. City may identify in the future any City-owned property it believes would be beneficial to receive water pursuant to this Agreement, and with the consent of District, such facility shall be added to the Agreed Facilities list, subject the District maintaining its discretion for determining the timing and amount of water to be delivered to such City facilities.

"**Average Annual Quantity**" shall initially mean approximately 10,000 a.f., such amount to be increased proportionally if adjustments to City's jurisdictional boundaries consistent with the Master Agreement results in more land being included within City boundaries or if the City increases its groundwater extractions from City-owned wells. Said Average Annual Quantity is to be annually derived in accordance with a formula as defined in Exhibit B attached hereto.

"**Credited Water Balance**" is defined as the amount of water, in acre feet, calculated by determining the total cumulative water delivered by District during the five year period immediately preceding the date of calculation, and subtracting from that amount the sum of the Average Annual Quantity for each of the previous five years or the number of years this Agreement has been in effect, whichever is less. By way of example only and not by limitation, assuming 55,000 acre feet have been delivered to the Agreed Facilities during the past five years, and assuming that the Average Annual Quantity in effect through the past five years is 10,000 acre feet, the Credited Water Balance would be equal to: 55,000 a.f. – (10,000 a.f. * 5); or 55,000 a.f. – 50,000 a.f.; or +5,000 a.f.

2. **Obligation to Deliver Water.** District hereby agrees to deliver on an annual basis a certain average quantity of water, defined above as the Average Annual Quantity, to the facilities defined above as the Agreed Facilities. District shall be responsible for determining, with the advice and consent of City, the manner and location of the water to be delivered, and shall not be

required to deliver all or any percentage of the water to be delivered to any particular basin, including the basin to be constructed by City and District jointly on the Plum Property. District shall endeavor to ensure that the Credited Water Balance, as annually reported pursuant to the provisions of paragraph 3 below, remains greater than or equal to zero. The purpose of the Credited Water Balance calculation is ensure that a total of 10,000 acre-feet of water is delivered on a rolling five year average annual basis, recognizing that water conditions will allow for more water to be delivered in some years and less in other years. The Credited Water calculation and accounting is not intended to establish a "water bank" or in any other way establish a right to the amount of water calculated through the Credited Water accounting system.

3. **Accounting for Delivered Water.** District shall, by October 31st each year, document and provide an annual summary of the water deliveries made pursuant the Water Purchase Agreement, and shall endeavor to document estimates of groundwater recharge benefits that resulted from or are anticipated to result from such water deliveries. As part of such annual summary, District shall calculate the Credited Water Balance according to the formula defined above.

4. **Timing of Water Deliveries.** Water deliveries shall occur only during those times when water is available to District for delivery, and can be recharged into the Agreed Facilities. To the extent that District makes deliveries to any of the Agreed Facilities that are under the City's control ("City's Facilities"), District shall provide an anticipated schedule of such deliveries and flow rate with reasonable advance notice to City for approval, and District shall not cause water to flow into any such City's Facilities without City's consent.

5. **Water Charges.** City shall pay a unit water delivery charge associated with such delivered water that is equal to the water charge paid by District for its Central Valley Project Class 2 contract supply. Such payment shall be made annually and shall be based on the then-current Average Annual Quantity.

6. **Water Source & Quality.** District reserves the right to determine the source of the water from which deliveries will be made to satisfy this Agreement. District does not guarantee the quality of water delivered pursuant to this Agreement; District agrees that such water shall be of a similar quality to water District delivers to other users from the Friant-Kern Canal or the Kaweah River.

7. **District's Obligations Contingent Upon Continuation of US-District Contract, Etc.** District's obligations to deliver water to the Agreed Facilities pursuant to this Agreement are contingent upon, and subject to, the continuing existence of (i) a contract between the United States government (or agency thereof) and District for the provision of water from the Central Valley Project via the Friant-Kern Canal, or (ii) a contract or entitlement otherwise affording District sufficient water to meet its obligations pursuant to Section 5.

8. **Term.** The Water Purchase Agreement shall be in effect for as long as the City and District continue to abide by the terms of the Master Agreement.

9. **Representations and Warranties of Authority.** Each party represents to all other parties that such party has the full power and authority to enter into this Agreement, that the execution and delivery thereof will not violate any agreement to which such party is a party or by which such party is bound, and that this Agreement, as executed and delivered, constitutes a valid and binding obligation of such party, enforceable in accordance with its terms. The corporate, partnership, and association signatories to this Agreement expressly warrant that they have been authorized by their respective company, partnership, or association entities to execute this Agreement and to bind them to the terms and provisions hereof. Any public agency signatory to this Agreement represents and warrants that the Agreement is executed in compliance with a resolution of the governing entity of the public agency, duly adopted by the governing entity and transcribed in full in the minutes of the governing entity. Any individual signing this Agreement on behalf of a public agency represents that she/he has full authority to do so.

10. **Duty to Cooperate.** Each party shall cooperate so as to facilitate the other party's efforts to carry out its obligations under this Agreement.

11. **Successors and Transferees.** The obligations and benefits of this Agreement do not run with the land, and are personal to the City and the District and are not assignable or transferable.

12. **Entire Agreement.** This Agreement constitutes the entire agreement between the parties, and it is expressly understood and agreed that the Agreement has been freely and voluntarily entered into by the parties with the advice of counsel, who have explained the legal effect of this Agreement. The terms of this Agreement are contractual and not mere recitals. The parties further acknowledge that no warranties, representations or inducements not contained in this Agreement have been made on any subject in connection with this Agreement, and that

they have not been induced to execute this Agreement by reason of non-disclosure or suppression of any fact. This Agreement may not be altered, modified or otherwise changed in any respect except by writing, duly executed by the parties or their authorized representatives. This Agreement is fully integrated.

13. Construction. The parties acknowledge that each party and its counsel have reviewed and revised this Agreement and that no rule of construction to the effect that any ambiguities are to be resolved against the drafting party shall be employed in the interpretation of this Agreement.

14. Severability. In the event any of the terms, conditions or covenants contained in this Agreement is held to be invalid, any such invalidity shall not affect any other terms, conditions or covenants contained herein which shall remain in full force and effect.

15. Governing Law. California law shall govern the interpretation and enforcement of this Agreement.

16. Remedies. Any motion or other action by the parties to enforce this Agreement shall be filed or otherwise brought and adjudicated in the Tulare County Superior Court. The Tulare County Superior Court shall maintain and reserve jurisdiction of this action for the purpose of enforcing the terms of this Agreement as a judgment or order of the Court. Nothing in this paragraph shall be interpreted in a manner to preclude whatever rights the parties may have to appeal rulings of the Tulare County Superior Court. The parties otherwise retain the full range of legal and equitable remedies to enforce the terms of this Agreement, including injunctive relief and specific performance, to ensure the parties comply with their commitments under this Agreement. In any action to enforce this Agreement, each party shall be responsible for its own attorneys' fees and costs. The parties shall meet and confer and attempt to resolve their differences informally before commencing any action to enforce this Agreement.

17. Further Assurances. In addition to the documents and instruments to be delivered as herein provided, each of the parties shall, from time to time at the request of the other parties, execute and deliver to the other parties such other instruments of transfer, conveyance and assignment and shall take such other action as may be required to more effectively carry out the terms of this Agreement.

18. Time of the Essence. Time is expressly declared to be of the essence of this Agreement and of every provision hereof in which time is an element.

19. Captions. Paragraph titles or captions contained herein are inserted as a matter of convenience and for reference, and in no way define, limit, extend or describe the scope of this Agreement or any provision thereof.

20. Notices. Where required by this Agreement, notice shall be provided by regular mail or overnight delivery, and shall be considered made when deposited in U.S. or express mail.

21. Counterparts. The parties may execute this agreement in counterparts. The counterparts, if any, constitute a single agreement.

IN WITNESS WHEREOF, the parties have executed this Agreement to be effective as of the date and year last below written.

CITY OF TULARE

"CITY"

By: _____ 5-7-08

Darrel L. Pyle — Date

City Manager

TULARE IRRIGATION DISTRICT

"DISTRICT"

By: _____ 6-10-2008

David G. Bixler — Date

President, Board of Directors

Attested

By: _____ 5/7/08

Deputy City Clerk — Date

By: _____ 6/11/08

J. Paul Hendrix — Date

General Manager

Approved as to form and content.

By: _____ 5/5/08

S.L. Kabot — Date

City Attorney

Approved as to form and content.

By: _____ 6/11/08

Alex M. Peltzer — Date

District Counsel

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EXHIBIT A

LEGEND

NORTH

TID BASIN LOCATION MAP

Exhibit B
Calculation of Average Annual Quantity

For the purposes of the Agreement, the following parameters will apply:

Avg. surface water supply to TID water users: 60%[1]

Groundwater overdraft in Tulare region: 7,000 AF[2]

City annual groundwater pumping: City Use

District area: TID A

City area: City A

City share of total area: City A ÷ (TID A + City A)

Based on the foregoing parameters, the Average Annual Quantity shall be computed as follows:

Average Annual Quantity = 60% X City Use + (City A/(TID A+City A) X 7,000)

Example for 2007: 60% X 18,870 AF + (18.78 sq. mi./ (104.04 sq. mi. + 18.78 sq. mi.)X 7,000 AF) = 12,392 AF

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(1) Based on long-term TID surface water deliveries and crop water usage
(2) Per KDWCD "Water Resources Investigation Report" - April 2005

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX E – RULES AND REGULATIONS GOVERNING DISTRIBUTION OF WATER IN THE TULARE IRRIGATION DISTRICT

RULES

AND

REGULATIONS

GOVERNING

THE DISTRIBUTION OF WATER

IN THE

[illegible]

[illegible] DISTRICT

RULES AND REGULATIONS

Governing The Distribution Of Water In The

TULARE IRRIGATION DISTRICT

Section 22257 of the Water Code of the State of California is, in part, as follows:

"Each district shall establish equitable rules for the distribution and use of water, which shall be printed in convenient form for distribution in the district."

RULE 1

CONTROL OF SYSTEM

The canals and works of the District are under the exclusive management and control of the Superintendent, appointed by the Board of Directors, and no other person, except his employees and assistants, shall have any right to interfere with said canals and works in any manner.

RULE 2

DITCHTENDERS AND OTHER EMPLOYEES

The Superintendent shall employ such ditchtenders and other assistants as may be necessary for the proper operation of the system, and the distribution of the water. Each ditchtender shall have charge of his respective section and shall be responsible to the Superintendent. From the ditchtender's decision an appeal may be made to the Superintendent. From the Action of the Superintendent, appeal may be made to the Board of Directors.

RULE 3
APPORTIONMENT OF WATER

The water will be apportioned to each distributing section by the Superintendent, and in cases of controversy or shortage of water the apportionment shall be made upon the basis of the assessed valuation of the land in each section.

RULE 4
DELIVERY OF WATER

Water will be delivered to the irrigator on demand or by rotation, depending upon the quantity available for distribution.

When delivery is made on demand application must be made to the ditchtender or the district office at least three days before the water is needed. Efforts will be made to make delivery in less than three days, and where possible the delivery will be made within 24 hours. All deliveries will be made in sequence of receipt of application.

When the quantity of water available is insufficient for full service on demand, a rotation schedule will be established. When water is available for irrigation notice will be given to each irrigator as soon as possible to allow preparation to be made to receive the water, which notice will state the approximate time when the run will be commenced, approximate head to be delivered and the time of discontinuance.

RULE 5
CONTINUOUS USE OF WATER

No allowance will be made for failure to use water at night during a regular run. If an irrigator

turns the water from his place, it will be considered that the irrigator has completed his irrigation, and service may be discontinued for the current delivery unless cessation of use be due to an emergency and necessary.

RULE 6
IRRIGATION OF EXCESSIVELY HIGH GROUND

The District will not be required to raise water to an excessive height in canals or ditches in order to give service to lands or ditches of unreasonable elevation. Such unreasonable elevation to be determined by the particular conditions wherein such diversions would jeopardize the District ditches and which would interfere with water users service above and below said diversions.

RULE 7
USE OF DELIVERY GATES

Irrigators will receive water only through the delivery gates provided. If it is found that water is taken through cuts in the canal bank, or in any other manner than that provided by the District, the irrigator can be refused further water until all damage caused has been repaired or paid for.

RULE 8
CONTROL OF DIVERTING GATES

The control of all structures on the District's system is under the management of the District, and no water user is allowed to change or interfere with them except by permission, or in case of an emergency, to be reported at once to the District office.

RULE 9

USING WATER OUT OF TURN

Any person who uses water out of his turn and without permission of his ditchtender forfeits his right to water at the next regular irrigation and is also subject to criminal prosecution.

RULE 10

WASTE OF WATER

Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land or who shall flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions will be refused the use of water until such conditions are remedied.

RULE 11

ACCESS TO LAND

The authorized agents of the District shall have free access at all times to lands irrigated from the canal system for the purpose of examining the canals and ditches and the flow of the water therein.

RULE 12

WATER RECEIPTS

Any person to whom water is offered must sign a receipt therefor. If the water is used, the receipt must show upon what kind of crop it was used; and if not used, the receipt must specify the reason.

RULE 13
IN CASE OF BREAKS

When a break or a succession of breaks occur under any distributing section, the person to whom the water is last given while the break is being repaired, will be allowed to finish before the water is taken from him, and shall not claim another irrigation for that run.

RULE 14
PARTY DITCHES

Before water is furnished to any private distributing ditch the land owners receiving the water therefrom must agree upon and sign rules and regulations satisfactory to the Board of Directors, providing for the repair, maintenance, and distribution of water from such ditch, authorizing some one to represent the users in all conferences with the ditchtender, and providing for the apportionment of water, subject to all rules and regulations of the District.

RULE 15
PUMPING RULES

All users pumping water from the canals shall be governed in all respects by the rules and regulations applicable to users under gravity service. The District will not be held responsible for any debris which may accumulate in stream flow which may tend to decrease the full operative capacity of pumps or pipelines.

RULE 16
USE OF DISTRICT RIGHT OF WAY

No trees, vines, or alfalfa shall be planted on

the right of way of any District canal and all such crops growing on such right of way shall belong absolutely to the District. Permission, however, may be granted by the Board of Directors, under such restriction as they may deem expedient, to raise annual crops thereon.

RULE 17
LIABILITY OF DISTRICT

The District will not be liable for any damage resulting directly or indirectly from any private ditch or the water flowing therein; but its responsibility shall absolutely cease when the water is turned therein according to these rules and regulations.

RULE 18
LIABILITY OF IRRIGATORS

Every consumer of water shall be responsible to the District for all damages caused by his wilful neglect or careless acts, and upon his failure to repair such damage after notification by the ditch-tender, such repairs shall be made at his expense by the District.

RULE 19
LIABILITY OF PERSONS INTERFERING WITH THE REGULATIONS OF WATER OR TAKING WATER OUT OF TURN

Section 592 of the Penal Code of California is as follows:

"WATER-DITCHES, ETC., PENALTY FOR TRESPASS OR INTERFERENCE WITH. Every person who shall, without authority of the owner or managing

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

Under such statute persons interfering with the regulation of water in the canals and ditches are subject to prosecution.

RULE 20

BUILDING DIVERTING GATES AND WEIRS

No openings shall be made or structures placed in any District canal without the special permission of the Superintendent. All structures in the District canals must be constructed according to requirements of the District, and must be maintained in a condition satisfactory to the Superintendent, and must not be changed without the permission of the Superintendent.

RULE 21

OBSTRUCTIONS ON RIGHT OF WAY

No fences or other obstruction shall be placed across or upon or along any canal bank or right of way belonging to the District without the special permission of the Board of Directors. Whenever such permission shall be granted it shall always

be with the distinct understanding that proper openings or passage ways for equipment shall be provided, and that such fence or obstruction must be removed whenever requested by the Superintendent.

RULE 22
ENFORCEMENT OF RULES

Refusal to comply with the requirements hereof, or transgression of any of the foregoing rules and regulations, or any interference with the discharge of the duties of any official, shall be sufficient cause for shutting off the water, and water will not again be furnished until full compliance has been made with all requirements herein set forth.