Tulare Irrigation District

2012 Agricultural Water Management Plan

December 2012

Tulare Irrigation District
6826 Avenue 240
Tulare, California 93274

Tulare Irrigation District

2012 Agricultural Water Management Plan

USBR Conditional Approval Letter

USBR Tulare Irrigation District
Water Management Plan

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Section 1

USBR Conditional Approval Letter

United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825-1898

IN REPLY REFER TO:

MP-410
WTR-4.00

SEP 0 8 2011

CERTIFIED - RETURN RECEIPT REQUESTED

Mr. Paul Hendrix
Tulare Irrigation District
P.O. Box 1920
Tulare, CA 93275-1920

Subject: Water Management Plan – Tulare Irrigation District

Dear Mr. Hendrix:

The Bureau of Reclamation is pleased to inform you that your District's Water Management Plan (Plan) conditionally meets the requirements contained in the 2008 Criteria for Evaluating Water Management Plans. Please send an electronic version and a resolution by the Board of Directors adopting the Plan to:

Bureau of Reclamation
Ms. Laurie Sharp
2800 Cottage Way, MP-410
Sacramento, CA 95825

A "Notice of Availability" regarding your Plan will be published in the *Federal Register*. Congress established the *Federal Register* publication system as a method of informing the public of the regulations affecting them. The official agency actions published in the *Federal Register* are available to the public and subject to the Freedom of Information Act. Once in the *Federal Register*, the public is given 30 days in which to view and comment on the Plan. If no comments are received within 30 days, the review process will officially be complete and your plan will be posted on the Reclamation WaterShare Web site. If public comments are received, additional changes may be required.

Reclamation appreciates the time and effort committed to preparing the Plan. If you have any questions, please contact Ms. Laurie Sharp, Water Conservation Specialist, at 916-978-5232 or e-mail lsharp@usbr.gov.

Sincerely,

Richard J. Woodley
Regional Resources Manager

Section 2

USBR Tulare Irrigation District

Water Management Plan

Tulare Irrigation District
Water Management Plan
2010

December 2010

Index

Section 1: Description of the District

District Name: *Tulare Irrigation District*

Contact Name: J. Paul Hendrix

Title: General Manager

Telephone: (559) 686-3425

E-mail: jph@tulareid.org

Web Address *www.tulareid.org*

A. History

The Tulare Irrigation District (District) was organized on September 21, 1889 for the purpose of managing, supplying and delivering water to growers in the Tulare area. The original proposal for the formation of the irrigation district covered 219,000 acres, extending from the Sierra Nevada foothills to Tulare Lake. The District was eventually reduced to 32,500 acres upon establishment of the District. The District continued in this status until January 1948 when the so-called "Kaweah Lands" (approximately 11,000 acres) were annexed. In October of 1948, approximately 31,000 acres, compromising the area served by the Packwood Canal Company were also annexed into the District.Today the District is approximately 68,000 acres in size and serves approximately 200 irrigation customers.

A U.S. Bureau of Reclamation contract was signed in 1950 providing an annual supply of 30,000 acre-feet of Class 1 water, and up to 141,000 acre-feet of Class 2 water from the Friant-Kern Canal.

After the annexations of the "Kaweah" and "Packwood" lands and the commencement of the diversion of the Central Valley Project water, the District proceeded with extensive improvements to the existing canal system, and the extension of the canal system to serve annexed areas. This work consisted of enlarging and/or relocating canals, constructing diversion structures, road crossings, checkgates, siphons, installing pipelines, etc. The majority of this work occurred between 1951 and 1964.

Since the completion of Terminus Dam in 1962, Kaweah River water rights owners have benefited by the regulation of the natural river flows – temporary storage of flood waters, uniform downstream releases, and options on the time and quantity of irrigation diversions.

The Kaweah Delta Water Conservation District (KDWCD) and the Tulare Irrigation District (TID) formed a joint-power authority in 1982 – the Kaweah River Power Authority (KRPA). The KRPA filed for a license to construct a 17MW hydroelectric plant at Terminus Dam and Lake Kaweah. KRPA proceeded with design and construction of the plant, and the plant went on-line in 1992 delivering power to Southern California Edison Company.

The District and KDWCD also have coordinated efforts to enhance the recharge of groundwater within the Kaweah Basin. During high flow times KDWCD may use the recharge basins within the District for recharge purposes. Further, KDWCD has historically provided for a financial incentive program through which the District sustains the level of groundwater recharge occurring within the Main Intake Canal, the primary artery delivering water from supply sources into the District. This

historical program was recently reinstated by both districts in lieu of the District's plans to concrete-line this canal to conserve the surface water.

The Tulare Irrigation District is a political subdivision of the State of California – an independent agency operating under the California Water Code. It is governed by a 5-member Board of Directors.

1. *Date district formed:* 1889 *Date of first Reclamation contract*: October 18, 1950
Original size (acres): 72,000 *Current year (last complete calendar year)*: 2010

2. *Current size, population, and irrigated acres*

	2010
Size (acres)	67,202
Population served	0
Irrigated acres	58,946

3. *Water supplies received in current year*

Water Source	*AF*
Federal urban water (Tbl 1)	0
Federal agricultural water (Tbl 1)	81,950
State water (Tbl 1)	0
Other Wholesaler (define) (Tbl 1)	0
Local surface water (Tbl 1)	162,115
Upslope drain water (Tbl 1)	0
District ground water (Tbl 2)	0
Banked water (Tbl 1)	0
Transferred water (Tbl 6)	30,072
Recycled water (Tbl 3)	0
Other (define) (Tbl 1)	0
Total	274,137

4. *Annual entitlement under each right and/or contract*

Agriculture AF/Y	*AF*	*Source*	*Contract #*	*Availability period(s)*
Reclamation Ag. Class I	30,000	San Joaquin River	175r-2485-LTR1	March 1st – February 28th
Reclamation Ag. Class II	141,000	San Joaquin River	175r-2485-LTR1	March 1st – February 28th
Local - Average Amount	83,000	Kaweah River		January - December

5. Anticipated land-use changes

The District surrounds but does not contain the City of Tulare. Growth of the City of Tulare has accounted for exclusions of land from the District due to conversion of farmland to developed City land. The District and the city of Tulare have an agreement that requires the city to pay District tax assessments on any land removed from the District by the City. As the City of Tulare continues to grow into the District, these areas will convert from agriculture to development, and will not be served by the District. The District has recently annexed two parcels of land into the District. This process has been handled through the Tulare County Local Agency Formation Commission and is being approved by the Bureau. The District is also working on a new annexation

6. Cropping patterns (Agricultural only)

List of current crops (crops with 5% or less of total acreage) can be combined in the 'Other' category.

Original Plan 1993		*Previous Plan 2002*		*Current Plan 2010*	
Crop Name	*Acres*	*Crop Name*	*Acres*	*Crop Name*	*Acres*
Cotton	27,176	Field Corn	20,936	Field Corn	22,486
Field Corn	14,001	Alfalfa	16,696	Alfalfa	15,346
Alfalfa	11,720	Cotton	15,162	Wheat	18,945
Wheat	4,209	Wheat	11,752	Cotton	7,042
Barley	3,324	Walnuts	2,871	Pistachios	4,667
Grapes	1,766	Pistachios	2,149	Walnuts	3,038
Walnuts	1,392	Grapes	1,134	Almonds	1,107
Other Grasses	1,050	Plums	555	Field Peas	1494
Other (<5%)	2,044	*Other (<5%)*	1,621	*Other (<5%)*	1,805
Total	66,682	*Total*	72,876	*Total*	75,930

(See Planner, Chapter 2, Appendix A for list of crop names)

7. Major irrigation methods (by acreage) (Agricultural only)

Original Plan 1985		*Previous Plan 2002*		*Current Plan 2010*	
Irrigation Method	*Acres*	*Irrigation Method*	*Acres*	*Irrigation Method*	*Acres*
Level Basin	20,645	Level Basin	32,116	Level Basin	34,613
Furrow	45,737	Furrow	37,992	Furrow	36,719
Low Volume-Est..	300	Low Volume Drip	2,597	Low Volume Drip	3,773
		Sprinkler	171	Sprinkler	825
Other		*Other*		*Other*	
Total	66,682	*Total*	72,876	*Total*	75,930

(See Planner, Chapter 2, Appendix A for list of irrigation system types)

B. Location and Facilities

See Attachment A for points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations

1. *Incoming flow locations and measurement methods*

Location Name	*Physical Location*	*Type of Measurement Device*	*Accuracy*
Main Canal/North Branch Split	SE ¼ of Sec. 17, T 19S, R 25E	Parshall Flume	+/- 6%
Cameron Creek @ Mooney's	NW ¼ of Sec. 18 T 19S R 25E	Parshall Flume	+/- 6%
Packwood Creek below Tagus	NW ¼ of Sec. 15 T 19S R 24E	Lined Section	+/- 6%
Evans Ditch	NE ¼ of Sec. 13 T 19 S R 23E	Parshall Flume	+/- 6%

2. *Current year Agricultural Conveyance System*

Miles Unlined - Canal	*Miles Lined - Canal*	*Miles Piped*	*Miles - Other*
300 +/-	1/4	30 +/-	

3 *Current year Urban Distribution System*

Miles AC Pipe	*Miles Steel Pipe*	*Miles Cast Iron Pipe*	*Miles - Other*
N/A			

4. *Storage facilities (tanks, reservoirs, regulating reservoirs)*

Name	*Type*	*Capacity (AF)*	*Distribution or Spill*
Abercrombie	G.W. Recharge/regulate	80	Distribution
Anderson	G.W. Recharge/regulate	680	Distribution
Creamline	G.W. Recharge/regulate	535	Distribution
Doris	G.W. Recharge/regulate	60	Distribution
Enterprise	G.W. Recharge/regulate	100	Distribution
Guinn	G.W. Recharge/regulate	675	Distribution
Tagus	G.W. Recharge/regulate	800	Distribution
Watte	G.W. Recharge/regulate	90	Distribution
K.D.W.C.D. # 3	G.W. Recharge/regulate	640	Distribution
K.D.W.C.D. # 6	G.W. Recharge/regulate	665	Distribution
K.D.W.C.D. # 8	G.W. Recharge/regulate	480	Distribution

5. *Outflow locations and measurement methods (Agricultural only)*
Provide this information in Section 2 F.

Please see Section 2 F and the District Map included in Attachment A.

6. *Description of the agricultural spill recovery system*

The District does not have an agricultural spill recovery system in place. The District utilizes terminal spill basins and an extensive Supervisory Control and Data Acquisition (SCADA) system to monitory and control the network of canals. These features allow the system to maintain a balance that reduces the amount of water that is spilled outside of the District.

7. *Agricultural delivery system operation (check all that apply)*

On-demand	*Scheduled*	*Rotation*	*Other (describe)*
	X		

District deliveries are on Modified Demand system and only available when the District makes water available. The customer does request a start time, but the District requires 24-hour notice to make deliveries and canal capacities. The District typically makes water available for a spring pre-irrigation during the month of February, and summer irrigation during the months of June through August. These deliveries are dependent on the Districts water supply.

8. *Restrictions on water source(s)*

Source	*Restriction*	*Cause of Restriction*	*Effect on Operations*
US Law	USBR Water	CVPIA PL 102-575	Loss of Water Supply
US Law	USBR Water	San Joaquin River Restoration	Future Loss of Water Supply

9. *Proposed changes or additions to facilities and operations for the next 5 years*

The District proposes the following facilities and operations improvements:

- **Increase groundwater sinking basin and regulation basin acres (approximately 165 acres).**
- **Increase amount of automated and remote sensing sites within the distribution system (SCADA).**
- **Upgrade distribution system checks and measurement devices as required.**

C. Topography and Soils

1. *Topography of the district and its impact on water operations and management*

The District is located on the eastern side of Tulare County and is generally characterized as having fairly flat sloping land. The District generally slopes from northeast to southwest at an average of 6.2 feet per mile. The topography of the District has not had an impact of water operations or water management.

2. *District soil association map (Agricultural only)*
   See Attachment B, District Soils Map

A NRCS soil classification maps is provided as Attachment B. Soils in the District are primarily a loam and sandy loam, which are compatible with the crops grown within the District. There are no known soil quality problems.

3. *Agricultural limitations resulting from soil problems (Agricultural only)*

Soil Problem	*Estimated Acres*	*Effect on Water Operations and Management*
Salinity		
High-water table		
High or low infiltration rates		
Other (define)		
Soil Problem	Estimated Acres	Effect on Water Operations and Management
Akers- Akers saline-sodic	11,300	No limit Akers. Leaching to maintain low saline-sodic levels for Akers saline-sodic.
Biggriz- Biggriz saline-sodic	29,000	No limitations on Biggriz, crop limitations on Biggriz saline sodic, leaching required.
Crosscreek- Kai	23,700	Duripan effects drainage rate, Kai soils require saline-sodic leaching.
Flamen loam	50	Duripan effects drainage rate.
Gambogy loam	400	Sodicity requires leaching to maintain low sodic levels.
Gambogy loam- Biggriz saline sodic	2,752	Salinity and sodic levels require leaching to keep levels down.

D. Climate

1. General climate of the district service area

The District is characterized has having hot and very dry summers, with relatively mild winters. Average annual precipitation is between 10 – 12 inches of rain. The estimated average daytime temperature in the summer months is approximately 95 degrees Fahrenheit the average winter temperature is about 40 degrees Fahrenheit. Frost-free days average 250 days per year in the District. Mean wind speed is less than 10 mph prevailing from the northwest. They are no known microclimates in the District.

With the long, hot summers that the District experiences there is a potential for approximately four feet of evaporation per year, with the majority occurring from April to October. Rainfall in the District primarily occurs during the winter with virtually no rainfall during the summer. Annual crop use per acre averages several times the amount of average precipitation that the District sees. 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.

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
Avg Precip. (in)	1.69	1.51	1.50	.86	.35	.07	.01	.01	.17	.43	.87	1.32	8.80
Avg Temp.(F)	46.4	51.7	55.9	61.1	67.8	75.1	80.5	78.9	73.7	65.2	54.5	46.8	63.1
Max. Temp.(F)	55.9	62.6	68.1	74.7	82.6	91.2	97.6	96.3	90.1	80.2	67.3	56.8	77
Min. Temp(F)	36.9	40.8	43.7	47.5	53.0	59.0	63.4	61.5	57.2	50.1	41.6	36.7	49.3
ETo (in)	.94	1.74	3.39	5.02	6.34	7.3	7.48	6.57	5.18	3.61	1.93	.95	50.45

Weather station ID Tulare, CA/Visalia, CA *Data period: Year* 1876 *to Year* 2010

Average wind velocity < 10 mph *Average annual frost-free days:* 250

2. Impact of microclimates on water management within the service area

There are no known microclimates located within the District, primarily due to the flat topography of the area.

E. Natural and Cultural Resources

1. Natural resource areas within the service area

Name	*Estimated Acres*	*Description*
Open space	0	

2. Description of district management of these resources in the past or present

Open space is privately owned and there are no known resource areas.

3. Recreational and/or cultural resources areas within the service area

There are no Recreational or Cultural resources within the District. District land is predominantly privately held land used only for agriculture.

Name	*Estimated Acres*	*Description*
None		

F. Operating Rules and Regulations

1. *Operating rules and regulations*
   See Attachment C, District Rules and Regulations (water related)

   The Rules and Regulations Governing the Distribution of Water in the Tulare Irrigation District is included in Attachment C. Also included in Attachment C is the Tulare Irrigation District – Irrigation Operation Procedures.

2. *Water allocation policy (Agricultural only)*
   See Attachment C, Page 3
   Summary –

   In most years the District does not provide an allocation policy for the distribution of surface water. The request for water is taken on a first-come first-serve basis. As water users go off-line, new services are started. In instances there is not enough water to distribute equally to all users, the District will prorate the water based upon the water available, total District acreage, and the water users' eligible acreage within the canal system and the District.

3. *Official and actual lead times necessary for water orders and shut-off (Agricultural only)*
   See Attachment C, Page 3
   Summary -

   The District requires 24-hours notice prior to start time required by the water user. The same 24-hour notice is required prior to a shot off of irrigation supplies.

4. *Policies regarding return flows (surface and subsurface drainage from farms) and outflow (Agricultural only)*
   See Attachment C, Page xx
   Summary -

   The District does not have any return flows, therefore does not have any policies concerning return flows.

5. *Policies on water transfers by the district and its customers*
   See Attachment C, Page xx
   Summary -

   The District does not have any written policies concerning the transfer of water by the District. In the event of a transfer, the terms and conditions are negotiated between parties and reviewed with the District Board of Directors. All transfers of water are approved by the Board of Directors. The District does not have any customer transfers, due to the fact that the water user does not have any water rights.

G. Water Measurement, Pricing, and Billing

1. *Agricultural Customers*

a. *Number of farms* 188

b. *Number of delivery points (turnouts and connections)* 535

c. *Number of delivery points serving more than one farm* 4

d. *Number of measured delivery points (meters and measurement devices)* *535*

e. *Percentage of delivered water that was measured at a delivery point* 100%

f. *Delivery point measurement device table (Agricultural only)*

Measurement Type	*Number*	*Accuracy (+/- %)*	*Reading Frequency (Days)*	*Calibration Frequency (Months)*	*Maintenance Frequency (Months)*
Orifices					
Propeller meter	55	3	Once a day	Every 2 to 5 yuears	Every 1 or 2 years
Weirs					
Flumes					
Venturi					
Metered gates	480	6%	1 -3 times a day	When requested	When needed / varies
Acoustic doppler					
Other (define)					
Total	535				

2. *Urban Customers*

a. *Total number of connections* 0

b. *Total number of metered connections*____________

c. *Total number of connections not billed by quantity* ____________

d. *Percentage of water that was measured at delivery point* ____________

e. *Percentage of delivered water that was billed by quantity* ____________

f. *Measurement device table*

Meter Size and Type	*Number*	*Accuracy (+/-percentage)*	*Reading Frequency (Days)*	*Calibration Frequency (Months)*	*Maintenance Frequency (Months)*
5/8-3/4"					
1"					
1 ½"					
2"					

3"					
4"					
6"					
8"					
10"					
Compound					
Turbo					
Other (define)					
Total					

3. *Agriculture and Urban Customers*

a. Current year agriculture and /or urban water charges - including rate structures and billing frequency
See Attachment C, Page XX, for current year rate ordinance

The District currently tracks the volumetric rate of water at each water user's turnout in units of acre-feet. The current charge for an acre-foot of water is $33.00 for peak demand irrigation deliveries. During winter months when the District is running recharge efforts, landowner have accessed irrigation water supplies at $25.00 per acre-foot. Each water user's monthly volumetric consumption of water is recorded in the District water accounting system and billed to each water user based on volumetric consumption at the turnout.

Annual charges collected from customers (current year data)

Fixed Charges			
Charges ($ unit)	*Charge units ($/acre), ($/customer) etc.*	*Units billed during year (acres, customer) etc.*	*$ collected ($ times units)*
$32.00 +-	$32.00 +- / acre	65,178 acres	$2,040,490.00

Volumetric charges			
Charges ($ unit)	*Charge units ($/AF), ($/HCF), etc.*	*Units billed during year (AF, HCF) etc.*	*$ collected ($ times units)*
$25.00	$/AF	12,932 AF	$324,877.00
$33.00	$/AF	122,108 AF	$4,052,359.00

See Attachment D, District Sample Bills

b. Water-use data accounting procedures

The District ditchtenders record daily water consumption readings at each water user turnout. This information is delivered to the District office where the Watermaster and the Accounting Department input the water use into the water billing software. The software tracks the water

usage for each turnout and all turnouts listed for each water user (water users have multiple turnouts throughout the District). At the end of each month a bill is created that is mailed to each water user indicating water usage and payment amounts.

The electronic and paper information that is created during this process is kept on file for a minimum of 10 years. The electronic system is kept on the District server and is secure and backed up on a daily basis.

H. Water Shortage Allocation Policies

1. *Current year water shortage policies or shortage response plan - specifying how reduced water supplies are allocated*
   See Attachment E, District Water Shortage Plan

   See attached Rules and Regulations and Operating Procedures (Attachment C). During severe drought periods, no water is available and efforts are made to carryover any water to next year in storage. Water users have the availability of deepwells to meet crop irrigation demands.

   Any time the District is unable to meet irrigation demands, due to water shortage or canal capacity, it will be necessary to prorate available water. The water will be prorated on a basis of water available, total District acreage, and water users' eligible acreage within the canal system and District. If a particular canal or pipeline capacity is not adequate to meet the demand, the prorate will be based upon the water available, acreage served by the canal or pipeline, and the water user's acreage by the canal or pipeline. All water deliveries otherwise, will be made in sequential recipt of application orders.

2. *Current year policies that address wasteful use of water and enforcement methods*
   See Attachment C, Page XX

   See attached Rules and Regulations and Operating Procedures (Attachment C).

Section 2: Inventory of Water Resources

A. Surface Water Supply

1. Acre-foot amounts of surface water delivered to the water purveyor by each of the purveyor's sources
See Water Inventory Tables, Table 1

2. Amount of water delivered to the district by each of the district sources for the last 10 years
See Water Inventory Tables, Table 8

B. Ground Water Supply

1. Acre-foot amounts of ground water pumped and delivered by the district
See Water Inventory Tables, Table 2

2. Ground water basin(s) that underlies the service area

Name	*Size (Square Miles)*	*Usable Capacity (AF)*	*Safe Yield (AF/Y)*
Kaweah	Unknown	Est. 3.4 million AF	740,000 AF/Y

3. Map of district-operated wells and managed ground water recharge areas
See Attachment F, District Map of Ground Water Facilities

Included, as Attachment A is a District Map that indicates the location of groundwater recharge basins and the district canal network. Recharge capacity is estimated to be approximately 225 cfs/day for all basins and unlined canals within the district.

Name	(T, R, & Sec.)	Acreage	Recharge Capacity AF/Day
Abercrombie	20 24 23	20	5
Anderson	20 23 6	167	45
Creamline	19 25 20	153	85
Doris	21 23 6	21	7
Enterprise	19 24 29	20	8
Guinn	19 23 30	162	50
Tagus	19 24 15	120	40
Watte	20 23 34	19	10
K.D.W.C.D. # 3	19 23 22	155	65
K.D.W.C.D. #6	19 23 35	155	65
K.D.W.C.D. #8	20 23 10	118	40

4. Description of conjunctive use of surface and ground water

The District maintains an aggressive conjunctive use program to maintain and decrease the depth to groundwater below the District. This program utilizes all unlined canals estimated to provide 450 acres of recharge basin capacity, as well as over 1,100 acres of recharge basins to provide for recharge of the groundwater table.   In very wet years when there is excess water on the Kaweah River System

and the Friant Kern Canal System, the District imports as much water as possible to fill recharge basins and canals. The District has historically maximized excess winter water, which may come free of charge, but also the District has aggressively purchased water during winter months to recharge the groundwater.

This has been an effective and efficient means of recharging the area's groundwater supply, and is one of the primary reasons why the District contracted for Class I and Class II water supply on the Friant Unit of the CVP. Between CVP and local surface water supplies, the District has been able to maintain a relatively steady depth to groundwater in the area with the exception of the drop produced by drought conditions observed recently. Obviously, this success depends on maximizing surface water imports.

5. *Ground Water Management Plan*
   See Attachment G, Ground Water Management Plan

6. *Ground Water Banking Plan*
   See Attachment H, Ground Water Banking Plan

   The District does not engage in ground-water banking.

C. Other Water Supplies

1. "Other" water used as part of the water supply
See the Water Inventory Tables, Table 1

D. Source Water Quality Monitoring Practices

1. Potable Water Quality (Urban only)
See Attachment I – District Annual Water Quality Report

2. Agricultural water quality concerns*:* Yes ____________ No _____*X*_____
(If yes, describe)

3. *Description of the agricultural water quality testing program and the role of each participant, including the district, in the program*

   The District collects groundwater samples and surface water samples each year from various locations throughout the District. The District targets multiple groundwater deepwells that are running throughout the District to sample from. An effort is made to sample different wells on a year-to-year basis. About every 5 years we try to go back and resample some of the earlier wells to run a comparison analysis. The testing shown in the charts below was performed between August 25th and September 5th of 2010.

4. *Current water quality monitoring programs for surface water by source (Agricultural only)*

Analyses Performed	*Frequency*	*Concentration Range*	*Average*
Calcium	Annually	4.2 – 4.8 ppm	4.4
Magnesium	Annually	0.7 – 1.1 ppm	1.0
Sodium	Annually	0.9 – 2.8 ppm	1.92
Potassium	Annually	0.4 ppm	0.4
Bicarbonate	Annually	25.3 – 36.8 ppm	31.05
Chloride	Annually	4.4 - 5 ppm	4.5
Nitrate - Nitrogen	Annually	<0.1 ppm	<0.1
Sulfate - Sulfur	Annually	0.8 – 1.4 ppm	1.07
Boron	Annually	0.01 – 0.02 ppm	0.01
pH	Annually	5.0 – 6.6 pH units	5.55
Ecw	Annually	0.03 – 0.04 dS/m	0.04
SAR	Annually	0.03 – 0.30	0.17
pHc	Annually	9.3	9.3
SAR / EC Ratio	Annually	2.6 – 9.0	6.15
TDS	Annually	23 - 27 ppm	25

Current water quality monitoring programs for groundwater by source (Agricultural only)

Analyses Performed	*Frequency*	*Concentration Range*	*Average*
Calcium	Annually	3 - 151 ppm	52.88
Magnesium	Annually	0.1 – 12.1 ppm	3.52
Sodium	Annually	21.9 - 124 ppm	46.94
Potassium	Annually	0.4 – 1.6 ppm	0.77
Bicarbonate	Annually	76.1 – 390 ppm	182.78
Chloride	Annually	7.6 – 88.2 ppm	30.45
Nitrate – Nitrogen	Annually	2.1 – 28.8 ppm	13.43
Sulfate – Sulfur	Annually	3 – 42.6 ppm	18.81
Boron	Annually	0.01 – 0.22 ppm	0.04
pH	Annually	5.4 – 8.1 pH units	7.06
Ecw	Annually	0.14 - .95 dS/m	0.49
SAR	Annually	0.8 – 5.1	2.31
pHc	Annually	7.1 – 9.1	7.81
SAR / EC Ratio	Annually	0.9 – 26.1	7.70
TDS	Annually	95 - 643 ppm	334.67

E. Water Uses within the District

1. Agricultural
See Water Inventory Tables, Table 5 - Crop Water Needs

2. Types of irrigation systems used for each crop in current year

Crop name	*Total Acres*	*Level Basin - acres*	*Furrow - acres*	*Sprinkler - acres*	*Low Volume - acres*	*Multiple methods - acres*
Corn	22,486		22,486			
Alfalfa	15,346	15,346				
Wheat	18,945	18,945				
Cotton	7,042		7,042			
Pistachios	4,667		1,568		3,099	
Walnuts	3,038		3,038			
Almonds	1,107		644	463		
Sorghums	37		37			
Pasture	322	322				
Field Peas	1,494		1,494			
Table Grapes	140				140	
Cherries	212		170		42	
Wine Grapes	307				307	
Plums	137		137			
Onions	272			272		
Rasin Grapes	69		69			
Blue Berries	40				40	
Lettuce	90			90		
Tomatoes	78				78	
Olives	44				44	
Persimmons	23				23	
Pomegranates	34		34			
Total	75,930	34,613	36,719	825	3,773	

3. Urban use by customer type in current year

Customer Type	*Number of Connections*	*AF*
Single-family	N/A	
Multi-family	N/A	
Commercial	N/A	
Industrial	N/A	
Institutional	N/A	
Landscape irrigation	N/A	
Wholesale	N/A	
Recycled	N/A	
Other (specify)	N/A	
Other (specify)	N/A	
Other (specify)	N/A	
Unaccounted for		
Total		

4. Urban Wastewater Collection/Treatment Systems serving the service area – current year

Treatment Plant	*Treatment Level (1, 2, 3)*	*AF*	*Disposal to / uses*
N/A			
N/A			
	Total		
Total discharged to ocean and/or saline sink			

5. Ground water recharge/management in current year (Table 6)

Recharge Area	*Method of Recharge*	*AF*	*Method of Retrieval*
Abercrombie	Basin Seepage	821	Private Wells
Anderson	Basin Seepage	8,255	Private Wells
Creamline	Basin Seepage	15,578	Private Wells
Doris	Basin Seepage	809	Private Wells
Enterprise	Basin Seepage	1,140	Private Wells
Guinn	Basin Seepage	6,641	Private Wells
Tagus	Basin Seepage	5,048	Private Wells
Watte	Basin Seepage	1,698	Private Wells
K.D.W.C.D. #3	Basin Seepage	9,033	Private Wells
K.D.W.C.D. #6	Basin Seepage	10,526	Private Wells
K.D.W.C.D. #8	Basin Seepage	8,073	Private Wells
District Canals	Canal Seepage	51,984	Private Wells
	Total	119,606	

6. Transfers and exchanges into or out of the service area in current year (Table 6)

The transfers listed below are not included in Table 6 because the information would conflict with the numbers reported in Table 1.

From Whom	*To Whom*	*AF*	*Use*
Garfield WD	Tulare ID	750	Ag to Ag
Ivanhoe ID	.Tulare ID	640	Ag to Ag
Orange Cove ID	Tulare ID	250	Ag to Ag
Exeter ID	Tulare ID	3,050	Ag to Ag
Lindsay-Strathmore ID	Tulare ID	2,832	Ag to Ag
Madera ID	Tulare ID	14,550	Ag to Ag
Tulare ID	Wheeler Ridge MWSD	4,000	Ag to Ag
Tulare ID	Kern-Tulare WD	6,300	Ag to Ag
Tulare ID	Arvin-Edison WSD	3,776	Ag to Ag
Tulare ID	Tri-Valley WD	15	Ag to Ag
Tulare ID	Ivanhoe ID	1,000	Ag to Ag
.Tulare ID	Tulare Lake Basins WSD	4,465	Ag to Ag
Tulare ID	Kaweah Delta WCD	24,493	Ag to Ag
Tulare ID	Lindsay-Strathmore ID	3,776	Ag to Ag
Paramount Citrus Assoc.	Tulare ID	4,000	Ag to Ag
Sun World International	Tulare ID	4,000	Ag to Ag

7. Trades, wheeling, wet/dry year exchanges, banking or other transactions in current year (Table 6)

From Whom	*To Whom*	*AF*	*Use*
N/A			
N/A			
N/A			
N/A			

8. Other uses of water in current year

Other Uses	*AF*
N/A	
N/A	

F. Outflow from the District (Agricultural only)

Districts included in the drainage problem area, as identified in "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley (September 1990)," should also complete Water Inventory Table 7 and Appendix B (include in plan as Attachment L)

See Facilities Map, Attachment A, for the location of surface and subsurface outflow points, outflow measurement points, outflow water-quality testing locations

1. *Surface and subsurface drain/outflow in current year*

The data listed below represents the surface water outflow from the District. The numbers below do not reflect any subsurface drainage due to the fact that the District does not have any subsurface drainage systems.

Outflow point	*Location description*	*AF*	*Type of measurement*	*Accuracy (%)*	*% of total outflow*	*Acres drained*
Section 7	Sec. 7, T. 21 S. R. 23 E.	74	Weir	+- 5%	47%	N/A
Section 9	Sec. 9, T. 21 S. R. 23 E.	66	Weir	+- 5%	42%	N/A
Cameron Creek	Sec. 6, T. 21 S. R. 23 E.	18	Weir	+- 5%	11%	N/A

Outflow point	*Where the outflow goes (drain, river or other location)*	*Type Reuse (if known)*
Section 7	Highline Canal / Tulare Lake Bottom	Irrigation/Groundwater Recharge
Section 9	Basin / Tulare Lake Bottom	Irrigation/Groundwater Recharge
Cameron Creek	Corcoran Irrigation District Basin	Groundwater Recharge

2. *Description of the Outflow (surface and subsurface) water quality testing program and the role of each participant in the program*

The information listed in the table below is representative of surface water quality samples taken at each of the District outflow points. The District does not have any subsurface drainage systems, and

therefore the data below is only representative of surface water quality. The samples shown in the chart below were taken between August 25th to September 5th 2010.

3. Outflow (surface drainage & spill) Quality Testing Program

Analyses Performed	*Frequency*	*Concentration Range*	*Average*	*Reuse limitation?*
Calcium	Annually	4.2 – 4.8 ppm	4.40	None
Magnesium	Annually	0.7 – 1.1 ppm	0.93	None
Sodium	Annually	0.9 – 2.3 ppm	1.37	None
Potassium	Annually	0.4 ppm	0.4	None
Bicarbonate	Annually	27.6 – 36.8 ppm	32.97	None
Chloride	Annually	4.4 – 5.0 ppm	4.6	None
Nitrate – Nitrogen	Annually	<0.1 ppm	<0.1	None
Sulfate – Sulfur	Annually	0.8 – 1.2 ppm	1.0	None
Boron	Annually	0.02 ppm	0.02	None
pH	Annually	5.0 – 6.6 pH units	5.97	None
Ecw	Annually	0.04 dS/m	0.04	None
SAR	Annually	0.03 – 0.10	0.08	None
pHc	Annually	9.3	9.3	None
SAR / EC Ratio	Annually	2.6 – 7.4	4.3	None
TDS	Annually	24 – 27 ppm	25	None

Outflow (subsurface drainage) Quality Testing Program

Analyses Performed	*Frequency*	*Concentration Range*	*Average*	*Reuse limitation?*
N/A				
N/A				
N/A				
N/A				

4. Provide a brief discussion of the District's involvement in Central Valley Regional Water Quality Control Board programs or requirements for remediating or monitoring any contaminants that would significantly degrade water quality in the receiving surface waters.

The Tulare Irrigation District is an active member of the Southern San Joaquin Valley Water Quality Coalition (Coalition) and more specifically the Kaweah River Sub Watershed group which is a comprised of water users on the Kaweah River and St. Johns River systems. The Coalition is a group of public agencies that have a water resources background and a common interest in water quality. The Coalition meets monthly at the offices of the Kaweah Delta Water Conservation District to discuss current water quality issues that face the Southern San Joaquin Valley. The District participates by sending the District Engineer to the monthly meeting to stay informed on any new or changing water quality issues that may face landowners within the District.

The Coalition has members of its Steering Committee that interact with the Central Valley Regional Water Quality Control Board (Regional Board) and attend the regional and state meetings. Steering

Committee members report to greater group during Coalition meetings on recent developments and interactions with the Regional Board. Issues that the Coalition is engaged in include:

- **Diary Monitoring Program**
- **Irrigation Lands Regulatory Program**
- **CV-SALTS**
- **Tulare Lake Basin Plan**
- **Management Plans**

The District Engineer provides reports back to the District based upon information gathered at Coalition meetings. The District Engineer also receives emails from the Regional Board by enrolling in the Regional Boards list-serve service.

The District has not identified any contamination issues and therefore has not had any contact with the Regional Board concerning contamination sites or remediation due to contamination.

G. Water Accounting (Inventory)

1. *Water Supplies Quantified*

   a. *Surface water supplies, imported and originating within the service area, by month (Table 1)*
   b. *Ground water extracted by the district, by month (Table 2)*
   c. *Effective precipitation by crop (Table 5)*
   d. *Estimated annual ground water extracted by non-district parties (Table 2)*
   e. *Recycled urban wastewater, by month (Table 3)*
   f. *Other supplies, by month (Table 1)*

2. *Water Used Quantified*

   a. *Agricultural conveyance losses, including seepage, evaporation, and operational spills in canal systems (Table 4) or*
   Urban leaks, breaks and flushing/fire uses in piped systems (Table 4)
   b. *Consumptive use by riparian vegetation or environmental use (Table 6)*
   c. *Applied irrigation water - crop ET, water used for leaching/cultural practices (e.g., frost protection, soil reclamation, etc.) (Table 5)*
   d. *Urban water use (Table 6)*
   e. *Ground water recharge (Table 6)*
   f. *Water exchanges and transfers and out-of-district banking (Table 6)*
   g. *Estimated deep percolation within the service area (Table 6)*
   h. *Flows to perched water table or saline sink (Table 7)*
   i. *Outflow water leaving the district (Table 6)*
   j. *Other*

3. *Overall Water Inventory*
   a. *Table 6*

H. Assess Quantifiable Objectives:

Identify the Quantifiable Objectives that apply to the District (Planner, chapter 10) and provide a short narrative describing past, present and future plans that address the CALFED Water Use Efficiency Program goals identified for the District.

QO #	*QO Description*	*Past, Present & Future Plans*
183	Decrease flows to salt sinks to increase the water supply for beneficial uses	The Tulare Irrigation District does not contain any salt sink areas. Water supplied to the District from the Friant-Kern Canal and the Kaweah River system is of relatively low salt content and assists in keeping the local water supply from accumulating excess salts.
186	Provide long-term diversion flexibility to increase water supply for beneficial uses	The District does not provide any diversion nor does it have a connection to the Pixley National Wildlife Refuge
187	Provide long-term diversion flexibility to increase water supply for beneficial uses	The Tulare Irrigation District has installed and utilizes a Supervisory Control And Data Acquisition system that monitors and control key structures throughout the system. The ability to manage fluctuations within the system conserves water that is utilized for irrigation purposes. The District also provides irrigation water in winter and spring months to landowners for pre-irrigation purposes. The District continues to increase the amount of SCADA systems within the District and hence increase the flexibility by which the system can meet farmer demands.

Section 3: Best Management Practices (BMPs) for Agricultural Contractors

A. Critical Agricultural BMPs

1. *Measure the volume of water delivered by the district to each turnout with devices that are operated and maintained to a reasonable degree of accuracy, under most conditions, to +/- 6%*

Number of turnouts that are unmeasured or do not meet the standards listed above: 0

Number of measurement devices installed last year: 0

Number of measurement devices installed this year: 0

Number of measurement devices to be installed next year: 2

The District measures all turnouts to District water users. This is a necessity being that the District bills water users based on a volumetric usage of surface water. A majority of measurement devices fall under the submerged orifice calculation. The Bureau of Reclamation's Water Measurement Manual states that submerged orifice turnouts have been calibrated to laboratory accuracy of +/- 3%. However, the District feels that given in-field constrains and flow conditions that the submerged orifice is only accurate to approximately +/- 6% on an instantaneous read.

The District has also begun to install on a limited basis propeller meters. These devices are made to deliver reading to an accuracy of +/- 2% under laboratory conditions. The District installs these devices per the manufactures recommendations however due to other constraints feels that the in-field application produces accuracies at approximately +/- 3%.

Types of Measurement Devices Being Installed	*Accuracy*	*Total Installed During Current Year*
Submerged Orifice	+/- 6%	0
Propeller Meters	+/- 3%	2

2. *Designate a water conservation coordinator to develop and implement the Plan and develop progress reports*

Name: Marco Crenshaw *Title:* Watermaster

Address: 6826 Avenue 240, Tulare, California 93274

Telephone: (559) 686-3425 *E-mail:* mjc@tulareid.org

3. *Provide or support the availability of water management services to water users*

See Attachment J, Notices of District Education Programs and Services Available to Customers.

a. On-Farm Evaluations

1) On farm irrigation and drainage system evaluations using a mobile lab type assessment

	Total in district	*# surveyed last year*	*# surveyed in current year*	*# projected for next year*	*# projected 2nd yr in future*
Irrigated acres	58,888	0	0	Unknown	Unknown
Number of farms	188	0	0	0-4	0-4

The District supports the availability of on-farm irrigation and drainage system evaluations. This is accomplished by maintaining a list of irrigation educators and professionals that provide these services at the District office and can making the list available to farmers upon request. The District also provides financial support to the North West Kern Resources Conservation District Mobile Lab Unit, which provides in-field irrigation efficiency testing. This service is made available to landowners upon request. Lastly, as a member of the Friant Water Authority, landowners have access to the Friant Waterline, which is a monthly publication that highlights stories and articles related to water use efficiency.

2) Timely field and crop-specific water delivery information to the water users

The District provides water usage reports to water users upon request and are encouraged to request data as needed. The District has recently invested in new software that will allow the District to better record and report water usage totals. The District has also investigated the potential of software that will make water usage reports available via the District website. The District is phasing the implementation of new water usage software and anticipates that full integration and website implementation will be completed in the next two years.

b. Real-time and normal irrigation scheduling and crop ET information

The District as a member of the Friant Water Authority receives weekly reports on soil water usage, CIMIS Eto data and crop coefficients. This information is made available to farmers upon request. The District is investigating the potential to make information more readily available via the District website.

The District also has plans to develop a CIMIS station on the property adjacent to the Administration and Operation facility. The landowner has agreed to permit the installation of a CIMIS station in a pasture that is currently being developed. Once the pasture is established the District will install the CIMIS station.

c. Surface, ground, and drainage water quantity and quality data provided to water users

The District Watermaster collects daily water measurements throughout the District canal system and daily readings are reported from ditchtenders on individual farm turnouts. This information is available to water users upon request. However, the District does not track groundwater usage, as deepwells are owned by private landowners and water usage is a private landowner right. The District collects groundwater and surface water quality samples each year from a selected number of agricultural wells and select surface water locations throughout the District. A general agricultural suitability test is conducted on the samples to determine the levels of constituents that can affect the usability of the water in regards to crop irrigation. The District does not do any

sampling or testing required for potable water. At the time of this report there were no water quality problems to report. Approximately 24 groundwater wells and 7 surface water samples are taken each year. About every five years the District attempts to cycle back and resample all of the earlier wells to run a comparison analysis of water quality.

d. Agricultural water management educational programs and materials for farmers, staff, and the public

Program	*Co-Funders (If Any)*	*Yearly Targets*
5th Grade Water Conservation Program (Project – Water Education of Tulare Students)	N/A	750 Students
Friant Waterline	Friant Water Users Authority	225 Landowners
District Water Efficiency Library	N/A	Open to the public
Online Educational Material	N/A	Variable
Water Education Talks	N/A	Approximately 25 talks per year reaching approximately 300 people

See Attachment J for samples of provided materials and notices

e. other

4. *Pricing structure - based at least in part on quantity delivered*
   Describe the quantity-based water pricing structure, the cost per acre-foot, and when it became effective.

   The District has utilized a volumetric pricing structure for water since the early 1950's. This system is utilized to provide monitoring and control of each irrigation event to each individual water user. The system the District utilizes requires ditchtenders to make daily readings of turnout gates that are receiving irrigation water. This information is then entered into a water accounting program that converts the volume of water used into a billing request. The cost for water within the District is currently $33.00 per acre foot of water. Monthly invoices are sent to landowners showing the amount of water used and the total cost for the water. A sample bill is included as Attachment D.

5. *Evaluate and describe the need for changes in policies of the institutions to which the district is subject*

   The District will consider the need for policy changes given current landowner concerns. At the current time the District has not received any formal complaints or concerns by landowners that would necessitate changes to any current District policies.

6. *Evaluate and improve efficiencies of district pumps*
   Describe the program to evaluate and improve the efficiencies of the contractor's pumps.

   The District provides an inspection of District owned lift pumps on a rotational basis. District lift pumps are tested for efficiency and if determined to need repairs or maintenance they will be

removed and the necessary work will be carried out. The District does not own or operate any deepwells that are utilized for irrigation purposes.

B. Exemptible BMPs for Agricultural Contractors

(See Planner, Chapter 2, Appendix C for examples of exemptible conditions)

1. *Facilitate alternative land use*

The District does have any lands that contain or are susceptible to any of the items listed below.

Drainage Characteristic	*Acreage*	*Potential Alternate Uses*
High water table (<5 feet)	0	N/A
Poor drainage	0	N/A
Ground water Selenium concentration > 50 ppb	0	N/A
Poor productivity	0	N/A

Describe how the contractor encourages customers to participate in these programs.

2. *Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils*

Water users located south of the City of Tulare Waste Water Treatment Plant receive irrigation water from the treatment plant. This arrangement is between the water user and the City of Tulare. The District does not provide any assistance in the ordering or delivery of treated effluent from the City of Tulare Wastewater Treatment Plant.

The District is currently working with the City of Visalia to develop a program to receive tertiary treated effluent from the City of Visalia Waste Water Treatment Plant (Plant). The City of Visalia has approved and is currently in the process of designing an upgrade to their Plant to move from a secondary treatment process to a tertiary treatment process. Currently the Plant discharges its effluent to a natural waterway and then to a terminal basin. The City of Visalia and District propose to install a concrete pipeline from the Plant to the northern edge of the District, which is approximately 2 miles away, and deliver the tertiary treated water to the District. The District will utilize the water for irrigation purposes and recharge capacity, all of which is dependent upon the water quality and restrictions placed on the usage of the tertiary treated water.

Sources of Recycled Urban Waste Water	*AF/Y Available*	*AF/Y Currently Used in District*
City of Tulare Waste Water Treatment Plant	12,558	8,609
City of Visalia Waste Water Treatment Plan	13,000	0

3. *Facilitate the financing of capital improvements for on-farm irrigation systems*

The District continues to seek grant funding from the State of California Department of Water Resources and the United States Bureau of Reclamation for water efficiency improvement projects. Current grant awards have been made to assist the District with facility upgrades, which in turn has helped improve the flexibility of the on-demand system of the District and reduce the amount of water that is spilled outside of the District. The District also supports water efficiency by making available

on-farm irrigation and drainage system evaluations, making available a list of water educators and professionals and provides the Friant Water Authority Water Line newsletter.

The District received a grant from the Natural Resources Conservation District (NRCS) in 2008 called the Agricultural Water Efficiency Program (AWEP). This grant application is aimed at providing funds to support on-farm water efficiency projects to individual water users within the District. The District was awarded $4 million to be spread over 5 years. The District has successfully funded two years of the project and accomplished approximately 17 projects within the District. Farmers utilize the funds provided by the NRCS to develop water efficiency projects like micro/drip irrigation or tailwater return systems. The District has also developed a low interest loan program that landowners can access to meet their cost share match for each on-farm efficiency project.

Funding source Programs	*How provide assistance*
NRCS AWEP Grant	Provide 50% cost share for on-farm water efficiency projects
District Low Interest Loan	Provide $250,000 annually to water users for assist in meeting 50% cost share for AWEP program

4. *Incentive pricing*

The District operates as a conjunctive use district, which means that the District provides surface water to water users to meet crop demands, but in many years is unable to meet the entire supply required to cultivate a crop. Therefore, water users are forced to utilize groundwater deepwells to meet the crop demands within the District. The District prices its water supply to be competitive with the ability to pump groundwater utilizing deepwells, therefore providing a cost effective alternative to extracting more groundwater and adding to the overdraft of the underlying basin. Each water user within the District owns and operates a deepwell as a part of their farming operations, and can generally pump water for a cost of approximately $30.00 to $50.00 per acre foot of water. If the District were to price water at rates higher than the cost to pump water, water users would simply rely upon their deepwells to meet crop demand. This would cause an excess amount of pumping to increase the overdraft situation that the District faces. For every land owner in the District, regardless of their use of irrigation water or not, there is a flat $32.00 per acre per year assessment.

Structure of incentive pricing	*Related goal*
Providing surface water at a reasonable rate, such that water users take surface water first and then use groundwater if required	Protection of the groundwater aquifer

5. *a) Line or pipe ditches and canals*

This BMP is not applicable to most of the canal system within the District, which will remain unlined by intention. The District maintains an aggressive conjunctive use program to maintain and decrease the depth to groundwater. This program utilizes all unlined canals, which is estimated to be the

equivalent of 450 acres of recharge basin capacity, as well as over 1,100 acres of recharge basins to provide for recharge of the groundwater table. The conversion of these unlined canals to lined canals would adversely impact the District's ability to recharge groundwater and increase the amount of overdraft experienced within the District.

Canal/Lateral (Reach)	*Type of Improvement*	*Number of Miles in Reach*	*Estimated Seepage (AF/Y)*	*Accomplished/ Planned Date*
None				

b) Construct regulatory reservoirs

The District has recently embarked on two new recharge basin projects (Please see Attachment A for a location map). The first project is a joint venture project with the City of Tulare called the Swall Basin. The Swall Basin is located northeast of the City of Tulare and will provide approximately 140 acres of recharge/regulation basin. The Swall Basin will be equipped with inlet and outlet features and Supervisory Control and Data Acquisition (SCADA) equipment, which will allow the District to utilize the basin for groundwater recharge and for regulation purposes. This basin is strategically located at the headworks of our Main Canal, which allows the District to regulate a large amount of water and provide a more flexible and on-demand water supply to our water users. The Swall Basin is currently under construction and estimated to be completed by 2012.

The other basin the District is developing is the Martin Basin, which is located in the center of the District behind the new District Administration and Operation & Maintenance Facility. The Martin Basin is approximately 25 acres in size and will involve the construction of a small regulation basin and a larger recharge basin. The basin will be designed with inlet and outlet facilities along with SCADA equipment that will be tied back to the District SCADA system. Water will be stored and released from the regulation basin to provide a more flexible and on-demand water supply to water users. The Martin Basin is ready for construction and is anticipated to begin in the spring of 2011.

The District also continues to search for future sites that can serve as a regulatory or recharge basin. Sites that are considered are reviewed to ensure the site meets the criteria of a regulatory/recharge basin and that the project is cost effective.

Reservoir Name	*Annual Spill in Section (AF/Y)*	*Estimated Spill Recovery (AF/Y)*	*Accomplished/ Planned Date*
Martin Basin	N/A	Unknown	December 2012
Swall Basin	N/A	Unknown	December 2012

6. Increase flexibility in water ordering by, and delivery to, water users
See Attachment L, contractor 'agricultural water order' form

The District provides surface water to water users based on an on-demand system with a 24-hour notice before delivery and shutoff. Water users are required to place calls to the District Watermaster 24-hours prior to the start of surface water and 24-hours prior to a shutoff of surface

water. In most cases the Watermaster is able to start surface water to a water user sooner than 24-hours. The District has also embarked on an aggressive program of installing regulation basins and specific SCADA equipment which allows the Watermaster to make faster changes within the District canal network and deliver water to water users on a quicker timeframe. The SCADA system also allows the canal network to stay closer to a balanced state and deliver a consistent supply of water to the water user. Please see the attached District Map for locations of SCADA Equipment

7. *Construct and operate district spill and tailwater recovery systems*

The District conducts water operations to prevent the operational spill of water out of the District canal system. When water does spill outside of the District, it is generally during flood release operations from the Kaweah River system, which the District is obligated to pass through its system. During all operations the District owns and operates a system of regulation and recharge basins near the end of all major canals within the District to prevent or minimize the operational spills. The names of these basins are Anderson Basin, Doris Basin, Enterprise Basin, Guinn Basin and Watte Basin (these basins are shown on the attached Facilities Map). The District also has large basin at the upstream end of the District, which allows the Watermaster to operate these basins as regulation basins. This feature allow for the Watermaster to store or release water much closer to the water user and improve water management decisions to reduce the amount of water that is spilled. The District has also installed several new SCADA monitored and controlled sites to assist the Watermaster in balancing the District Canal system and preventing operational spills.

Distribution System Lateral	*Annual Spill (AF/Y)*	*Quantity Recovered and reused (AF/Y)*
Section 7	74	0
Section 9	66	0
Doris Basin	18	0
Total	158	

Drainage System Lateral	*Annual Drainage Outflow (AF/Y)*	*Quantity Recovered and reused (AF/Y)*
None		
Total		

8. Plan to measure outflow.

Total # of outflow (surface) locations/points 3

Total # of outflow (subsurface) locations/points 0

Total # of measured outflow points 3

Percentage of total outflow (volume) measured during report year 100%

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

Location & Priority	*Estimated cost (in $1,000s)*				
	2009	*2010*	*2011*	*2012*	*2013*
Section 7					

Section 9					
Doris Basin					

9. Optimize conjunctive use of surface and ground water

The District has historically operated under an aggressive conjunctive use program. This program consists of aggressively pursuing wet year excess water (flood water from the Kaweah River system and Class II water fromm the Friant Kern Canal System) to provide groundwater recharge benefits to the District. The District utilizes a vast network of unlined canals and 1,100 acres of recharge basin within the District to place excess water and allow it to recharge the groundwater. The District also does not pursue the active lining of canals which are utilized to provide recharge to groundwater as surface water is delivered to water users. Lastly, the District provides a pricing structure for surface water that encourages the use of surface water versus the use of deepwells that pump groundwater.

The District is also actively seeking the acquirement of new recharge basins within the District. In the last several years the District has added approximately 165 acres of new recharge basins in specific locations throughout the District. The District seeks lands that are located in high permeability soils and are located near District canal facilities that will deliver surface water. Given an analysis of these criteria and the cost/benefit of the site, the District can and will pursue the development of any site as a recharge basin.

10. Automate canal structures

The District began a System Modernization Project in 2007 to install a SCADA monitoring and control system on select canal systems within the District. This project included the installation of several monitoring sites, two level control gates (LOPAC gates), one flow/level control gate (Langemann Gate) and a pump back system out of a reservoir (See attached District Map for a location of SCADA facilities). This project was completed in 2008, at which time the District began evaluating future sites for the inclusion of canal automation and monitoring. Since that time the District has received several grants to install new SCADA sites and has either completed those projects or is in the progress of installing those facilities. The District continues to evaluate new sites to be outfitted with SCADA monitoring and control equipment and based upon a cost/benefit analysis will pursue such projects which are a benefit to the District.

11. Facilitate or promote water customer pump testing and evaluation

See Attachment K, Notices of District Education Programs and Services Available to Customers

The District coordinates pump testing between individual water users and Southern California Edison (SCE) or Pacific Gas and Electric (PG&E) upon request. The District advertises this service through the FWUA and monthly newsletters. The District is also in the process of coordinating the use of the new District Administration Office as a seminar site for SCE to hold water user meetings for pump testing. The District also requests from the utility companies any results of efficiency test performed on pumps within the District for a record of pump efficiencies within the District.

12. Mapping

The District is currently working with an engineering consultant who is developing the layers to be utilized in a Geographical Information System (GIS) map. The work began in 2010 and will be completed by the end of 2011.

GIS maps	*Estimated cost (in $1,000s)*				
	2009	*2010*	*2011*	*2012*	*2013*
Layer 1 – Distribution system		13,000			
Layer 2 – Drainage system					
Suggested layers:					
Layer 3 – Ground water information			2,500 Well Monitoring		
Layer 4 – Soils map					
Layer 5 – Natural & cultural resources					
Layer 6 – Problem areas					

C. Provide a 3-Year Budget for Implementing BMPs

1. Amount actually spent during current year.

BMP #		*BMP Name*	*Actual Expenditure (not including staff time)*	*Staff Hours*
A	*1*	*Measurement*	*$15000**	*750*
	2	*Conservation staff*	*$1500*	*40*
	3	*On-farm evaluation /water delivery info*	*$2000*	*10*
		Irrigation Scheduling	*$500*	*5*
		Water quality	*$2000*	*80*
		Agricultural Education Program	*$500*	*40*
	4	*Quantity pricing*	*$13700*	*100*
	5	*Policy changes*	*$1500***	*25*
	6	*Contractor's pumps*	*$5000*	*15*
B	*1*	*Alternative land use*	$0	0
	2	*Urban recycled water use*	$12000	75
	3	*Financing of on-farm improvements*	$0	60
	4	*Incentive pricing*	$0	0
	5	*Line or pipe canals/install reservoirs*	$200000	1000
	6	*Increase delivery flexibility*	$0	0
	7	*District spill/tailwater recovery systems*	$0	0
	8	*Measure outflow*	*$0*	80
	9	*Optimize conjunctive use*	$0	0
	10	*Automate canal structures*	$0	0
	11	*Customer pump testing*	$0	0
	12	*Mapping*	$0	0
		Total	$253,700	2,280

**Value does not include maintenance*

*** Value indicated hours spent to address California SB 7x-7 regulations*

2. *Projected budget summary for the next year.*

BMP #		BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A	1	Measurement	$20,000	800
	2	Conservation staff	$1,500	50
	3	On-farm evaluations/water delivery info	$2,500	15
		Irrigation Scheduling	$500	5
		Water quality	$2,500	80
		Agricultural Education Program	$1,000	50
	4	Quantity pricing	$2,000	80
	5	Policy changes	$0	0
	6	Contractor's pumps	$5,000	15
B	1	Alternative land use	$0	0
	2	Urban recycled water use	$25,000	100
	3	Financing of on-farm improvements	$250,000	150
	4	Incentive pricing	$0	0
	5	Line or pipe canals/install reservoirs	$250,000	2,000
	6	Increase delivery flexibility	$0	0
	7	District spill/tailwater recovery systems	$0	0
	8	Measure outflow	$0	80
	9	Optimize conjunctive use	$0	0
	10	Automate canal structures	$100,000	500
	11	Customer pump testing	$0	0
	12	Mapping	$0	0
		Total	$660,000	3,925

3. *Projected budget summary for 3rd year.*

BMP #		BMP Name	Budgeted Expenditure (not including staff time)	Staff Hours
A	1	Measurement	$20,000	800
	2	Conservation staff	$1,500	50
	3	On-farm evaluations/water delivery info	$2,500	15
		Irrigation Scheduling	$500	5
		Water quality	$2,500	80
		Agricultural Education Program	$1,000	50
	4	Quantity pricing	$2,000	80
	5	Policy changes	$0	0
	6	Contractor's pumps	$5,000	15

(continued)

BMP #		*BMP Name*	*Budgeted Expenditure (not including staff time)*	*Staff Hours*
B	*1*	*Alternative land use*	$0	0
	2	*Urban recycled water use*	$50,000	200
	3	*Financing of on-farm improvements*	$250,000	150
	4	*Incentive pricing*	$0	0
	5	*Line or pipe canals/install reservoirs*	$0	0
	6	*Increase delivery flexibility*	$0	0
	7	*District spill/tailwater recovery systems*	$0	0
	8	*Measure outflow*	*$0*	80
	9	*Optimize conjunctive use*	$0	0
	10	*Automate canal structures*	$0	0
	11	*Customer pump testing*	$0	0
	12	*Mapping*	$0	*0*
		Total	$335,000	1,525

Section 4: Best Management Practices for Urban Contractors
(Due to the adoption of revised BMPs in December 2008, this section will be updated in Spring 2009.)

A. Urban BMPs

Not Applicable

Year of Data | 2010 | **Enter data year here**

Table 1

Surface Water Supply

2010 Month	Federal Ag Water (acre-feet)	Federal non-Ag Water. (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Water (define) (acre-feet)	des into District (acre-feet)	Upslope Drain Water (acre-feet)	Total (acre-feet)
Method								
January	39	0	0	13048	0	760	0	13,847
February	21	0	0	11784	0	544	0	12,349
March	0	0	0	9539	0	0	0	9,539
April	13967	0	0	3689	0	7386	0	25,042
May	31821	0	0	15073	0	0	0	46,894
June	12721	0	0	36078	0	0	0	48,799
July	15891	0	0	27006	0	10832	0	53,729
August	7490	0	0	28696	0	10550	0	46,736
September	0	0	0	7127	0	0	0	7,127
October	0	0	0	0	0	0	0	0
November	0	0	0	52	0	0	0	52
December	0	0	0	10023	0	0	0	10,023
TOTAL	81,950	0	0	162,115	0	30,072	0	274,137

Table 2

Ground Water Supply

2010 Month	Groundwater (acre-feet)	Agric Groundwate *(acre-feet)
Method		
January	0	12,000
February	0	12,000
March	0	12,000
April	0	12,000
May	0	12,000
June	0	12,000
July	0	12,000
August	0	12,000
September	0	12,000
October	0	12,000
November	0	12,000
December	0	12,000
TOTAL	0	144,000

*normally estimated

Table 3

Total Water Supply

2010 Month	Surface Water Total (acre-feet)	Groundwater (acre-feet)	M&I Wastewater (acre-feet)	District Water (acre-feet)
Method				
January	13,847	0	0	13,847
February	12,349	0	0	12,349
March	9,539	0	0	9,539
April	25,042	0	0	25,042
May	46,894	0	0	46,894
June	48,799	0	0	48,799
July	53,729	0	0	53,729
August	46,736	0	0	46,736
September	7,127	0	0	7,127
October	0	0	0	0
November	52	0	0	52
December	10,023	0	0	10,023
TOTAL	274,137	0	0	274,137

*Recycled M&I Wastewater is treated urban wastewater that is used for agriculture.

Table 4

Agricultural Distribution System

2010 Canal, Pipeline, Lateral, Reservoir	Length (feet)	Width (feet)	Surface Area (square feet)	Precipitatio (acre-feet)	Evaporation (acre-feet)	Spillage (acre-feet)	Seepage (acre-feet)	Total (acre-feet)
Intake Canals	52,800	50	2,640,000	78.9	227.3	0	0	(148)
In District Canals	1,584,000	25	39,600,000	1,184.1	3,409.8	0	0	(2,226)
Basins	6,922	6,922	47,914,084	1,432.7	4,125.8	0	0	(2,693)
Section 7	0	0	0	0.0	0.0	581	0	(581)
Section 9	0	0	0	0.0	0.0	790	0	(790)
Cameron Creek	0	0	0	0.0	0.0	393	0	(393)
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
	0	0	0	0.0	0.0	0	0	0
TOTAL				2,695.7	7,762.9	1,764	0	6,831

Table 5

Crop Water Needs

2010 Crop Name	Area (crop acres)	Crop ET (AF/Ac)	Leaching Requiremen (AF/Ac)	Cultural Practices (AF/Ac)	Effective Precipitatio (AF/Ac)	Appl. Crop Water Use (acre-feet)
Corn	22,486	3	0	1	0	76,677
Alfalfa	15,346	4	0	1	0	74,121
Wheat	18,945	2	0	1	0	47,363
Cotton	7,042	3	0	1	0	26,055
Pistachios	4,667	3	0	1	0	18,341
Walnuts	3,038	4	0	1	0	14,066
Almonds	1,107	4	0	1	0	4,793
Sorghum	37	3	0	1	0	126
Pasture	322	2	0	1	0	741
Field Peas	1,494	2	0	1	0	4,661
Table Grapes	140	3	0	1	0	466
Cherries	212	3	0	1	0	812
Wine Grapes	307	3	0	1	0	1,022
Plums	137	4	0	1	0	593
	0	0	0	0	0	0
Onions	272	0	0	1	0	218
Raisin Grapes	69	3	0	1	0	230
Blueberries	40	2	0	1	0	125
Lettuce	90	0	0	1	0	72
Tomatoes	78	0	0	1	0	62
Olives	44	0	0	1	0	35
Persimmons	23	3	0	1	0	88
Pomegranates	34	0	0	1	0	27
Crop Acres	75,930					270,696

Total Irrig. Acres 59,590 (If this number is larger than your known total, it may be due to double cropping)

Table 6

2010 District Water Inventory

Water Supply	Table 3		274,137
Riparian ET	(Distribution and Drain)	minus	0
Groundwater recharge	intentional - ponds, injection	minus	119,606
Seepage	Table 4	minus	0
Evaporation - Precipitation	Table 4	minus	5,067
Spillage	Table 4	minus	1,764
Transfers/trades/wheeling	(out of District)	minus	17,753
Water Available for sale to customers			129,947
2005 Actual Agricultural Water Sales	From District Sales Records		135,042
Private Groundwater	Table 2	plus	144,000
Crop Water Needs	Table 5	minus	270,696
Drainwater outflow	(tail and tile, not recycled)	minus	0
Percolation from Agricultural Land	(calculated)		8,346

Table 7

Influence on Groundwater and Saline Sink

2010

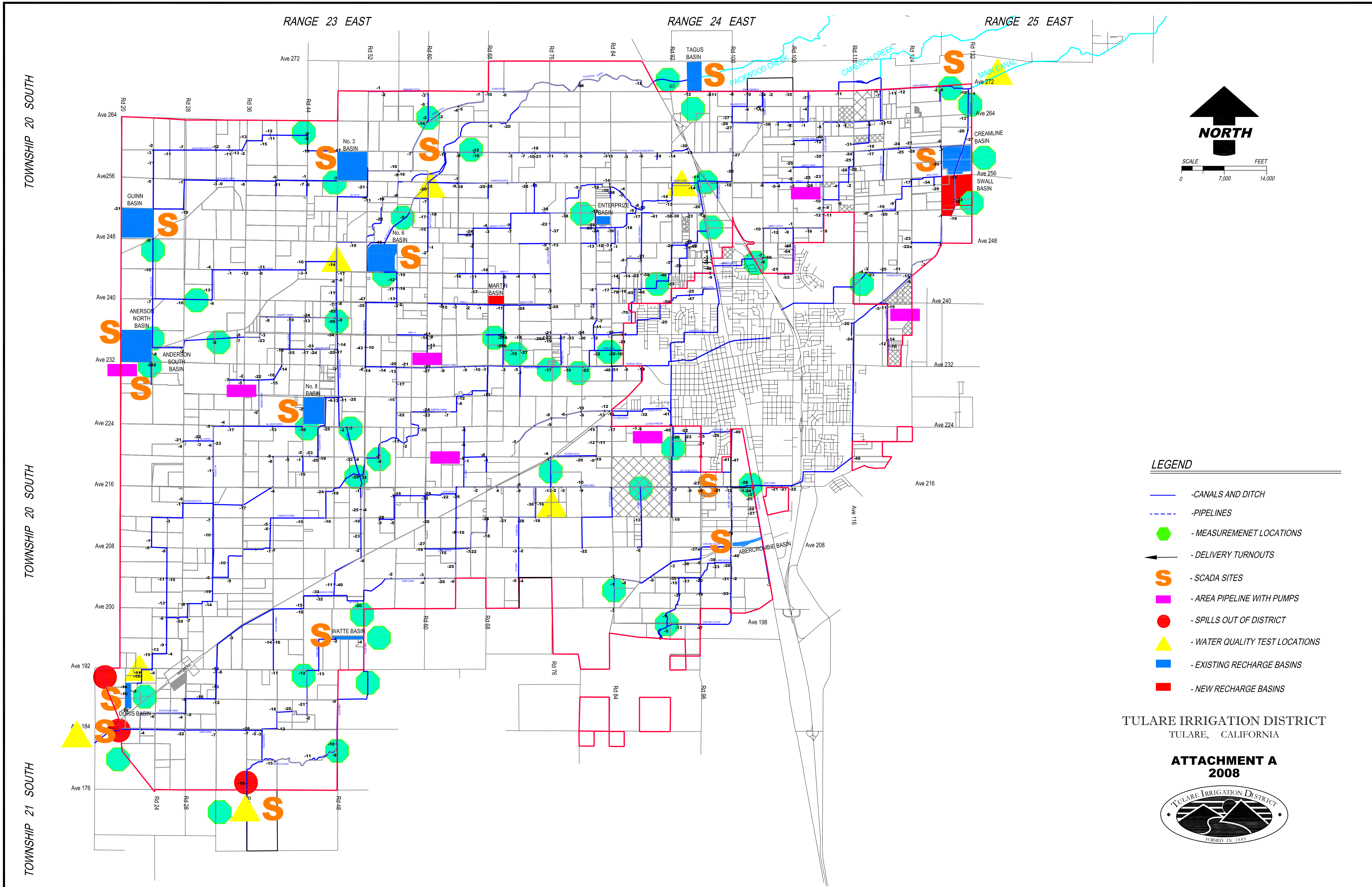
Agric Land Deep Perc + Seepage + Recharge **-** Groundwater Pumping = District Influence	119,606
Estimated actual change in ground water storage, including natural recharge)	-118,350
Irrigated Acres (from Table 5)	75,930
Irrigated acres over a perched water table	0
Irrigated acres draining to a saline sink	0
Portion of percolation from agri seeping to a perched water table	0
Portion of percolation from agri seeping to a saline sink	0
Portion of On-Farm Drain water flowing to a perched water table/saline sink	0
Portion of Dist. Sys. seep/leaks/spills to perched water table/saline sink	0
Total (AF) flowing to a perched water table and saline sink	0

Table 8

Annual Water Quantities Delivered Under Each Right or Contract

Year	Federal Ag Water (acre-feet)	Federal non-Ag Water. (acre-feet)	State Water (acre-feet)	Local Water (acre-feet)	Water (define) (acre-feet)	des into District (acre-feet)	Upslope Drain Water (acre-feet)	Total (acre-feet)
2001	24,907	0	0	49,755	0	0	0	74,662
2002	40,026	0	0	61,445	0	0	0	101,471
2003	86,742	0	0	85,821	0	0	0	172,563
2004	28,199	0	0	45,682	0	0	0	73,881
2005	213,811	0	0	169,188	0	0	0	382,999
2006	131,291	0	0	170,849	0	0	0	302,140
2007	18,838	0	0	28,639	0	0	0	47,477
2008	23,932	0	0	59,154	0	0	0	83,086
2009	73,367	0	0	75,956	0	0	0	149,323
2010	81,950	0	0	162,115	0	30,072	0	274,137
Total	723,063	0	0	908,604	0	30,072	0	1,661,739
Average	72,306	0	0	90,860	0	3,007	0	166,174

Attachment A


RANGE 23 EAST
RANGE 24 EAST
RANGE 25 EAST
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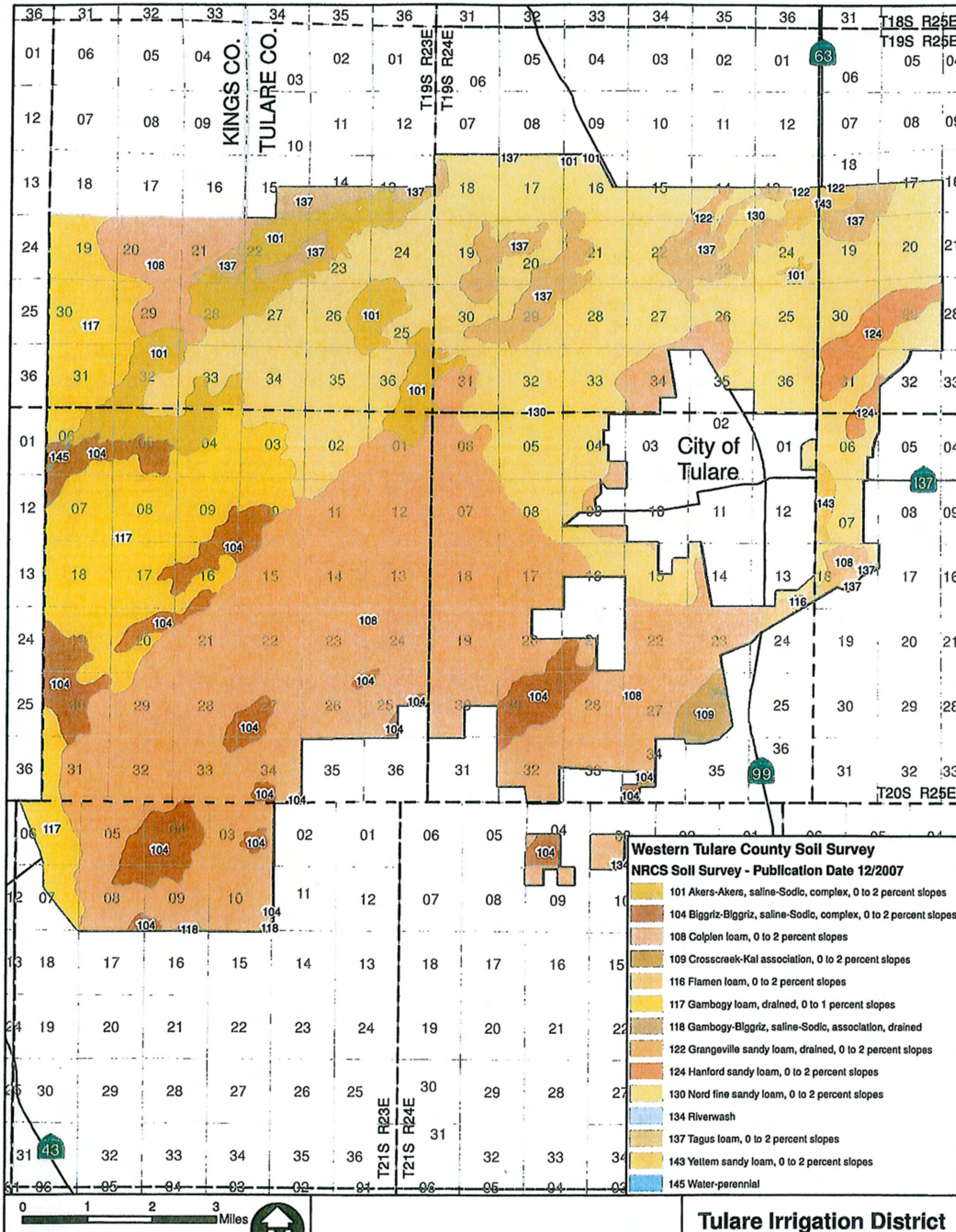
TOWNSHIP 20 SOUTH
TOWNSHIP 21 SOUTH
NORTH
SCALE
FEET
0
7,000
14,000
TAGUS BASIN
No. 3 BASIN
GUINN BASIN
No. 6 BASIN
ENTERPRIZE BASIN
MARTIN BASIN
ANERSON NORTH BASIN
ANDERSON SOUTH BASIN
No. 8 BASIN
WATTE BASIN
DORIS BASIN
ABERCROMBIE BASIN
CREAMLINE BASIN
SWALL BASIN
PACKWOOD CREEK
CAMERON CREEK
MAIN CANAL
LEGEND
-CANALS AND DITCH
-PIPELINES
- MEASUREMENET LOCATIONS
- DELIVERY TURNOUTS
- SCADA SITES
- AREA PIPELINE WITH PUMPS
- SPILLS OUT OF DISTRICT
- WATER QUALITY TEST LOCATIONS
- EXISTING RECHARGE BASINS
- NEW RECHARGE BASINS
TULARE IRRIGATION DISTRICT
TULARE, CALIFORNIA
ATTACHMENT A
2008
TULARE IRRIGATION DISTRICT
FORMED IN 1889

Attachment B



EST 1968
PROVOST& PRITCHARD
CONSULTING GROUP
An Employee Owned Company
130 N. Garden Street
Visalia, CA 93291
(559) 636-1166

Tulare Irrigation District

Attachment B

Soils

Attachment C

RULES

AND

REGULATIONS

GOVERNING

THE DISTRIBUTION OF WATER

IN THE

TULARE

IRRIGATION DISTRICT

Adopted April 25, 1893

Amended July 7, 1953

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 wilfully, 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 resopnsible 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 appartus 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.

Tulare Irrigation District
Irrigation Operation Procedures
(2009)

<u>Water Rate:</u>

Water users will be notified of rates established by the Board of Directors.

<u>Owners:</u>

1. Any District **property owner** having a delinquent assessment which includes water charges, shall not be eligible to receive District water until such delinquent assessment is paid.

<u>Minimum Charge:</u>

The minimum delivery charge through any turnout will be two (2) acre feet for each irrigation order.

<u>Rules and Regulations:</u>

The following rules and regulations must be observed by all water users to provide adequate service:

1. Water orders shall be placed with the watermaster at the District office **<u>48 hours</u>** in advance. The water user must give the gate number when placing a water order.

2. Orders not accepted by the water user within 12 hours of the requested "turn-on" time will be canceled and must be reordered unless arrangements have been made with the watermaster.

3. Notice shall be given to the District office, during regular office hours, at least 24 hours before the closing of a turnout gate. In the absence of shut-off notification, the water charge will be based on the last gate reading made and the time required to reduce the flow through the District facilities, however, the charge will not exceed 24 hours.

4. Only the ditch tender is authorized to operate T.I.D. canals, laterals, check gates, and points of diversions.

5. In case of an emergency, you are requested to immediately notify the District office, or your ditch tender.

Prorating of Water:

1. Any time the District is unable to meet irrigation demands, due to water shortage or canal capacity, it will be necessary to prorate available water. The water will be prorated on a basis of water available, total District acreage, and the water users' eligible acreage within the canal system and District.

2. If a particular canal or pipeline capacity is not adequate to meet the demand, the prorate will be based upon the water available, acreage served by the canal or pipeline, and the water user's acreage served by the canal or pipeline.

3. All water deliveries otherwise, will be made in sequential receipt of application orders.

Water Measurements:

Any complaint regarding the quantity of water charged shall be brought to the attention of the watermaster or office prior to the 30th day of the month following the date of billing. All charges will be considered as final after that date.

Communications:

Telephone: District Office, 7:00 am to 5:00 pm and after hours messages, 686-3425.
Emergency Telephone: 799-9462

Mailing Address: Tulare Irrigation District
1350 W. San Joaquin
Tulare, CA 93274

Attachment D

TULARE IRRIGATION DISTRICT
FORMED IN 1889
P.O. Box 1920 ◆ (559) 686-3425
Tulare, California 93275-1920

STATEMENT

Net 30 Days, 1% interest on unpaid balance

[redacted]

DATE 09/01/10

ACCOUNT NO. [redacted]

AMOUNT ENCLOSED

PLEASE DETACH AND RETURN WITH YOUR REMITTANCE

TURN OUT NUMBER	STARTING DATE	ENDING DATE	DESCRIPTION	ACRE FEET	RATE PER A/F	AMOUNT
			PREVIOUS BALANCE			15,450.60
		08/20/10	Payment: Thank You	0.0	0.00	15,450.60
0419-18	08/01/10	08/23/10	Irrigation	142.2	33.00	4,692.60
0419-9	08/01/10	08/03/10	Irrigation	20.1	33.00	663.30
0419-9	08/10/10	08/15/10	Irrigation	41.7	33.00	1,376.10
0419-9	08/20/10	08/23/10	Irrigation	20.9	33.00	689.70
0420-5	08/01/10	08/24/10	Irrigation	101.0	33.00	3,333.00

ALLOTMENT		
THIS YEAR	TOTAL USED	REMAINING
[redacted]	[redacted]	[redacted]

TOTAL AMOUNT DUE: 10,754.70

TULARE IRRIGATION DISTRICT
P.O. Box 1920 - TULARE, CA 93275-1920

Attachment E

The District does not have a water shortage policy or plan. Please see Attachment C, Rules and Regulations.

Attachment F

Please see Attachment A – District Map, for locations of existing recharge basins, existing District canal network and proposed recharge basins that are either under construction or pending construction.

Attachment G

GROUNDWATER MANAGEMENT PLAN

TULARE IRRIGATION DISTRICT

TULARE IRRIGATION DISTRICT
FORMED IN 1889

SEPTEMBER 2010

PREPARED BY:

PROVOST AND PRITCHARD
CONSULTING GROUP

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

REGISTERED PROFESSIONAL ENGINEER
DENNIS RAY MILLS
No. 67,478
Civil
STATE OF CALIFORNIA

Dennis Ray Mills

Date: 9/2/10

TABLE OF CONTENTS

Attachments

Tables

Appendices

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.

10 - REFERENCES

1. Bertoldi, G. L., Johnston, R. H., and Evenson, K. D. (1991), *Ground Water in the Central Valley, California – A Summary Report*, USGS Professional Paper 1401-A.

2. California Department of Water Resources, *Bulletin No. 74-81 – Water Well Standards: State of California*, 1981.

3. California Department of Water Resources, *Bulletin No. 74-90 – Water Well Standards: State of California, Supplement to Bulletin 74-81*, 1990.

4. California Department of Water Resources, *California's Groundwater, Bulletin 118*, September 1975.

5. California Department of Water Resources, *California's Groundwater, Bulletin 118 (Update 2003)*, 2003.

6. California Department of Water Resources, *Groundwater Basins in California, Bulletin 118-80*, January 1980.

7. California State Senate, *Senate Bill No. 1938, Chapter 603, Groundwater Management: State Funding*, 2002.

8. CH2M Hill, *Main Intake Canal Lining Project – Revised Final Environmental Impact Report*, State Clearinghouse No. 98081101, February 2000.

9. Cherry, J. A., Freeze A. R., *Groundwater*, 1979.

10. Croft, M. G and Gordon, G. V., *Geology, Hydrology, and Quality of Water in the Hanford-Visalia Area, San Joaquin Valley, California*, U. S. Department of the Interior, Geologic Survey, Water Resources Division, Open-File Report prepared in cooperation with the California Department of Water Resources, 1968.

11. Davis, G. H, Green, J. H., Olmsted, F. H., and Brown, D. W., *Ground-Water Conditions and Storage Capacity in the San Joaquin Valley, California, USGS Open-file Report*, 1957.

12. Davis, G. H., Lofgren, B. E. and Mack, Seymour, *Use of Ground-water Reservoirs for Storage of Surface Water in the San Joaquin Valley, California, US Geological Survey Water-Supply Paper 1618*, 1964.

13. Driscoll, F. G., *Groundwater and Wells*, 2nd Edition, 1986.

14. Fugro West, Inc., *Water Resources Investigation of the Kaweah Delta Water Conservation District – Final Report*, December 2003 (Revised July 2007).

15. Ireland, R. L., Poland, J. F., and Riley, F. S., *Land Subsidence in the San Joaquin Valley, California, as of 1980, U.S. Geological Survey Prof. Paper 497-I*, 1984.

16. Kaweah Delta Water Conservation District, *Kaweah Delta Water Conservation District Groundwater Management Plan*, Updated November 7, 2006.

17. Klausing, R. L., Lofgren, B. E., *Land Subsidence Due to Groundwater Withdrawals, Tulare-Wasco Area, California*, *United States Geological Survey Professional Paper 437-B*, 1969.

18. Klausing, R. L., Lofgren, B. E., *Land Subsidence Due to Groundwater Withdrawals, Tulare-Wasco Area, California*, *United States Geological Survey Professional Paper 437-B*, 1969.

19. Natural Resources Conservation Service, *Soil Survey for Western Tulare County*, 2007.

20. Page, R. W., *Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections, U.S. Geological Survey, Professional Paper 1401-C*, 1986.

21. Swanson, A. A., *Land Subsidence in the San Joaquin Valley, updated to 1995*, 1998.

22. Thomson West, *California Water Code, 2003 Desktop Edition, Chapter 3 – Groundwater Management Plans*, 2003.

23. Tulare County, *Tulare County Code, Part 4 – Health, Safety and Sanitation, Chapter 13 – Wells*, 2009.

24. Tulare Irrigation District, *2002 Agricultural Water Management Plan*, 2002.

25. Tulare Irrigation District, *Groundwater Management Program*, October 1992.

26. Tulare Irrigation District, *Phase One of the Plum Basin Project, Water for America Challenge Grant Application*, January 2009.

27. Tulare Irrigation District, *Regional Water Management Study: Operations, Regional Planning and Asset Management, Policy Assessment and Strategic Plan Preparation, Water for America 2009 System Optimization Review Grant Application*, January 2009.

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.

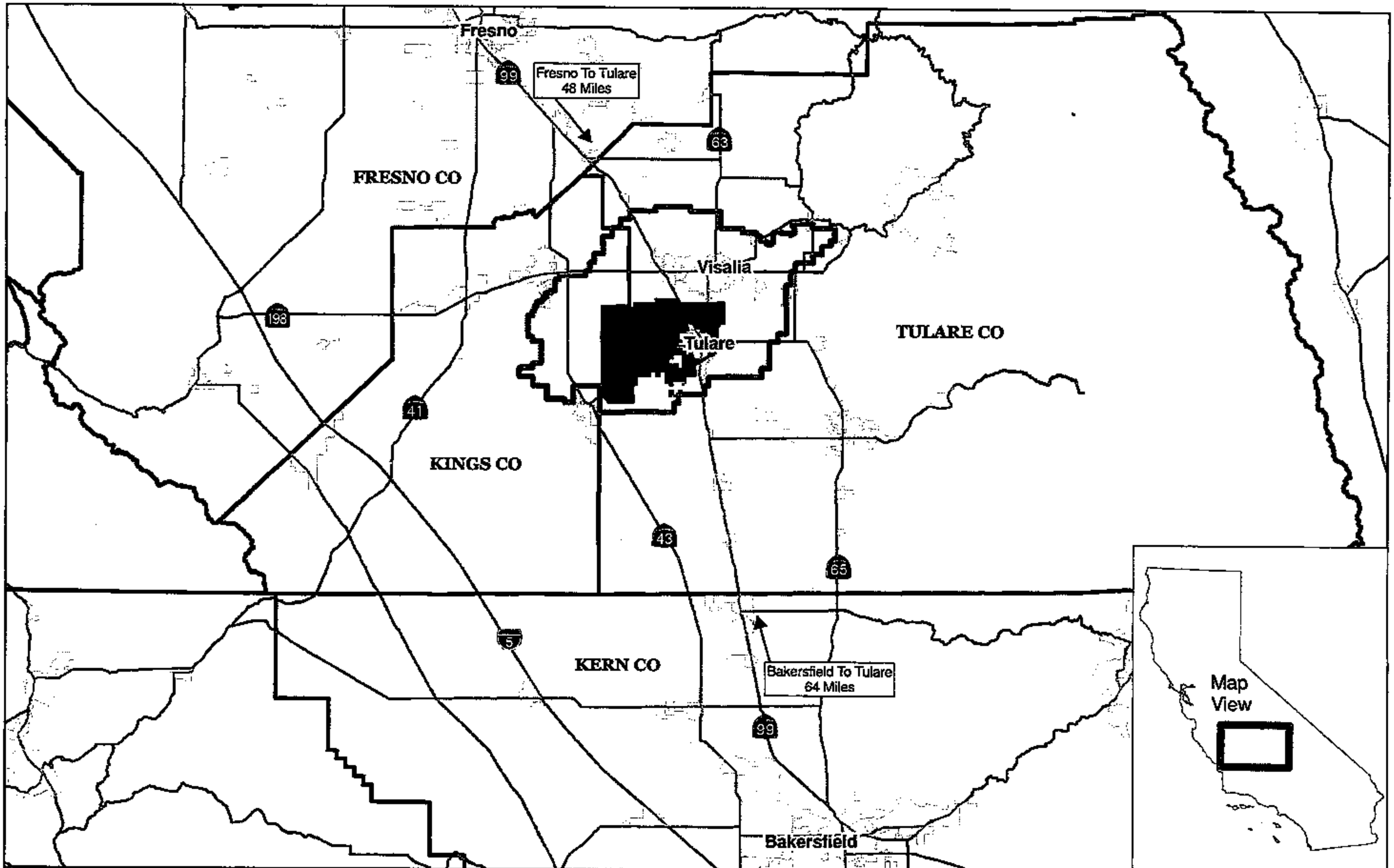
30. United States Department of the Interior Bureau of Reclamation, *Technical Studies in Support of Factual Report – Tulare Irrigation District*, February 1949.

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

TULARE IRRIGATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

ATTACHMENTS



EST 1968
PROVOST&
PRITCHARD
CONSULTING GROUP
An Employee Owned Company

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

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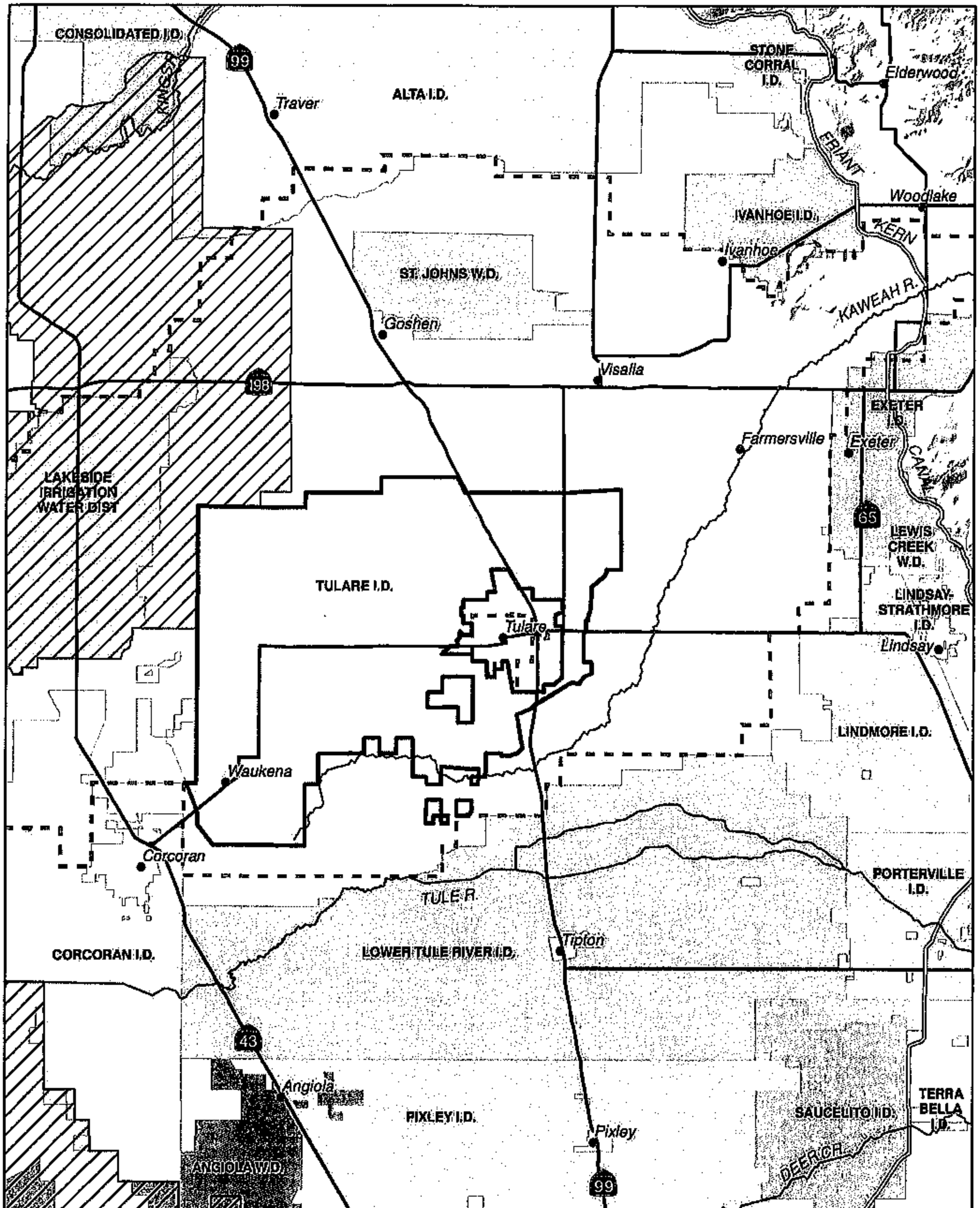

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Legend

- KAWEAH DELTA W.C.D.
- KINGS COUNTY W.D.
- TULARE LAKE BASIN W.S.D.

Tulare Irrigation District

Attachment 2a

Neighboring Surface Water Delivery Districts

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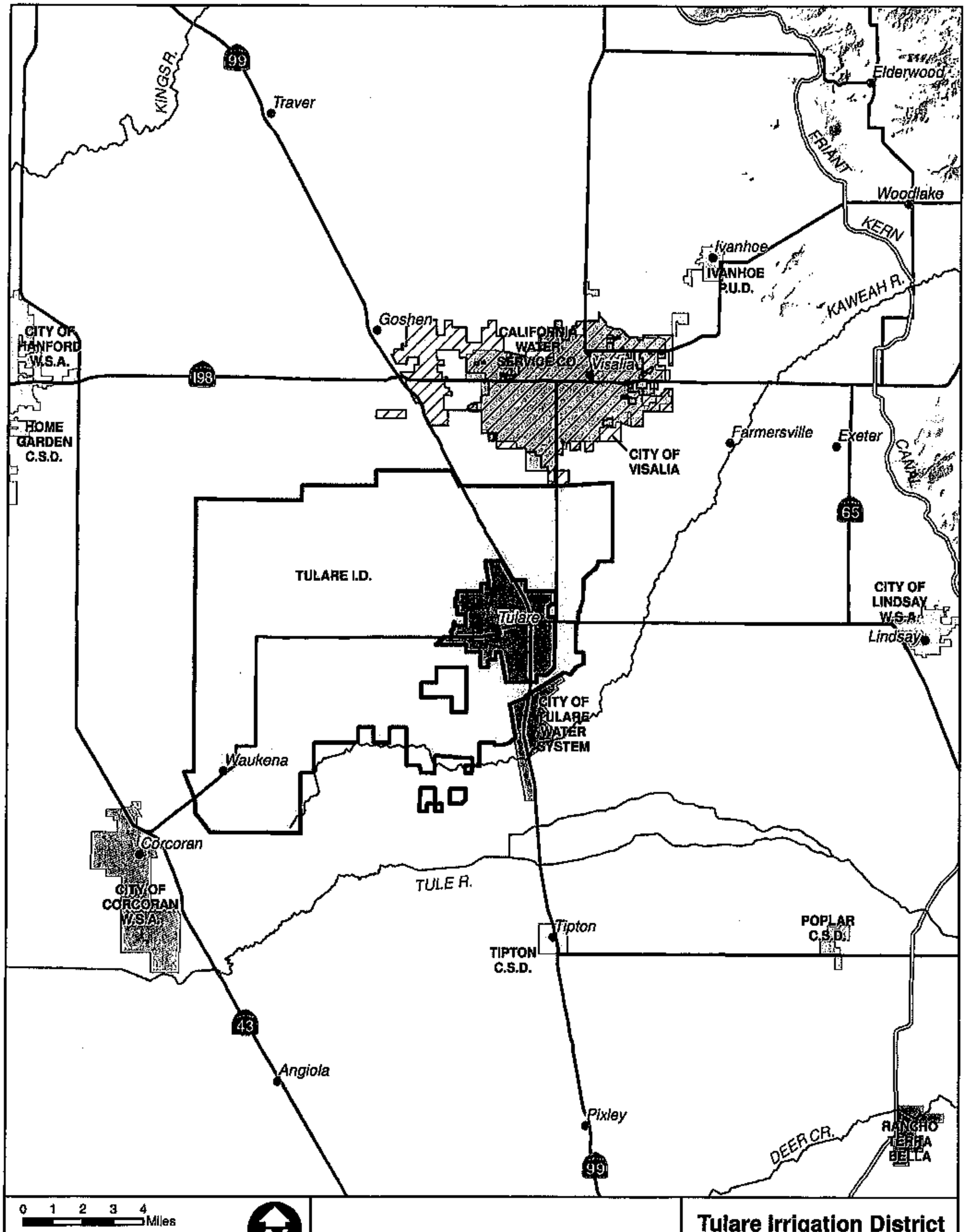

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Tulare Irrigation District

Attachment 2b

Neighboring Municipal Water
Delivery Districts

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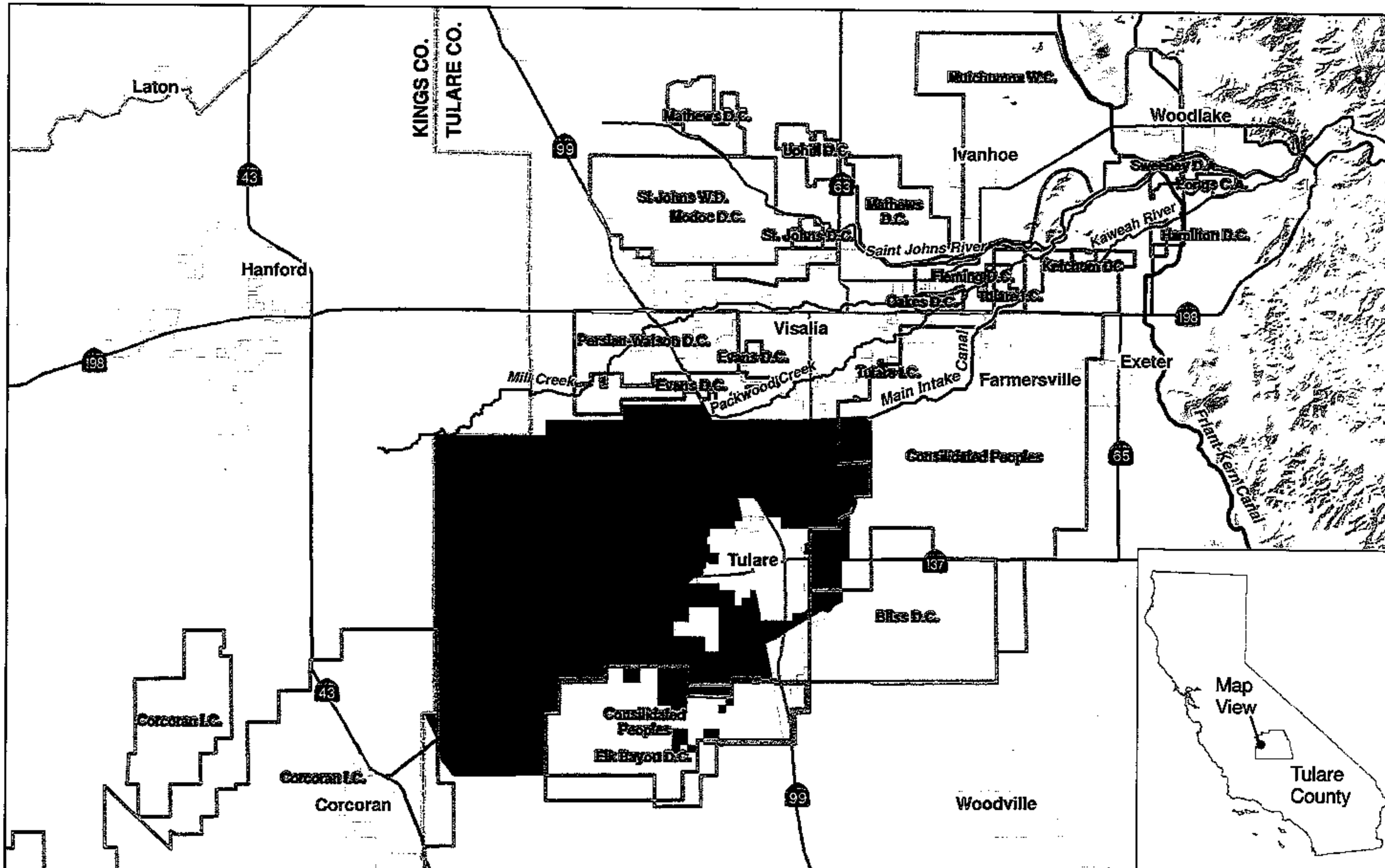

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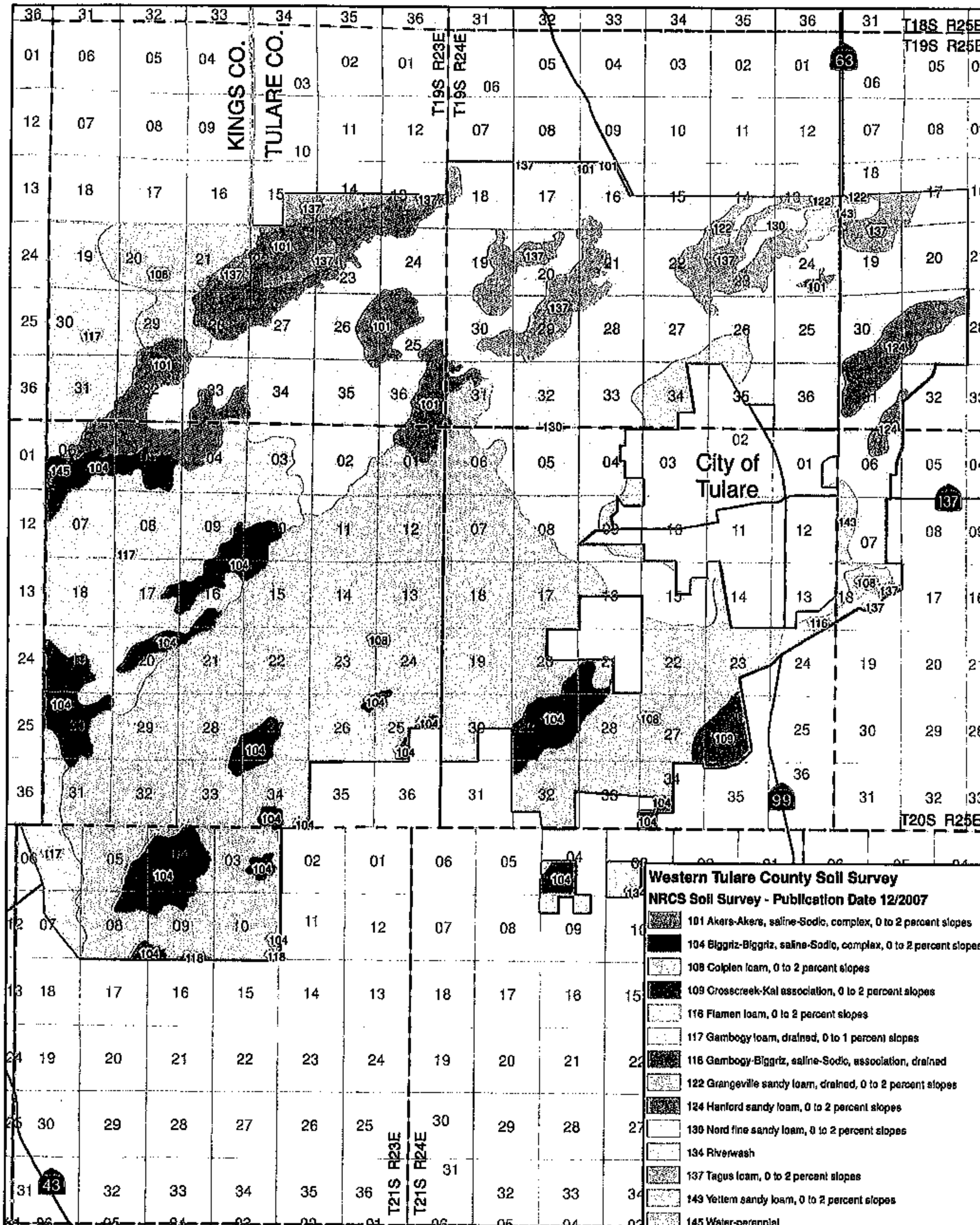
Tulare Irrigation District

Attachment 3

Neighboring Ditch and Irrigation Companies

11/30/2009 \\goose\vst_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment3_DitchCompanies.mxd



0 1 2 3 Miles

EST. 1950
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

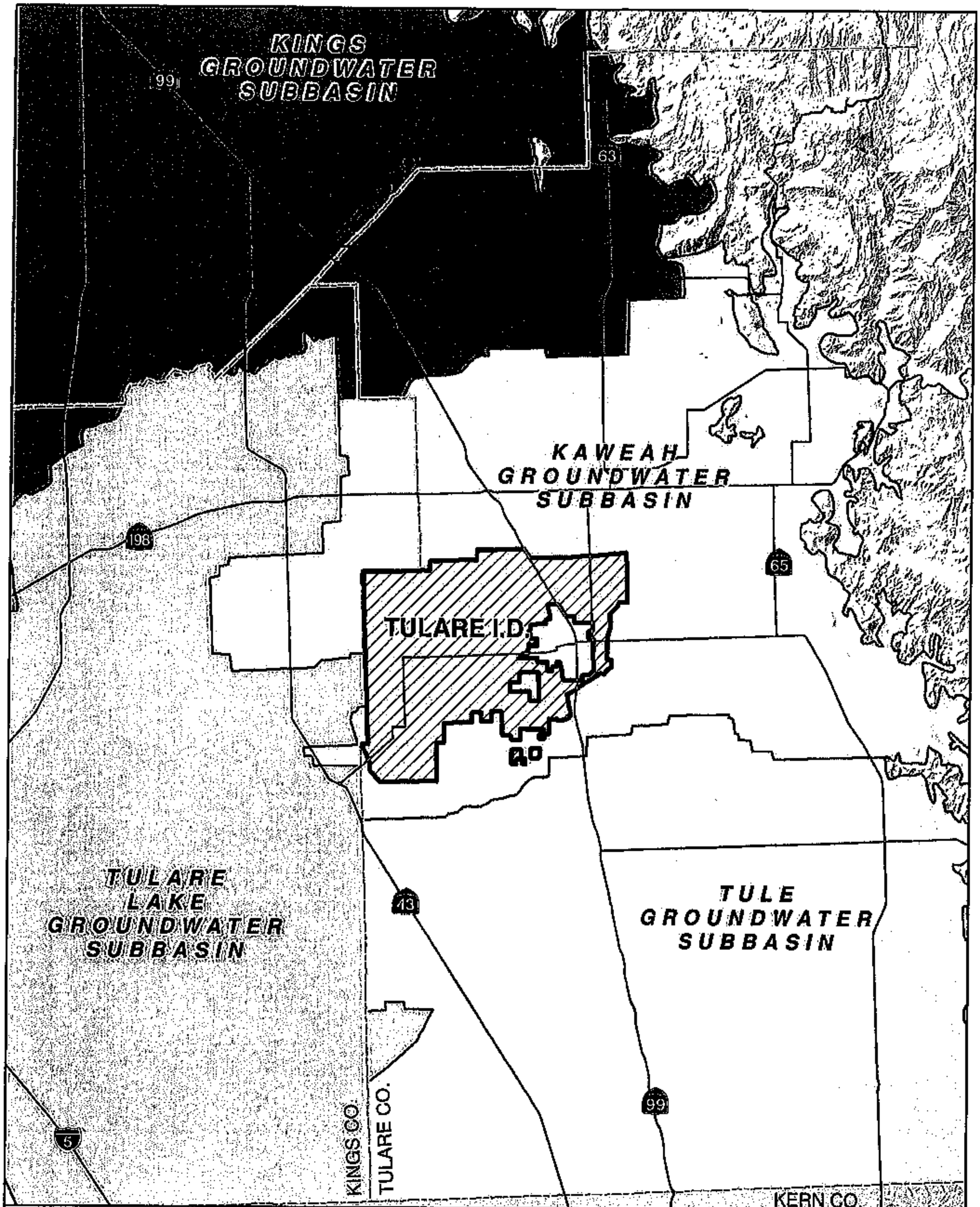
130 N. Garden Street
Visalia, CA 93291
(559) 636-1166

Tulare Irrigation District

Attachment 4

Soils

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



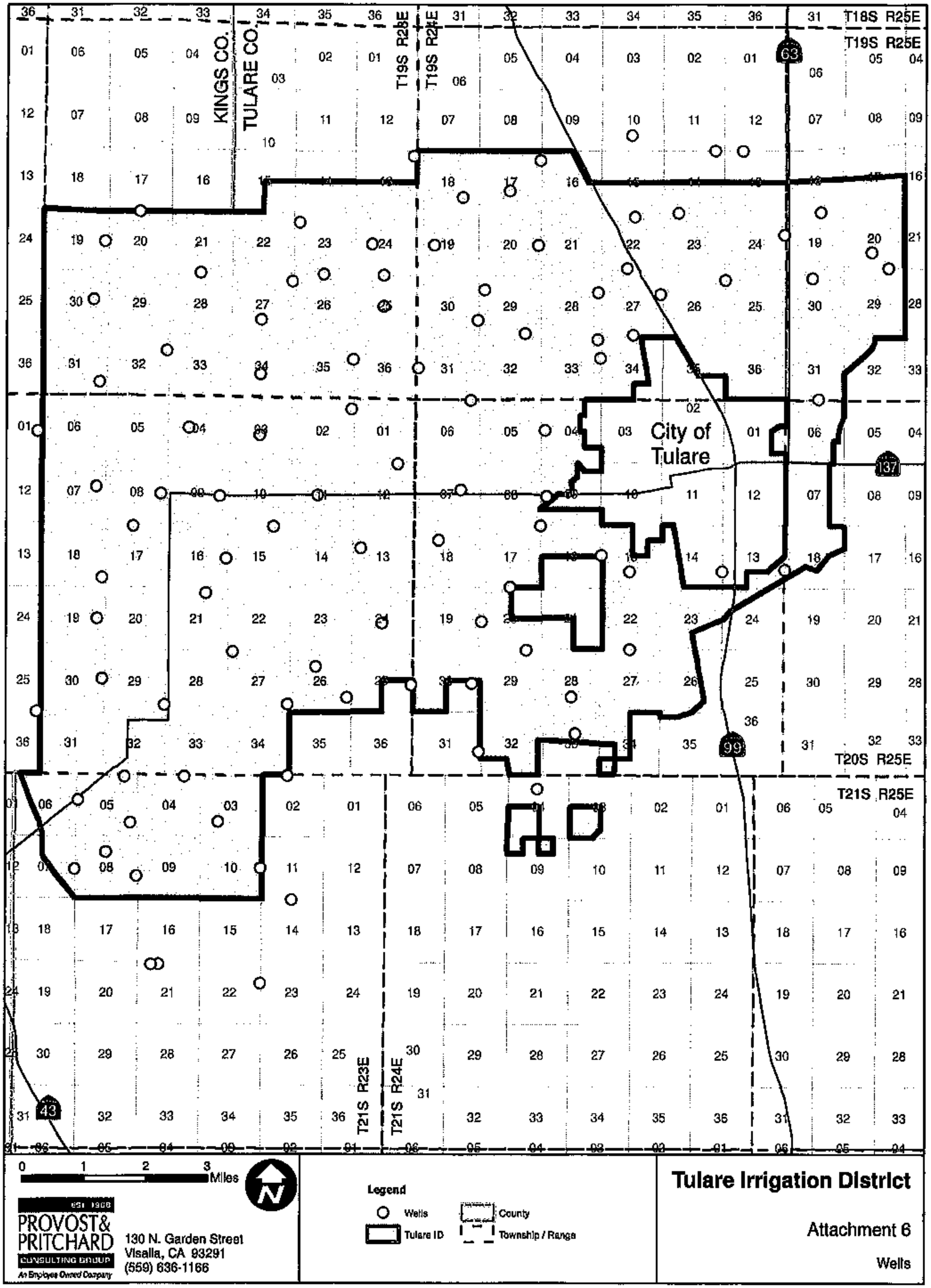
PROVOST& PRITCHARD CONSULTING GROUP
An Employee Owned Company
130 N. Garden Street
Visalia, CA 93291
(559) 636-1166

Tulare Irrigation District

Attachment 5

Groundwater Sub Basins

11/24/2009 \\goose\wsl_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment5_GWBasins.mxd



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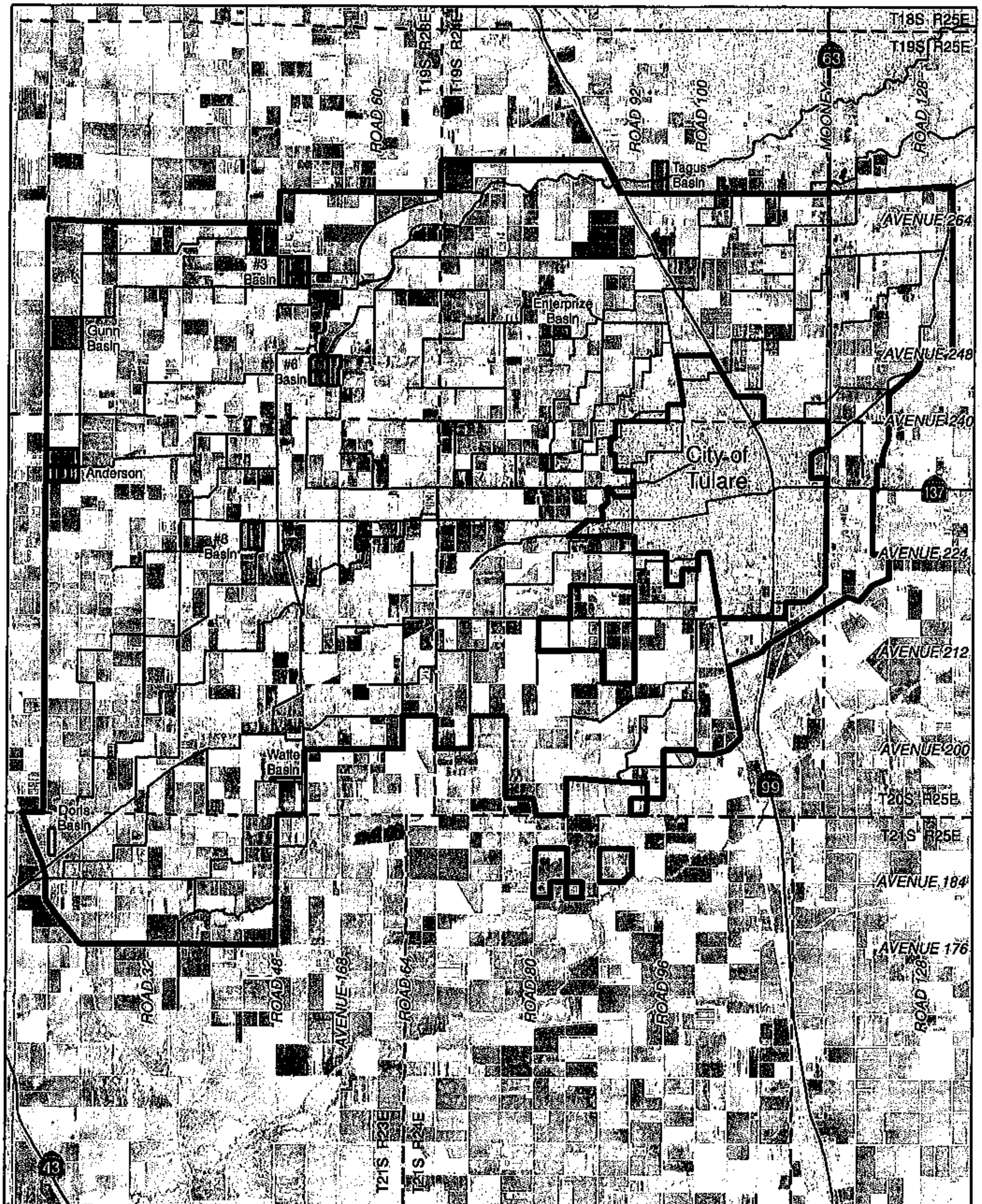


0 1 2 3 Miles

N

EST 1968
PROVOST& PRITCHARD
CONSULTING GROUP
An Employee Owned Company

130 N. Garden Street
Visalia, CA 93291
(559) 636-1166

Legend

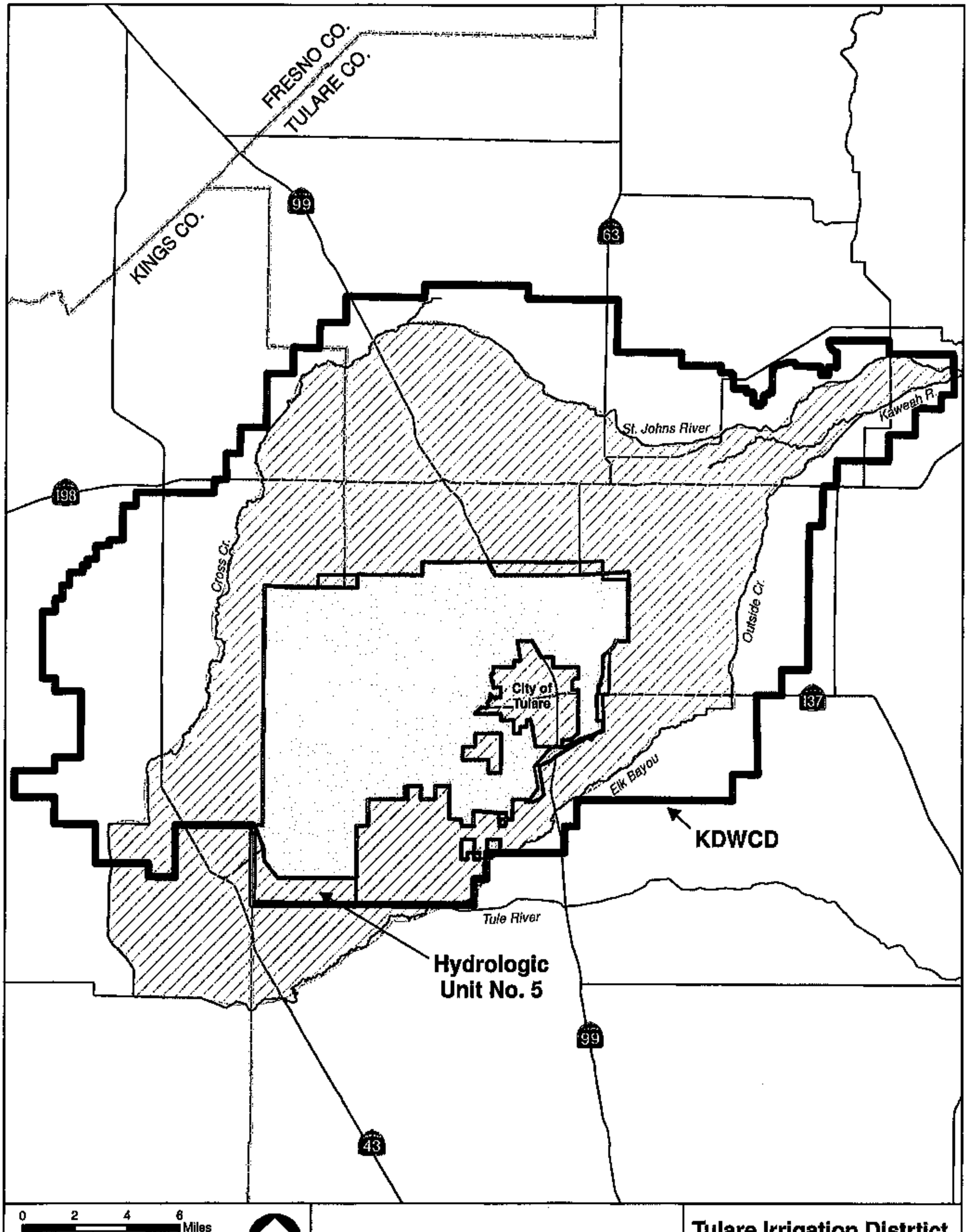
- Ditch / Stream
- Recharge Basin
- Tulare ID
- County
- Township / Range

Tulare Irrigation District

Attachment 7

Conveyance Facilities and Recharge Basins

11/24/2009 \\goose\wsi_clients\Clients\Tulare ID-1246\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment7_Facilities.mxd



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

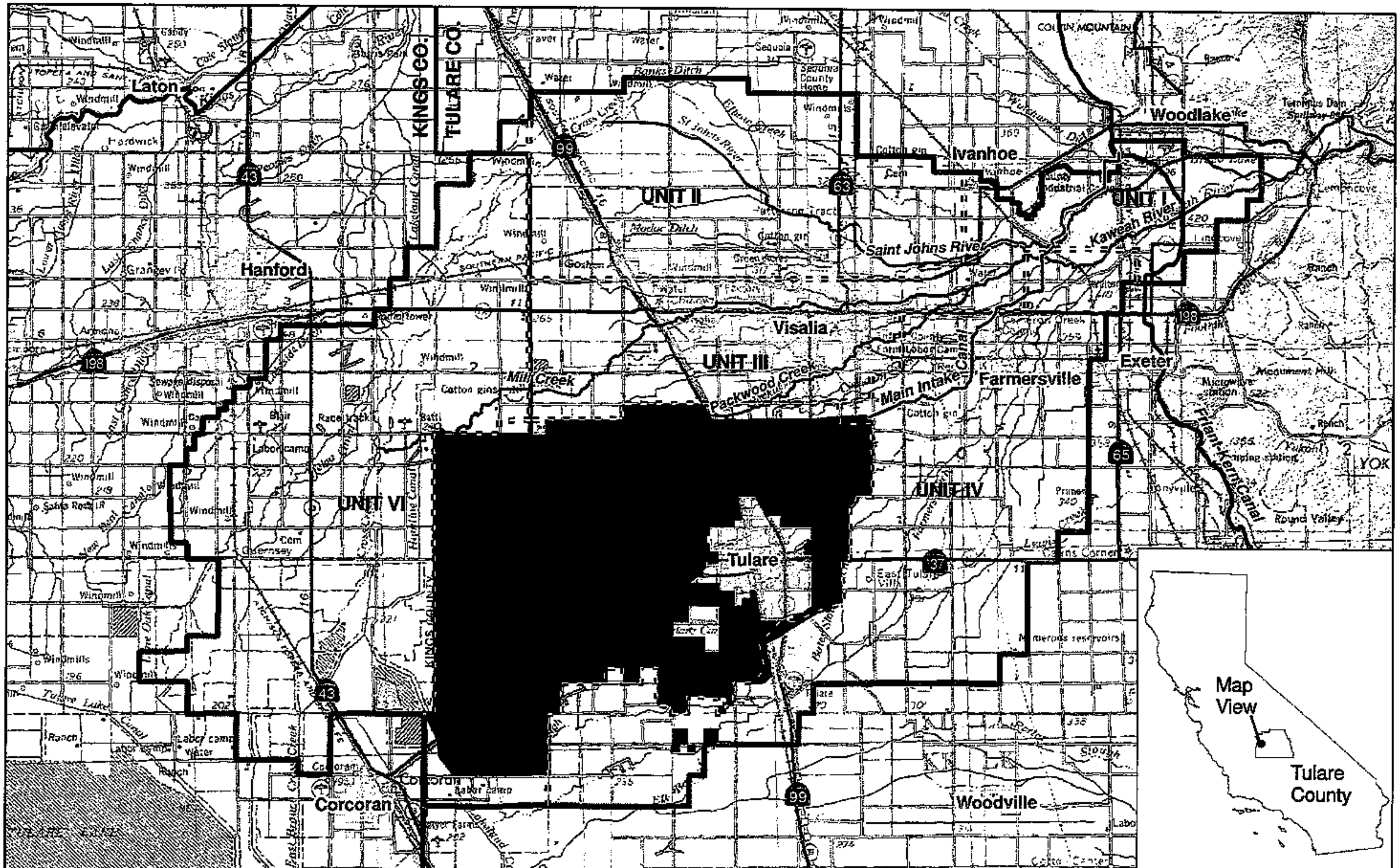
130 N. Garden Street
Visalia, CA 93291
(559) 636-1166

Tulare Irrigation Distrtict

Attachment 8

Water Management Boundaries

11/30/2009 \\goose\wl_clients\Clients\Tulare ID-1246\124609V1-Update Groundwater Management Plan\GIS\Map\Attachment8_WaterMngmntBoundaries.mxd



0 1 2 3 4 5
Miles

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

Legend

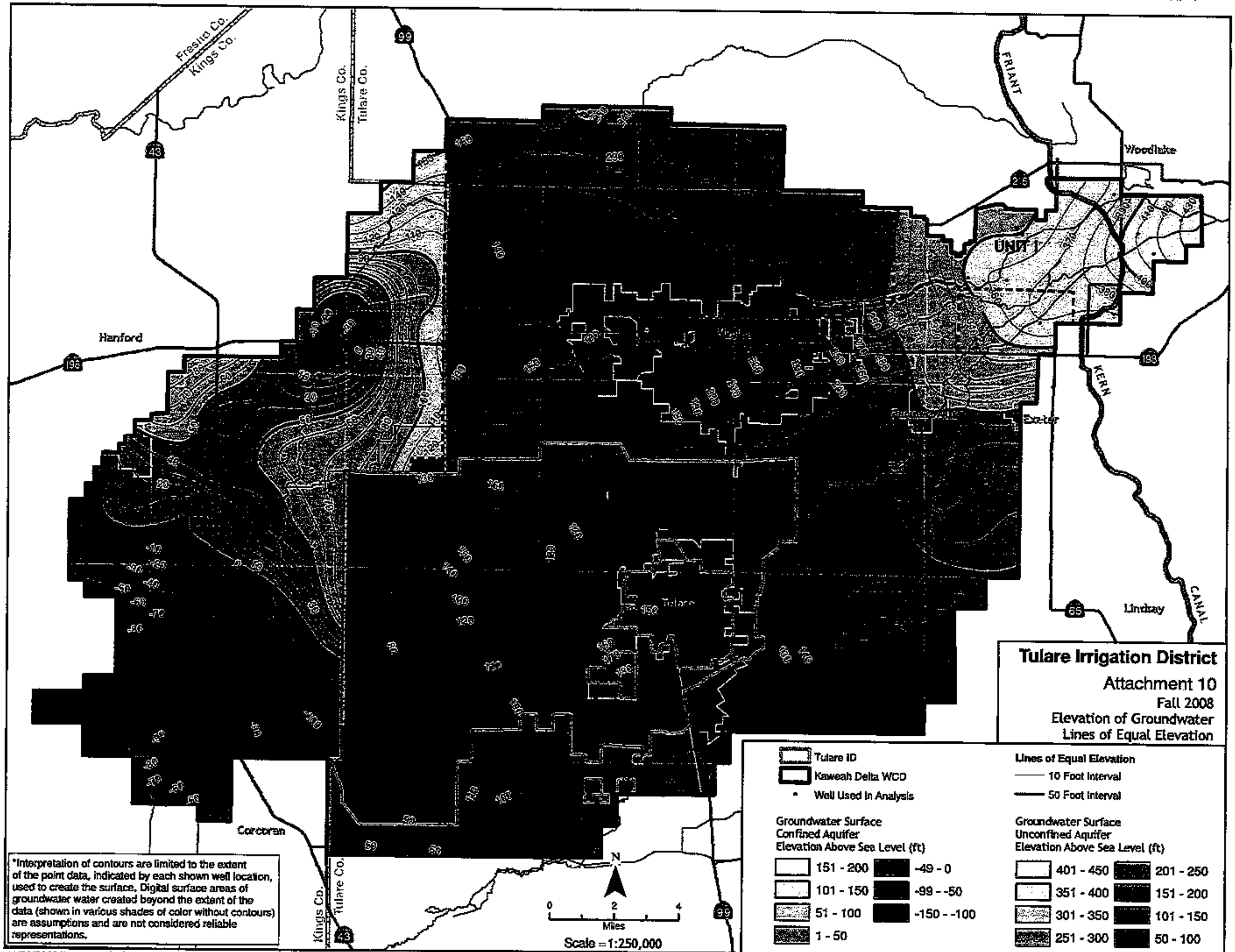
- Tulare ID
- Main Intake Canal
- Kaweah Delta WCD
- KDWCD Hydrologic Unit
- City
- County
- Major Road

Tulare Irrigation District

Attachment 9

Regional Hydrologic Units

11/24/2009 \\goose\vs_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\Attachment9_HydroUnits.mxd



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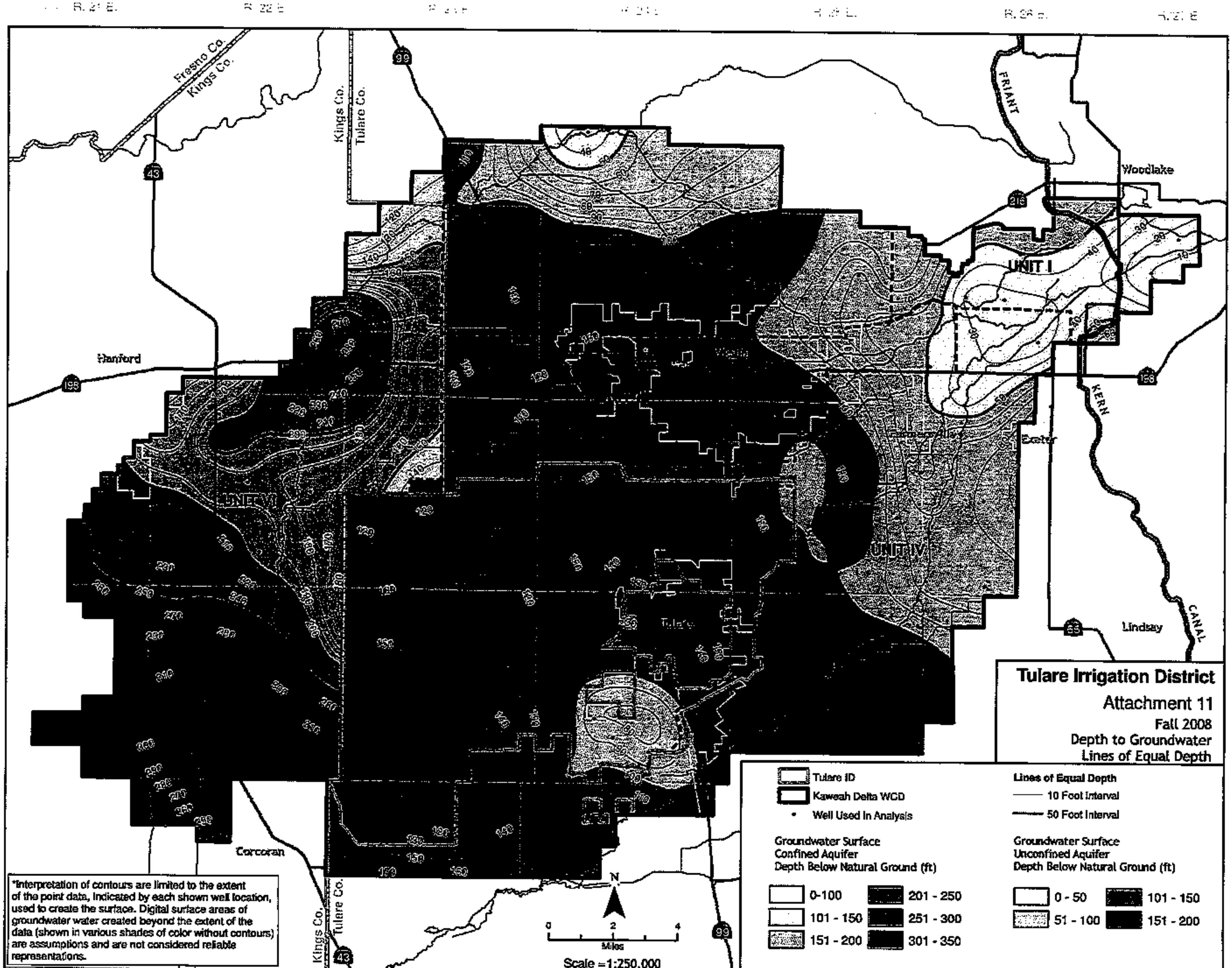

11/30/2009 \\goose\vst_clients\Clients\Tulare ID-1248\124809V1-Update Groundwater Management Plan\GIS\Map\KDWCDdtw_fall08_8x11_Aquifers.mxd

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

Table Of Contents

ATTACHMENT 14

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

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 ______________	By ______________
Title *Chairman*	Title **President**
By ______________	By ______________
Title *Secretary*	Title **General Manager**

DLR\Agrmnts\KDWCDTID\4.3.96

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 $\mathbf{V} = \pi r^2 h\ 7.48$ where **V** is the volume of one well casing of water in gallons ($1ft^3$ = 7.48 gallons); π = 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^0 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

EST. 1968
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	**TULARE IRRIGATION DISTRICT**
"CITY"	**"DISTRICT"**
By: ________ 5-7-08	By: ________ 6-10-2008
Darrel L. Pyle — Date	David G. Bixler — Date
City Manager	President, Board of Directors
Attested	
By: ________ 5-7-08	By: ________ 6/11/08
Chief Deputy City Clerk — Date	J. Paul Hendrix — Date
	General Manager
Approved as to form and content.	*Approved as to form and content.*
By: ________ 5/7/08	By: ________ 6/11/08
S.L. Kabot — Date	Alex M. Peltzer — Date
City Attorney	District Counsel

\\DHPSERVER\Data\Client Files\Tulare Irrigation District 59\1XX Administrative\104 City of Tulare Agreement Follow up\Agreement w COT re Purchase & Delivery of Water.doc

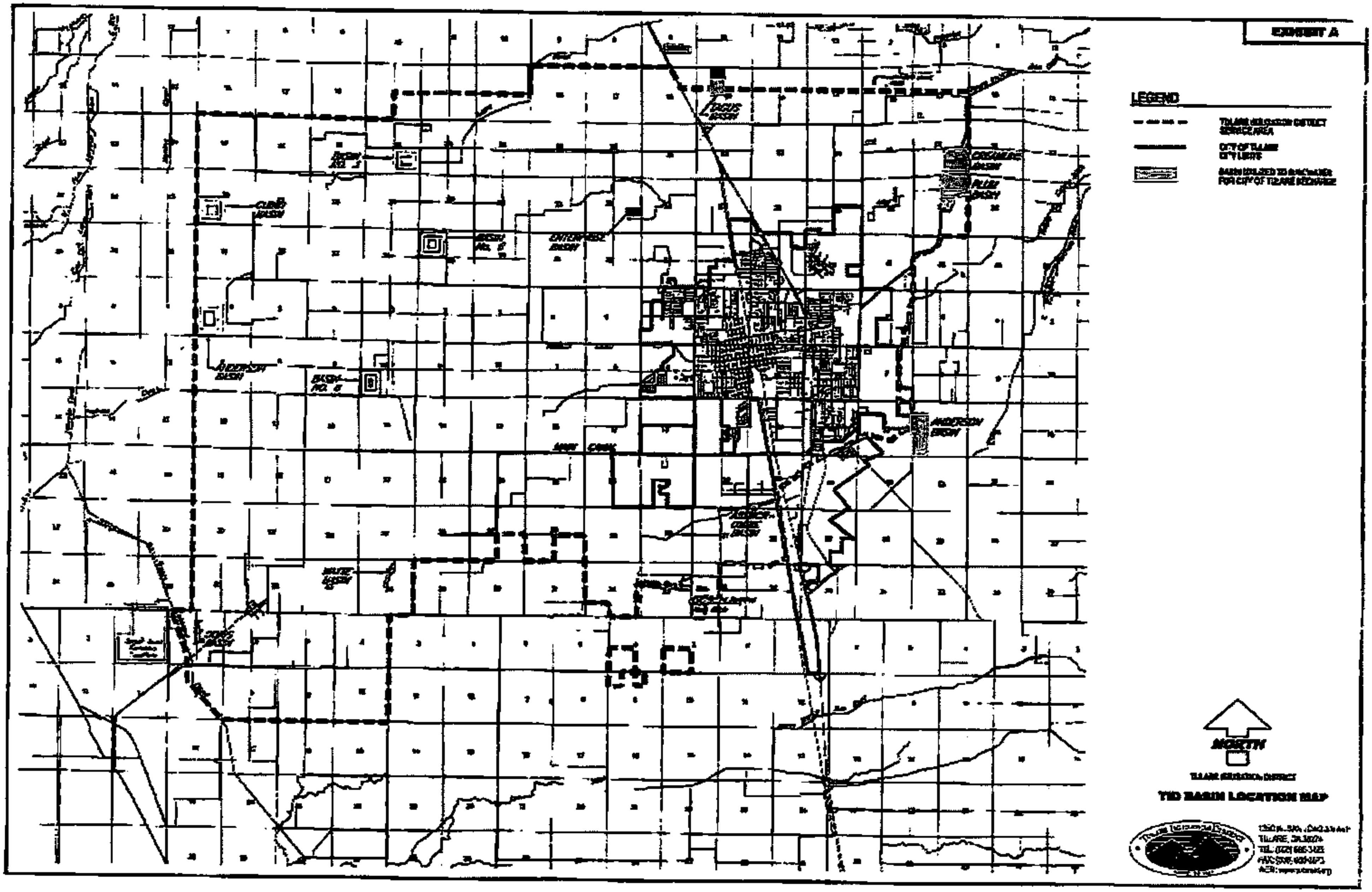
EXHIBIT A
LEGEND
ANDERSON BASIN
NORTH
TID BASIN LOCATION MAP

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]

IRRIGATION DISTRICT

[illegible]

[illegible]

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 resopnsible 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 appartus 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.

Attachment H

The District does not have a Groundwater Banking Plan. For groundwater operations and plans please see Attachment G – Groundwater Management Plan

Attachment I

The District does not produce an annual water quality report as it does not supply any municipal surface water supplies.

Attachment J

FRIANT WATER AUTHORITY

FRIANT WATERLINE

October 2010

Irrigation Tech-Line

Farm Water Efficiency

Evaluating Irrigation Systems Pays Off For Growers

Friant Water Authority / J. Randall McFarland

North West Kern Resources Conservation District General Manager Brian Hockett checks pressure in a manifold line as he evaluates micro-irrigation system uniformity.

Eastern San Joaquin Valley agriculture has spent the past two decades eagerly embracing techniques and tools for farm irrigation efficiency but that is only part of the challenge.

Keeping systems operating at peak effectiveness is an ongoing task that is not only a sound objective. It's a necessity.

FRIANT SERVICE

To help keep micro-irrigation systems and components in tip-top condition by detecting problems, Friant Division growers and others who farm in parts of the south valley have available a low-cost public service.

Brian W. Hockett, North West Kern Resource Conservation District Manager, for 23 years has been taking a mobile laboratory into valley fields to analyze efficiency of all types of irrigation systems, including flood and border strip, furrow and different types of sprinklers. He also undertakes water audits.

"Predominately, I'm looking at drip and micro-sprinklers," Hockett said. "More things go wrong in this type of system and there are more opportunities for correction." Most of those systems serve the valley's constantly expanding acreages of permanent crops.

His objective and that of the mobile lab operation "is to help growers be as efficient as possible."

Resource Conservation Districts and their programs are services of the U.S. Department of Agriculture.

EVALUATIONS

For a $100 fee charged by the district, Hockett examines and tests all parts of a grower's system, and prepares a thorough report for the farmer or farm manager – neatly bound – containing maps and data on water pressures along with problem areas and recommendations.

Under an agreement with the U.S. Bureau of Reclamation, North West Kern and Hockett provide evaluation services throughout the Central Valley Project's Friant Division.

The mobile lab made 118 on-farm

Please see **Mobile Lab**, back page

To Schedule A Mobile Lab Visit On Your Farm

Making arrangements for an in-the-field analysis of farm irrigation system efficiency is easy. Call Brian Hockett, North West Kern Resource Conservation District Manager, at (661) 336-0967, extension 138. His e-mail address is *brian.hockett@ca.nacdnet.net.*

The "mobile lab" upon which Brian Hockett and the growers he serves with irrigation system evaluation includes an off-road vehicle and a variety of measuring and related equipment housed in a district pickup truck.

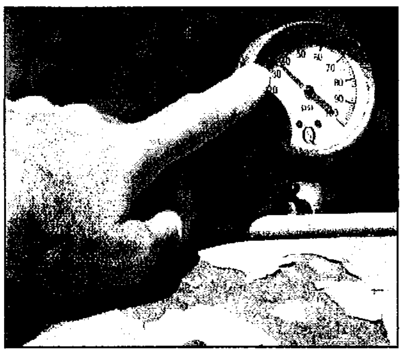
Friant Water Authority

How Each System Is Evaluated

When Brian Hockett arrives in the field with his North West Kern Resource Conservation District mobile laboratory equipment to evaluate the farm's micro-irrigation system efficiency, he follows a fairly standard procedure that leads to one goal. "We're just out there doing what we can to help growers be more efficient," said Hockett.

AT THE START

He begins at the farm's on-site water source by examining the pumping plant's filter system and, if one is in use, the reservoir that is used to store water. Reservoirs also provide an opportunity for various impurities to settle to the bottom, acting as another guard against fouling the distribution system.



Friant Water Authority

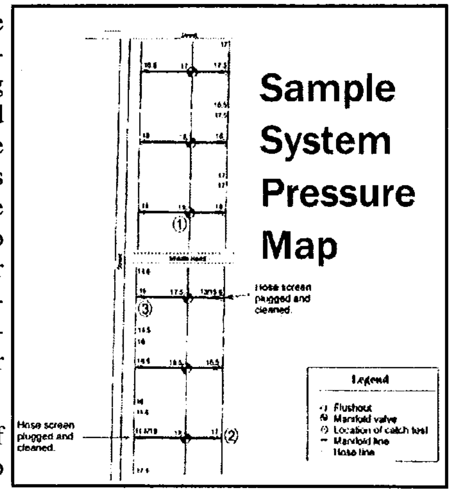
Filter system pressures are a crucial part of a micro-system evaluation.

Around the filters, Hockett checks the pressure gauges before and after the filtration process.

"This is where I start because if the filters are not performing properly, the grower is not going to get enough pressure to the field," he said.

Looking over sand media filters at an almond orchard east of Wasco in Kern County, Hockett determines the pressure of water that has passed through filtration is about two pounds lower than the head-end reading. He also watches the filters as they flush to spot any problems. Hockett determines that these filters are clean and functioning as intended.

Hockett maps the system and then begins testing, looking over each manifold and taking pressure readings at distances that increase from the filters. He takes into consideration whether the system is compensating or non-compensating for pressure fluctuations.



North West Kern Resource Conservation District

Uniformity of pressure is vital to achieve desired flow rates. "I'm checking to see that all of these manifolds are at a good pressure," Hockett said. If pressure drops below 8 pounds or less per square inch in a pressure compensating system, emitters are going to put out less water and the tree or vine will suffer.

He also tests pressure at many locations in hose lines and measures the amount of water actually being emitted throughout the field. Water is caught at locations with a high, a medium, and a low pressure to correlate changes in the flow rate with the changes in pressure. In the office, the data is plotted on a spread sheet that a computerized program will later help analyze "what we really have." A formula is applied to help determine if water distribution uniformity has been achieved.

If there are problems, a follow-up evaluation is scheduled to determine if all the necessary corrections have been made.

Mobile Lab: Irrigation Tested

Continued from front page

visits last year, with 2-5 per week made during the summer, all on a grower-request basis. Each field and system evaluation requires about 2½ - 5 hours in the field, with another two hours in the office.

"These tests ideally should be made on each system about once every five years," said Hockett.

VITAL NEED

Growers installing micro-irrigation systems or operating existing systems quickly become aware that on-going inspection and maintenance are vital to ensure water is delivered as intended to plantings.

"As micro systems like this become more prevalent and more people are keyed into it, they know what it takes," Hockett said.

Larger farm operations – many of which have their own irrigation department staffs – are generally better equipped to evaluate system efficiency along with routine inspections and maintenance than are smaller operators.

"Small farmers are doing everything," Hockett says.

No matter the size and scope of the farm, he notes that "irrigation is just one aspect of the overall farming operation but if you don't get the right amount of water on, it could have a big impact on the whole operation, because you won't be maximizing your yields."

Friant Water Authority / J. Randall McFarland

After using a catch device, Brian Hockett measures the water to help determine flow rates.

Links

Weather

- Geostationary Satellite Server
- National Weather Service
- The Weather Channel
- Jet Stream
- California Data Exchange Center
- Yahoo Weather

Other Water Agencies

- Friant Water Users Authority
- Friant Water Authority
- U.S. Bureau of Reclamation
- N.W.R.A.
- Calif. Dept. of Water Resources
- CALFED Bay-Delta Program
- San Luis & Delta Mendota W.A.
- Kaweah Delta Water Conservation District

Counties

- Tulare County
- Kings County
- Kern County
- Fresno County

Cities

- Tulare
- Visalia
- Lindsay

- Hanford
- Porterville

Education

- Cal Poly SLO I.T.R.C.
- CSU Fresno - C.A.T.I.
- Calif. Farm Water Coalition
- Wateright
- U.C. Integrated Pest Management
- Water Education Foundation
- Ag Water Management Council
- Watershare

Utilities

- Southern California Edison
- Pacific Gas & Electric Company

Government

- California Energy Commission
- Tulare County Ag. Commissioner
- Kern County Ag. Commissioner
- Kings County Ag. Commissioner

Attachment K

The District does not have a Water Order form. Water user orders are taken over the phone and documented in an order book.

Section 3

Attachment A

Attachment A

Legal Certification and Apportionment Required for Water Measurement – Lack of Legal Access to Farm-Gate

The Tulare Irrigation District (District) currently measures surface water flows within the District canal system at critical distribution points along with individual farm-gate turnouts. The District possesses various forms of easements, some in fee, to secure its canal system rights of way. Water deliveries to individual landowners are tracked on a volumetric basis and billed according to the amount of water used per month. Therefore, the District does not intend to provide aggregated farm-gate delivery values.

Documentation Requirement:

1. Certification for lack of legal access by the water supplier legal counsel (CCR §597.3(b(1)(A)).
   NOT APPLICABLE
   The District has access to all farm-gate turnouts to measure daily irrigation water usage.

2. Documentation on apportionment of volume of water delivered to customers (CCR §597.3(b(2)(C)).
   NOT APPLICABLE
   The District does not apportion water to landowners; however the District does track individual landowner consumption on a daily basis and charges landowners based upon an individual monthly volumetric rate of use.

Section 4

Attachment B

Attachment B

Engineer Certification and Apportionment Required for Water Measurement – Technically Infeasible

The Tulare Irrigation District (District) currently measures surface water irrigation supplies to landowners at the farm-gate turnout to each individual landowner. Each irrigation delivery to a landowner is measured through a flow measurement device that is utilized to bill the landowner for a volumetric rate of use on a monthly basis.

Documentation Requirement:

1. Engineer determination that accuracy standards of CCR §597.3(a) cannot be met at the farm-gate CCR §597.3(b)(1)(B) and CCR §597.3(b)(2)(B). NOT APPLICABLE
   The District currently measures each irrigation delivery at the individual landowner farm-gate turnout; therefore there is no need for the required engineering determination that said accuracy standards cannot be met.

2. Documentation on apportionment of volume of water delivered to customers as described above (Guidebook section 5.1 A.2) (CCR §597.3(b(2)(C)). NOT APPLICABLE
   The District does not deliver water on an apportionment basis, however the volumetric rate of usage by each individual landowner is determined through the daily measurement of flows through the individual farm-gate turnout.

Section 5

Attachment C

Attachment C

Description of Water Measurement Best Professional Practices

The Tulare Irrigation District (District) has historically measured irrigation deliveries to landowners at each individual farm-gate turnout and based the billings to landowners on the volume of water delivered. In order to accomplish this level of water measurement the District has utilized a system of water orders, delivery and billings that has been in place since about 1960.

District Background

The District serves surface water to approximately 67,000 irrigated acres through the utilization of approximately 300 miles of earthen canals and approximately 30 miles of pipeline. Water is delivered to landowners through approximately 535 farm-gate turnouts serving 230 customers. Each farm-gate turnout is equipped with a flow measurement device. The three main flow measurement devices utilized include:

- Meter Gate Installation (500 turnouts) (See Appendix B for a typical Meter Gate Installation)
- Propeller Meter Installation (32 turnouts)
- Mace Meter Doppler Flow Measurement (3 turnouts)

The District utilizes an established set of standards called the *Rules and Regulations Governing the Distribution of Water in the Tulare Irrigation District* to govern the request and delivery of irrigation water to landowners. The notable rules and regulations pertaining to water measurement are:

- Landowner must contact the District office or ditchtender three days before water is needed. The District makes all attempts to deliver the water within 24 hours.
- Landowners can only receive irrigation water through turnouts provided by the District.
- The District controls and maintains all structures including turnouts to deliver water to the landowner.
- District staff shall have free access at all times to irrigated lands to examine District canals and ditches and the overall flow of water therein.

The above rules assist the District in operating and maintaining an efficient water delivery and measurement system. Landowners are required to contact the District to order water ahead of their needs. The District logs and meets the requests for water deliveries based upon the order in which the request was taken. All water orders are taken by the District Watermaster, who in turn determines which order may be satisfied based on canal system flows and projected near-term changes there-to. Once these determinations have been made by the Watermaster, he relays the orders to the Ditchtenders who are able to coordinate the daily start times and stop times for turnouts. Ditchtenders open and shut farm-gate turnouts along with providing daily readings of flow metering devices. The District has implemented a digital flow logging system whereby each Ditchtender is given an electronic device that allows them to enter flow readings into an Apple iPod Touch (Data Collector) loaded with a custom application that interfaces with the District billing system. When the Ditchtender comes into the office for daily meetings the electronic devices are able to remotely upload information to the District water billing software, which is called STORM Water Accounting and Management Software. STORM tracks daily irrigation water usage by utilizing the readings taken from Ditchtenders and, on a monthly basis, generates an invoice for irrigation water specific to each landowner. Included in Appendix C is a typical monthly billing that is representative of what a landowner receives from the District.

Best Management Practices

Collection of Water Measurement Data

The District relies upon daily readings taken by Ditchtenders to record the necessary data required to determine volumetric water deliveries to landowners. Ditchtenders are required to record the beginning date and time and the stop date and time of each irrigation run at each individual farm-gate turnout. If a landowner must stop and restart his/her irrigation the Ditchtender must coordinate this with the landowner and record such data. By recording the start, stop and potential interruption dates and times, the Ditchtender is able to establish the run period (hours) that the landowner is utilizing water.

Depending on the type of water meter that is utilized at each farm-gate turnout the Ditchtender will also be required to record the daily measurement parameters. For each device the following is recorded:

- Meter Gate – Ditchtenders will start a landowner by opening his/her farm-gate turnout and note the "start" time and date on their Data Collector . The Ditchtender will not take a flow reading immediately, however will return 20-30 minutes later and take a "start" reading. The Ditchtender will record the head conditions upstream of the farm-gate turnout, downstream of the farm-gate turnout and the gate position and input these variables into the Data Collector. While the landowner is running, which averages approximately 4-5 days per irrigation, the Ditchtender will inspect the farm-gate turnout at minimum once a day and record the date, time, head upstream and downstream of the farm-gate turnout, and gate position in the Data Collector. When the irrigation has completed the Ditchtender is notified by the landowner or the Watermaster and the Ditchtender will close the farm-gate turnout and record the date and time in the Data Collector. All information that is collected is converted from input variables into the volumetric rate of use. Each day as the Ditchtender visits the office to attend meetings, held by the Watermaster, the information that is logged in the Data Collector is uploaded to a dedicated server in the District office that houses STORM.
- Propeller Meter - Ditchtenders will start a landowner by opening his/her farm-gate turnout gate and noting the "start" time and date on their Data Collector. The Ditchtender will also note the meter reading at the time of "start." The Ditchtender then inspects the farm-gate turnout and takes a date, time and meter reading once a day until the landowner has completed his/her irrigation. Once complete the Ditchtender closes the farm-gate turnout and records the stop time and date in the Data Collector. All information that is collected is converted from input variables into a volumetric rate of use. Each day as the Ditchtender attends office meetings, held by the Watermaster, the information that is logged in the Data Collector is uploaded to a dedicated server in the District office that houses STORM.
- Mace Meter - Ditchtenders will start a landowner by opening his/her turnout gate and noting the "start" time and date on their Data Collector. The Ditchtender will also note the meter reading at the time of "start." The Ditchtender then inspects the farm-gate turnout and takes a date, time and meter reading once a day until the landowner has completed his/her irrigation. Once complete the Ditchtender closes the farm-gate turnout and records the stop time and date in the Data Collector. All information that is collected is converted from input variables into a volumetric rate of use each day when the Ditchtender attends office meetings, held by the Watermaster, the information that is

logged in the Data Collector is uploaded to a dedicated server in the District office that houses STORM.

Frequency of Reading

The District has a long-established policy of reading canal levels, meter gates and flow meters once a day. The District employs 7 ditchtenders to control and monitor flows within its conveyance system and to deliver irrigation water to the previously-cited 535 farm-gate turnouts. Each Ditchtender manages a separate portion of the District's 67,000-acre service area called "irrigation runs."

The District has long-determined that its practice of daily instantaneous meter readings is adequate to capture volumetric deliveries over a 24-hour period. This information is brought to the daily Watermaster meetings and turnout measurement data is fed into STORM as previous described. Supporting this approach is a study conducted by the Irrigation Training & Research Center at the California Polytechnic State University, San Luis Obispo, which evaluated the accuracy impact of reading flow rates once per day versus more frequently. The report, which was titled SBx7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts, found that for districts such as Tulare Irrigation District, which can operate to serve approximately 10 farm irrigation cycles per season, the estimate of annual volumetric error due to fluctuations in canal water levels is approximately +/- 0.5%. This represents a fairly small incremental error that could only be reduced by investing a great deal of money and time to increase the frequency of flow readings to more closely capture any fluctuations in the canal levels.

Method for Determining Irrigated Acres

The District has historically maintained a detailed crop survey that allows the District to determine the irrigated acreage in the District. Each year the District conducts two visual crop surveys throughout the District to identify crops that are being grown. District employees log each parcel and field within the District and regress the information into a database and map to reflect the acreages of each crop within the District. A sample of the information is provided as Appendix A.

Quality Control and Quality Assurance Plan

The District currently utilizes multiple levels of quality control and assurance measures to assure the reliability of data and calculations utilized to determine the volumetric rate of water delivered to a farmer is accurate. Measures implemented include:

- Ditchtenders are trained by the Watermaster prior to being deployed into the Water Department. Often an employee will shadow a veteran Ditchtender prior to being utilized as a full-time Ditchtender. The principles of water measurement along with the critical components required to take an accurate reading are reviewed with the employee prior to any duty as a Ditchtender.
- Readings that are taken by Ditchtenders in the field are entered into electronic recording devices and uploaded to the District water billing software called STORM. The District had historically utilized hand-written records that were delivered to the office and inputted into computers for billing purposes. The Data Collectors utilized today allow the District to minimize the potential for errors in interpreting hand-written notes and mistyped values in the computer system.
- Once the information is uploaded into STORM the Watermaster reviews the daily water deliveries to ensure conformity between what is being ordered by landowners and what is being delivered.
- Each month when bills are printed, another verification that water deliveries are in conformance with what is ordered and what is delivered is made before billings are sent out to landowners.
- The last level of quality assurance resides with the landowner, who can request that the District audit their billing to ensure that the appropriate amount of water is being delivered and billed.

Section 6

Attachment D

Attachment D

Documentation of Water Measurement Conversion to Volume

The District utilizes different methods for measuring volumetric flow rates delivered to landowners, therefore this document shall discuss each calculation of volumetric flow rate separately.

Meter Gate Measurements

A majority of the District turnouts are measured through a Meter Gate for flow measurement. A diagram of the method for measurement is provided in Appendix B. In taking this measurement, the gate opening is determined by measuring the height of the gate stem above the gate wheel and the change in hydraulic head across the meter gate is determined by measuring the height of water in the upstream stilling well and the downstream stilling well (collectively called the meter gate parameters). Meter gate parameters and the standard discharge rating tables are used to determine the instantaneous flow rate in cubic feet per second (CFS). The rating table included as Appendix D is a sample of the typical rating table that is utilized to determine the instantaneous flow rate.

Once the farm-gate turnout is opened the Ditchtender records the time and date of the "start" on a hand-held digital device (Apple Touch device that has a special application that works with the District billing system STORM). Measurements are taken every 24-hours and each reading that is taken by the Ditchtender records the date, time and meter gate parameters. When the farmer has completed with his/her irrigation the Ditchtender records the "stop" date and time.

The STORM billing system that the District utilizes takes the individual recordings and multiplies the instantaneous flow reading, which is in units of cubic feet per second, by the time period between readings and a conversion constant. The equation utilized is:

$$\text{Volume} = \text{flow} \times \text{time} \times 1.9837$$

Volume is in acre-feet/day

Flow is in cubic feet per second

Time is in hours

Propeller Meters / Mace Meters

A limited number of farm-gate turnouts within the District are equipped with Propeller Meters or Mace meters that utilize the flow across a propeller or sensor to calculate the flow and volumetric rate of water. Typically these meters will read in cubic feet per second on an instantaneous basis and totalize flow in acre-feet. On a limited number of meters the readout will have flow in gallons per minute and totalize in gallons. In these instances the District uses unit conversions to yield cubic feet per second and acre-feet. In order for the District to determine the volumetric rate delivered to farmers Ditchtenders will read the totalizing meter reading when the irrigation begins, in increments of 24-hours thereafter, and when the irrigation stops. The volumetric rate utilized to bill the landowner is:

$$\text{Volume} = \text{Start Meter Reading} - \text{Stop Meter Reading}$$

Section 7

Attachment E

Attachment E

Device Corrective Action Plan

The Tulare Irrigation District (District) has a long history of measuring individual farm-gate deliveries to each landowner and the utilization of volumetric billing rates to each landowner. The District has a contract with the United States Bureau of Reclamation for a water supply from the Friant Unit of the Central Valley Project and, as such, complies with the water delivery and measurement requirements as originally established in the Reclamation Reform Act of 1982 and its water management plan criteria. The District typically utilizes a meter gate installation to take readings on a daily basis. A meter gate allows the District to measure the upstream water level (head) conditions and the downstream water level conditions, and with the gate position the District can determine the instantaneous flow rate through the canal gate. A discussion of the methods used in determining the volumetric rate of deliveries can be found in Attachment C.

The District is aware of the the SB 7x-7 regulations and associated implementation timetable. However, given the very dry year combined with the delayed release of the Agricultural Water Measurement Regulations (Regulations) passed in July 2012, the District has been unable to perform the initial Accuracy Certification per the Regulations. Although the District has been unable the complete this feature the District is proposing to implement an Agricultural Water Measurement Master Plan (Master Plan), which will contain details on the initial certification of existing water measurement devices and any corrective actions that will need to be taken. The Master Plan will also contain a Schedule, Budget and Finance Plan to accomplish the tasks set forth in the Master Plan. The Master Plan is attached in Appendix E.

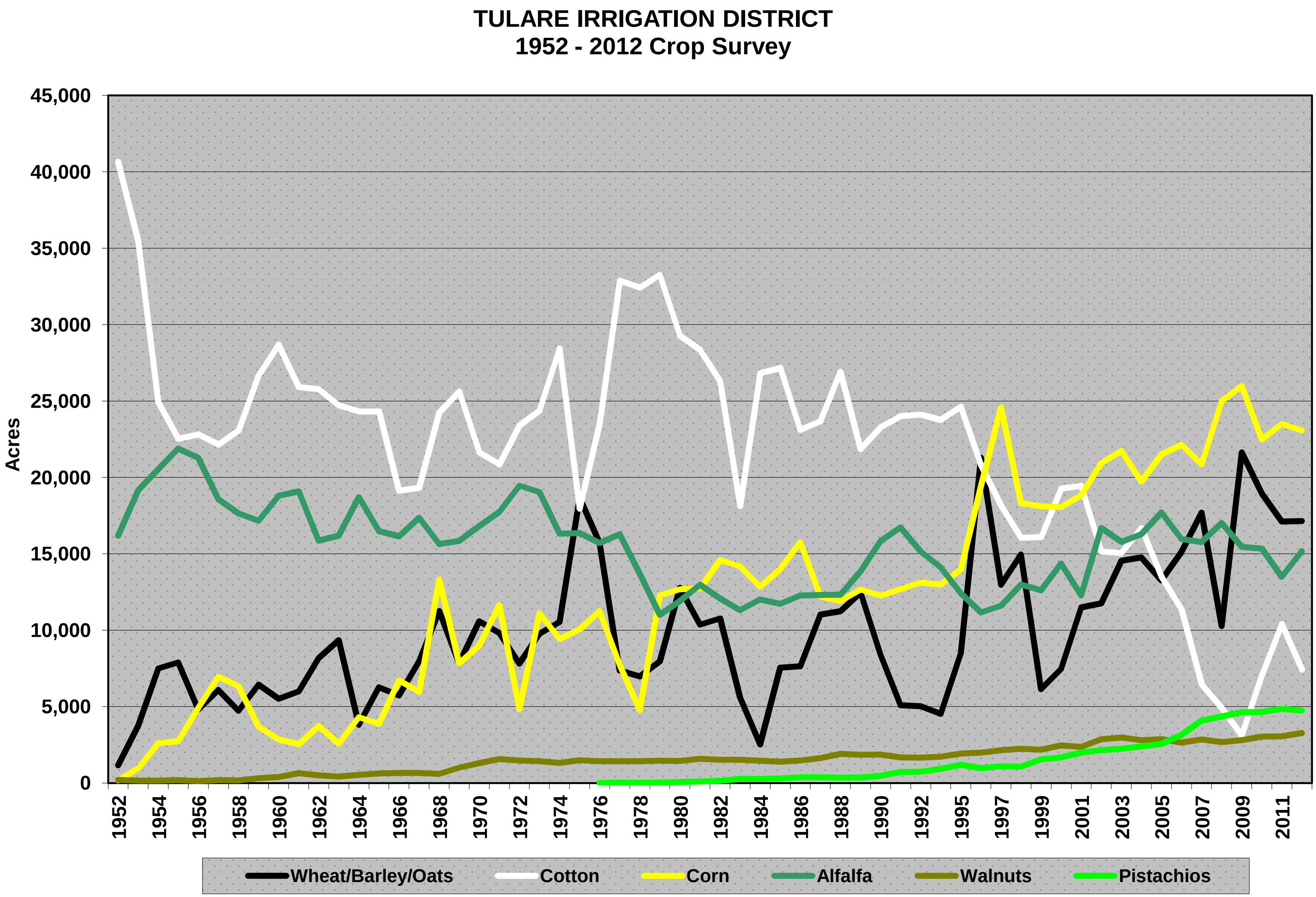
Section 8

District Crop Survey

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Crop	Acres	Price	Unit	Yield
Native Pasture	520			
Alfalfa	13366			
Milo Maize	147			
Field Corn	7894			
Wheat	17142			
Field Peas	1720			
Strawberries	2			
Bush Berries	97			
Lettuce	40			
Cauliflower	10			
Pomegranites	4			
Cherries	212			
Olives	72			
Plums	120			
Persimmons	8			
Peaches	7			
Oranges	40			
Table Grapes	179			
Raisin Grapes	209			
Wine Grapes	231			
Cotton	7121			
Fallow	426			
No Crop	261			
Almonds	1291			
Pears	10			
Walnuts	3278			
Pistachios	4753			
Nursery	156			
Non-Ag Land	3022			
Farmstead	2975			
Commercial	478			
Wast & Misc.	225			
Residential	1144			
Total	67,160	0	0	0



TULARE IRRIGATION DISTRICT
1952 - 2012 Crop Survey
Acres
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1995
1997
1999
2001
2003
2005
2007
2009
2011
Wheat/Barley/Oats
Cotton
Corn
Alfalfa
Walnuts
Pistachios

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 23 E.

Section

Crop	13	14	15	19	20	21	22	23	24	25	Total
Alfalfa	82	114		340	157	201				51	945
Field Corn	26	163	78	258			197	180	149	135	1186
Wheat	94		77	80	86	322		299	145	79	1182
Field Peas							76			79	155
Tomatoes											0
Cotton	45				123	80			132	151	531
Fallow											0
Walnuts										122	122
Pistachios	32				237		37		169		475
Non-Ag Land	21				14	15	156	30	38	11	285
Comercial											0
Farmstead	9	34		1	14	2	156	121	9	2	348
Residential					3	9				6	18
Waste & Misc											0
											0
											0
											0
											0
Section Totals	309	311	155	679	634	629	622	630	642	636	5247

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 23 E.

Section

Crop	26	27	28	29	30	31	32	33	34	35	Total
											0
Native Pasture		9									9
Alfalfa		156	318	70	336	164	184	149	186	70	1633
Milo Maize										35	35
Field Corn	187				158			100	70	249	764
Wheat	272	194	229	400		247	175	101	40		1658
Field Peas									225		225
Cherries						39					39
Olives						52					52
Wine Grapes						138					138
Cotton	87	156					130	159		76	608
No Crop											0
Idle Crop											0
Almonds								88		34	122
Walnuts		70									70
Pistachios									79		79
Non-Ag Land	27	11	4	3	171	21	9	15	32	166	459
Farmstead	61	16	65	143	5	4	132	16		1	443
Wast & Misc.	2		3			1	6	5	1		18
Residential	1	12	2			3	1	5	9	5	38
Commercial								1			1
											0
Section Totals	637	624	621	616	670	669	637	639	642	636	6391

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 23 E.

Section

Crop	36										Total
											0
Alfalfa											0
Field Corn	112										112
Wheat	144										144
Field Peas	34										34
Onions											0
Cotton	237										237
Almonds	40										40
Pistachios	35										35
Farmstead	22										22
Residential	6										6
											0
Section Totals	630	0	0	0	0	0	0	0	0	0	630

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 24 E.

Section

Crop	13	14	15	16	17	18	19	20	21	22	Total
Alfalfa		61		164	292	138	135	384	198		1372
Field Corn				147	248	378	10	150		14	947
Wheat	222	165		125	105	127	347	38	198	262	1589
Field Peas											0
Cotton											0
Cherries			48	20							68
Fallow			6								6
Wine Grapes										93	93
Walnuts	35	66	66					39	238	204	648
Pistachios			70								70
Nursery			102								102
Non-Ag Land	4	20		28	5	11	29	30	9	51	187
Farmstead	22	4	2	23			128		1	1	181
Commercial			23	3				1			27
Wast & Misc.							4			10	14
Residential	36	3	3	6			3	7	1	7	66
											0
											0
Section Totals	319	319	320	516	650	654	656	649	645	642	5370

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 24 E.

Section

Crop	23	24	25	26	27	28	29	30	31	32	Total
											0
Native Pasture		15	24		25		11			10	85
Alfalfa	154						119	270	84	212	839
Milo Maize							37				37
Field Corn	34		214	165	59	43	19	98	79	27	738
Wheat	280			67	92	229	80	241	40	299	1328
Field Peas	30	30		51	55						166
Onions											0
Plums		14									14
Table Grapes		95									95
Wine Grapes					16						16
Cotton	37	36				65	92		144		374
Fallow			9								9
No Crop			40	108	39						187
Almonds		103							180	39	322
Walnuts	34	260	129	150	171	250	77			7	1078
Pistachios				37	2	13	40		45		137
Nursery		17									17
Non-Ag Land	10	25	20	16	52	5	59	16	45	8	256
Farmstead	49	27	9	22		15	89	16	18	19	264
Commercial			14	12	67	6					99
Wast & Misc.			8	7	4	1	1	1	4		26
Residential	11	14	14	4	12	9	15	1		12	92
Section Totals	639	636	481	639	594	636	639	643	639	633	6179

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 24 E.

Section

Crop	33	34	35	36							Total
											0
Native Pasture	60	107		0							167
Alfalfa				0							0
Field Corn	203	10		0							213
Wheat		7	15	0							22
Field Peas	43	34		0							77
Cherries	6			0							6
Cotton	80	36		0							116
Fallow		33	129	0							162
No Crop				0							0
Walnuts	96	8	18	0							122
Pistachios	30	24		0							54
Nursery		8		0							8
Non-Ag Land	38	97	25	0							160
Commercial			83	0							83
Farmstead	8	4	2	0							14
Wast & Misc.	1	1	1	0							3
Residential	40	12	3	0							55
											0
											0
Section Totals	605	381	276	0	0	0	0	0	0	0	1262

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 19 S. Range: 25 E.

Section

Crop	17	18	19	20	29	30	31	32			Total
											0
Ladino Clover						15					15
Sudan Grass			19								19
Native Pasture		49					28				77
Alfalfa			60			76	118				254
Field Corn	81		149	102			126				458
Wheat			38		25	262	236				561
Cotton											0
Bush Berries								40			40
Olives			20								20
Plums			84		22						106
Pears					10						10
Persimmons						8					8
Oranges						40					40
Table Grapes								84			84
Raisin Grapes			140								140
Fallow	15				56						71
No Crop											0
Pecans											0
Walnuts	191	161	10	336	335	109	5				1147
Pistachios											0
Nursery											0
Non-Ag Land	13	6	14	185	200	12	13	2			445
Farmstead	3					54	16				73
Commercial		44	18		6	17	8				93
Wast & Misc.			1				7				8
Residential	4	38	52	13	4	17	34	2			164
						10					
Section Totals	307	298	605	636	658	620	591	128	0	0	3833

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 23 E.

Section

Crop	1	2	3	4	5	6	7	8	9	10	Total
											0
Native Pasture				22				39			61
Alfalfa		154	221	268	370	80	95		292	83	1563
Field Corn	80	120	18		77				40	105	440
Wheat	57	137	109	132	202	248	269	318	266	78	1816
Field Peas	70	38	67								175
Cauliflower										10	10
Lettuce								40			40
Onions											0
Cherries						40					40
Cotton	426	152	163	135				55		36	967
No Crop											0
Almonds				13							13
Pistachios			50			120	273	140		65	648
Non-Ag Land	15	13	8	28	9	196	22	2	12	151	456
Farmstead	12	46	34	42	5		22	42	18	66	287
Commercial									13	15	28
Wast & Misc.		2		18	4		5	1		1	31
Residential	6	11	7	9	1			13	8	54	109
											0
											0
Section Totals	666	673	677	667	668	684	686	650	649	664	6684

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 23 E.

Section

Crop	11	12	13	14	15	16	17	18	19	20	Total
Native Pasture											0
Alfalfa		118	137		75	254	130		171	246	1131
Milo Maize				23							23
Field Corn	39	198	96	37			36				406
Wheat	161	113	220	350	140	198	281	586	395	341	2785
Field Peas					42						42
Onions											0
Cherries	25										25
Cotton	76		57	161	164	38	31				527
No Crop			59								59
Almonds			38	36	46						120
Pistachios	311	103			117	39	106				676
Non-Ag Land	18	29	18	3	39	16	39	23	17	2	204
Farmstead	12	70	8	40	26	2		47	77	35	317
Commercial						74					74
Wast & Misc.	3	4				16		5	5		33
Residential	4	7	5	2	2	3	13			2	38
											0
Section Totals	649	642	638	652	651	640	636	661	665	626	6460

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 23 E.

Section

Crop	21	22	23	24	25	26	27	28	29	30	Total
											0
Native Pasture							5				5
Alfalfa	92	174	37	46	187	9	422	98	266	235	1566
Milo Maze											0
Field Corn	37	39		73	99		99		53	38	438
Wheat	151	140	275	147	41	166		102	90	286	1398
Field Peas				137	38	35		25	143		378
Lettuce											0
Cherries		20									20
Cotton	171	118	117	94	78	90		207			875
No Crop					15						15
Almonds		39									39
Walnuts											0
Pistachios	152	72	178	86		313	66	156		39	1062
Non-Ag Land	9	22	16	19	14	6	14	26	10	12	148
Farmstead	25	8	11	28	6	11	20	14	56	48	227
Wast & Misc.				3	1	4		3			11
Residential	7	7	10	9	4	4	2	6	4	1	54
											0
											0
Section Totals	644	639	644	642	483	638	628	637	622	659	6236

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 23 E.

Section

Crop	31	32	33	34							Total
											0
Native Pasture		13									13
Alfalfa	235	102	162	199							698
Milo Maize	25	27									52
Field Corn		15		44							59
Wheat	214	268	426	246							1154
Cotton	76			106							182
Fallow											0
Pistachios	77	30	29								136
Non-Ag Land	6	18	13	21							58
Farmstead	16	106	2	4							128
Wast & Misc.		10	3	3							16
Residential	9	27		3							39
											0
Section Totals	658	616	635	626	0	0	0	0	0	0	2535

2012 Crop Survey Report
Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 24 E.

Section

Crop	1	2	3	4	5	6	7	8	9	12	Total
											0
Native Pasture					42		15				57
Alfalfa				88	117	251		102			558
Field Corn				32	49		74	233	12		400
Wheat					18	131	70		20		239
Field Peas							85	42	69		196
Cotton					147	162	157	79			545
Fallow											0
Almonds					25			115	39		179
Walnuts					75						75
Pistachios					52	88	228				368
Nursery				29							29
Non-Ag Land				12	42	22	11	31	7		125
Farmstead				4	45	18	35	15	6		123
Commercial						1		12	4		17
Wast & Misc.					3			1			4
Residential				3	38	9	8	6	64		128
											0
Section Totals	0	0	0	168	653	682	683	636	221	0	3043

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 24 E.

Section

Crop	13	14	15	16	17	18	19	20	21	22	Total
											0
Native Pasture			8								8
Alfalfa			38		72	95	86		57	81	429
Field Corn			187	39	38	51		138		45	498
Wheat		141	67		126	263	460	34		85	1176
Field Peas				151						55	206
Cherries				14							14
Raisin Grapes			69								69
Cotton					245	238		131		102	716
Fallow		6									6
Almonds				111							111
Pistachios					123					151	274
Non-Ag Land			3		20	20	33	11	1	9	97
Farmstead			3		4	8	104		6		125
Commercial		6	3		8					16	33
Wast & Misc.		1					2				3
Residential		1	13	4	2	7	7	8	6	80	128
											0
Section Totals	0	155	391	319	638	682	692	322	70	624	3893

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 24 E.

Section

Crop	23	26	27	28	29	30	32	33	34		Total
											0
Alfalfa	11	46	56	191	406	182	8	7	77		984
Field Corn	40	118	164	232	71	171		124	113		1033
Wheat	72		27								99
Field Peas						66					66
Cotton		198	317	193	160	79		66			1013
Fallow	133										133
Almonds							345				345
Pistachios							177	80	38		295
Non-Ag Land	24	6	34	4	2		5	2			77
Farmstead	28	14	16	5		23		8	3		97
Commercial	18										18
Wast & Misc.	8	1		1	3		2	7	1		23
Residential	46		28						10		84
											0
Section Totals	380	383	642	626	642	521	537	294	242	0	4267

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 20 S. Range: 25 E.

Section

Crop	6	7	18								Total
Native Pasture			38								38
Alfalfa			120								120
Field Corn											0
Wheat	85										85
Bush Berries	57										57
Strawberries			2								2
Peaches			7								7
Plums											0
Table Grapes											0
Cotton											0
Fallow											0
Walnuts			16								16
Non-Ag Land	4										4
Farmstead			5								5
Commercial											0
Wast & Misc.	2										2
Residential	65		3								68
											0
											0
Section Totals	213	0	191	0	0	0	0	0	0	0	404

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 21 S. Range: 23 E.

Section

Crop	3	4	5	6	7	8	9	10			Total
Native Pasture											0
Alfalfa	252	375	34	47		39	177	233			1157
Field Corn	26		34				62	80			202
Wheat	152	238	78	136	50	520	386	306			1866
Pomegranates				4							4
Lettuce											0
Cotton	119		111	54		74					358
Fallow			39								39
No Crops											0
Pistachios	49		238	157							444
Non-Ag Land	11	5	3	3	6	7		20			55
Farmstead	12	14	55	59	147	6	24				317
Commercial			5								5
Wast & Misc.			2		26	3		2			33
Residential	5	2	37	12			1				57
											0
											0
Section Totals	626	634	636	472	229	649	650	641	0	0	4537

2012 Crop Survey Report

Form One, Acreage
Field Statistics

DISTRICT: Tulare Irrigation District (1st Rnd)

Township: 21 S. Range: 24 E.

Section

Crop	3	4	9								Total
											0
Alfalfa	77		40								117
Field Corn											0
Wheat			40								40
Cotton	72										72
Non-Ag Land	6										6
Farmstead	4										4
Wast & Misc.											0
Residential											0
											0
Section Totals	159	0	80	0	0	0	0	0	0	0	239

Section 9

Typical Meter Gate Installation

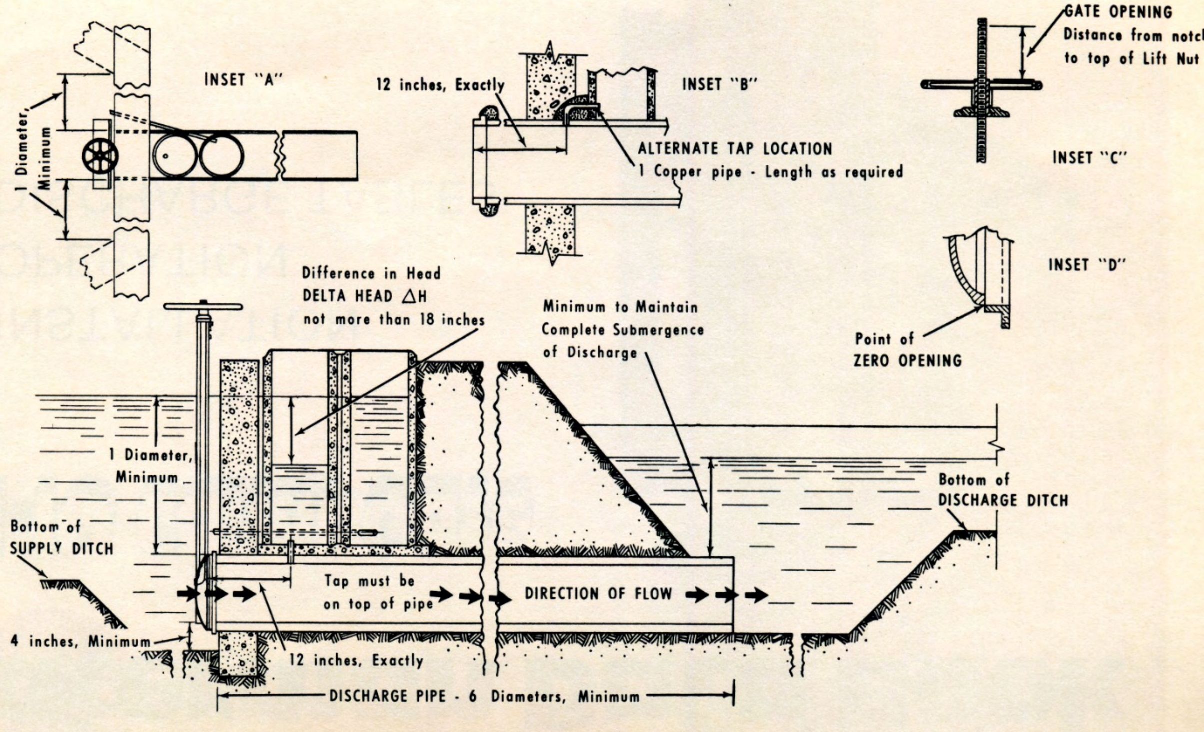


Figure 1. Installation Diagram

INSTALLATION. (See figure 1.)

MEASUREMENTS AND CONDITIONS. Install WATERMAN MODEL CM-10 CANAL GATE as diagramed in figure 1. Calibrations in this book have been made to these measurements and conditions, and any variation in the installation must be considered in the use of the calibrations. Standard settings and dimensions have been maintained to permit the immediate interchangeability with systems already in operation.

FIRST TAP. The tap to the first well, usually 3/4-inch diameter brass pipe, must be located exactly 12 inches from the face of the gate seat, and must be on the top centerline of the pipe. On corrugated metal pipe, the tap must be on the outside diameter of the crown, protrude to the average diameter, and be finished off smoothly on a horizontal plane with filler cement. Where the headwall thickness is 12 inches or greater, or where other conditions make a direct connection impracticable, the tap may be connected by a smooth bend as shown in Inset B.

SECOND TAP. The tap to the upstream stilling well can be made by normal plumbing practice. To facilitate measurements the taps of the metering wells should be level and the same height.

MINIMUM DISTANCES. Maintain the minimum distances as shown. Obstructions, such as log or trash stops, should not be placed immediately in front of the gate opening.

DISCHARGE PIPE. The discharge pipe should not be less than six diameters in length.

WATER LEVEL. Both inlet and outlet ends of the pipe must be submerged at all times. A minimum submergence of 12 inches is recommended. This may be insured on the outlet end by using a 90° elbow set with its discharge end straight up.

GATE OPENING. After the gate has been installed, raise the gate to the point of "zero opening", as shown in Inset C. At this point, file a notch in the gate stem to mark the top of the gate nut. Thereafter the gate opening can always be determined by measuring the distance from this notch to the top of the gate nut. (See figure 2.)

Section 10

Sample Water Bill

TULARE IRRIGATION DISTRICT
PO Box 1920
TULARE, CA 93275-1920
(559) 686-3425

STATEMENT

Billing Month:	June
Statement Period:	6/1/11 - 6/30/11
Beginning Balance:	$12,176.50
Current Charges:	$21,849.75
Account No.:	
Page:	1 of 2

Bill To:

Amount Due: $ 21,849.75
Remit Stub with Total Amount Due

Current charges due 5/31/2012. 1% interest applies to unpaid balances after due date.

IMPORTANT NOTICE
Any Water Sales and Sales of Service accounts with an upaid balance as of October 2011, will be added to the firs installment of the landowners' 2012 Assessment.

If you have any questions or comments, contact our office (559) 686-3425.

Date	Description	Amount
6/1/2011	**Beginning Balance**	**$12,176.50**
6/21/11	**water payment**	**($12,176.50)**
6/30/11	**June Water Deliveries**	

Turnout	Start Date	Ending Date	AcFt	Rate	
0314-11	6/19/2011	6/26/2011	65.30	$25.00	$1,632.50
0314-6	6/19/2011	6/26/2011	39.90	$25.00	$997.50
0315-19	6/16/2011	6/29/2011	92.20	$25.00	$2,305.00
0315-3	6/17/2011	6/30/2011	143.60	$25.00	$3,590.00
0316-5	6/13/2011	6/19/2011	40.80	$25.00	$1,020.00
032-11	6/12/2011	6/16/2011	22.30		
	6/26/2011	6/29/2011	17.60		
			39.90	$27.50	$1,097.25
0321-7	6/14/2011	6/29/2011	147.30	$25.00	$3,682.50
0327-28	6/17/2011	6/21/2011	53.10	$25.00	$1,327.50
048-22	6/7/2011	6/9/2011	14.40		
	6/21/2011	6/25/2011	30.10		
			44.50	$25.00	$1,112.50
049-49	6/13/2011	6/22/2011	74.20	$25.00	$1,855.00
9413-11	6/29/2011	6/30/2011	15.90	$25.00	$397.50
9414-2	6/28/2011	6/30/2011	27.80	$25.00	$695.00
9414-35	6/27/2011	6/30/2011	20.90	$25.00	$522.50
9414-36	6/27/2011	6/30/2011	57.50	$25.00	$1,437.50
9426-10	6/28/2011	6/30/2011	7.10	$25.00	$177.50
					$21,849.75

Section 11

Typical Meter Gate Chart

DISCHARGE DATA

15" WATERMAN REDTOP CANAL GATES WITH METERING WELLS - C-10

Head	Net Gate Opening in Inches																	
	2	2.5	3	3.5	4	4.5	5	5.5	6	7	8	9	10	11	12	13	14	15
(in)	Discharge in Cubic Feet Per Second																	
1	0.50	0.62	0.74	0.69	0.78	0.85	0.94	1.02	1.10	1.22	1.35	1.50	1.67	1.78	1.86	1.98	2.05	2.11
1.25	0.56	0.69	0.83	0.77	0.86	0.94	1.05	1.13	1.24	1.35	1.51	1.68	1.86	1.97	2.07	2.19	2.27	2.35
1.5	0.61	0.75	0.90	0.84	0.95	1.03	1.14	1.23	2.35	1.48	1.65	1.83	2.04	2.10	2.27	2.40	2.48	2.57
1.75	0.67	0.83	0.98	0.91	1.02	1.12	1.23	1.33	1.45	1.59	1.78	1.97	2.19	2.33	2.46	2.58	2.67	2.76
2	0.71	0.87	1.03	0.97	1.08	1.18	1.32	1.42	1.55	1.70	1.90	2.10	2.34	2.48	2.61	2.76	2.85	2.95
2.25	0.75	0.92	1.10	1.03	1.15	1.26	1.39	1.50	1.64	1.80	2.00	2.23	2.48	2.64	2.77	2.92	3.03	3.17
2.5	0.79	0.97	1.16	1.08	1.22	1.33	1.46	1.58	1.72	1.89	2.11	2.35	2.60	2.77	2.90	3.08	3.19	3.29
2.75	0.83	1.02	1.21	1.13	1.27	1.38	1.53	1.66	1.80	1.98	2.22	2.45	2.73	2.90	3.05	3.22	3.33	3.44
3	0.87	1.07	1.27	1.18	1.33	1.45	1.60	1.72	1.89	2.07	2.31	2.56	2.85	3.02	3.19	3.36	3.48	3.60
3.25	0.90	1.11	1.32	1.23	1.38	1.50	1.66	1.80	1.97	2.15	2.40	2.66	2.97	3.14	3.31	3.50	3.62	3.73
3.5	0.94	1.16	1.37	1.28	1.43	1.57	1.73	1.86	2.04	2.23	2.49	2.76	3.08	3.28	3.46	3.62	3.75	6.88
3.75	0.97	1.19	1.42	1.33	1.48	1.62	1.78	1.93	2.10	2.30	2.58	2.85	3.18	3.38	3.56	3.74	3.88	4.00
4	1.00	1.23	1.46	1.63	1.53	1.67	1.84	1.99	2.17	2.38	2.66	2.95	3.28	3.49	3.67	3.87	4.00	4.13
4.25	1.03	1.27	1.50	1.40	1.57	1.72	1.90	2.05	2.25	2.45	2.75	3.04	3.38	3.59	3.78	3.98	4.11	4.23
4.5	1.06	1.30	1.55	1.44	1.62	1.76	1.95	2.10	2.30	2.52	2.82	3.12	3.48	3.70	3.88	4.10	4.24	4.38
4.75	1.09	1.33	1.58	1.48	1.66	1.82	2.00	2.16	2.37	2.58	2.89	3.20	3.57	3.79	3.99	4.20	4.35	4.50
5	1.11	1.37	1.63	1.52	1.70	1.85	2.05	2.23	2.43	2.65	2.96	3.27	3.66	3.88	4.09	4.30	4.46	4.60
5.5	1.16	1.43	1.70	1.59	1.78	1.95	2.12	2.33	2.55	2.78	3.11	3.45	3.82	4.08	4.30	4.51	4.68	4.83
6	1.22	1.50	1.78	1.66	1.86	2.04	2.25	2.43	2.65	2.90	3.25	3.60	4.00	4.25	4.49	4.71	4.89	5.05
6.5	1.27	1.57	1.86	1.73	1.94	2.12	2.36	2.53	2.76	3.00	3.38	3.74	4.16	4.41	4.67	4.90	5.10	5.25
7	1.31	1.61	1.92	1.79	2.01	2.20	2.43	2.62	2.86	3.12	3.50	3.89	4.31	4.59	4.84	5.10	5.29	5.45
7.5	1.36	1.67	1.98	1.85	2.08	2.27	2.51	2.71	2.96	3.23	3.62	4.01	4.48	4.75	5.00	5.27	5.45	5.63
8	1.40	1.72	2.05	1.91	2.15	2.35	2.60	2.80	3.06	3.33	3.72	4.02	4.61	4.89	5.17	5.42	5.62	5.80
8.5	1.44	1.78	2.11	1.97	2.22	2.43	2.68	2.88	3.15	3.46	3.85	4.28	4.78	5.05	5.31	5.60	5.80	5.86
9	1.48	1.82	2.17	2.02	2.29	2.49	2.75	2.96	3.24	3.54	3.97	4.39	4.90	5.20	5.48	5.76	5.96	6.17
9.5	1.53	1.89	2.25	2.08	2.34	2.56	2.82	3.04	3.32	3.63	4.07	4.50	5.01	5.32	5.61	5.90	6.12	6.33
10	1.57	1.93	2.30	2.14	2.40	2.62	2.90	3.12	3.40	3.72	4.18	4.62	5.15	5.46	5.78	6.09	6.30	6.50
11	1.65	2.03	2.41	2.24	2.51	2.75	3.03	3.26	3.58	3.90	4.38	4.85	5.39	5.71	6.03	6.35	6.59	6.79
12	1.72	2.12	2.52	2.34	2.63	2.86	3.18	3.41	3.72	4.08	4.56	5.06	5.61	5.98	6.30	6.62	6.85	7.10
13	1.80	2.21	2.63	2.43	2.73	2.98	3.29	3.55	3.89	4.24	4.75	5.26	5.85	6.20	6.55	6.89	7.12	7.37
14	1.85	2.28	2.71	2.51	2.82	3.09	3.40	3.69	4.02	4.40	4.91	5.45	6.08	6.43	6.79	7.15	7.39	7.65
15	1.93	2.37	2.81	2.60	2.92	3.20	3.52	3.80	4.16	4.55	5.10	5.65	6.28	6.67	7.00	7.40	7.65	7.90
16	1.98	2.44	2.90	2.69	3.01	3.30	3.64	3.92	4.30	4.70	5.25	5.80	6.49	6.88	7.23	7.61	7.90	8.18
17	2.04	2.52	3.00	2.76	3.10	3.40	3.75	4.04	4.40	4.82	5.40	6.00	6.69	7.08	7.46	7.85	8.13	8.30
18	2.11	2.61	3.10	2.85	3.20	3.49	3.85	4.16	4.55	4.98	5.56	6.18	6.89	7.29	7.70	8.09	8.39	8.65

Section 12

Agricultural Water Measurement Master Plan

Tulare Irrigation District

SB 7x-7

Agricultural Water Measurement Master Plan

Tulare Irrigation District Background

The Tulare Irrigation District (District) was organized on September 21, 1889 as one of the very early irrigation districts in California. For several decades the District operated to deliver surface water supplies from its Kaweah River water rights to landowners and farmers within the District. In 1950 the District signed a contract with the United States Bureau of Reclamation for 30,000 acre-feet of Class 1 and 141,000 of Class 2 water from the Friant Unit of the Central Valley Project. The District averages approximately 150,000 acre-feet of surface water diversions to District landowners in their requirement to meet irrigation demand on approximately 67,202 acres of irrigated agriculture. The District serves approximately 230 family farms with irrigation water.

To meet the irrigation demands of landowners, the District utilizes approximately 300 miles of earthen canals and approximately 30 miles of pipelines. The District also operates approximately 1,275 acres of groundwater recharge basins. Each landowner within the District receives surface water from the District through an individual farm-gate turnout. The District equips each farm-gate turnout with a Meter Gate, which allows the District to measure the instantaneous flow through each farm-gate turnout, which is utilized to determine the volumetric rate of use and bill based upon the volume of water used.

Water Measurement Background

The District utilizes a network of canals and pipelines to deliver water to each landowner within the District. Along each canal or pipeline are farm-gate turnouts that include a canal gate (referred to in this plan as a Meter Gate), which allows the District to control the delivery of irrigation water and measure the instantaneous rate of delivery to each parcel. When landowners request delivery of irrigation water the District Watermaster determines when the landowner can begin his/her irrigation based upon the supply and demand of surface water and the capacity of the canal system. Once the Watermaster has determined the start time for the landowner an order is placed with the Ditchtender that monitors the area where the landowner requested irrigation service. The Ditchtender then coordinates with the landowner and the Meter Gate is opened. The date, time and flow is recorded when the irrigation begins. The Ditchtender will then return approximately every 24-hours to take another flow reading at the Meter Gate, and again the date, time and flow are recorded. The Ditchtender will continue to return to the turnout and read the Meter Gate until the landowner indicates that they have completed their irrigation, at which time the Meter Gate is closed and the date and time is recorded.

All information that is taken is recorded on hand-held devices, which is an Apple iPod Touch that has a custom application that is integrated with the District billing software, STORM Water Accounting and Management Software (Billing Software). The information that is collected in the field by Ditchtenders is brought back to the office and uploaded to the Billing Software which calculates the volumetric water use by multiplying the flow rate by the time between readings. Landowners are then billed on a monthly basis for volumetric water usage.

Meter Gate Operation

The District currently utilizes 535 irrigation farm-gate turnouts to deliver water to District landowners. Each of these turnouts includes a typical Meter Gate (ARMCO gate or Waterman C-10 canal gate). A limited number of turnouts are utilized in concert with a low-head lift pump, which pumps water from the canal onto a landowner's field. In many of these circumstances the landowners have installed a propeller meter downstream of the pump to measure instantaneous flow and totalize the amount of water used (in gallons or acre-feet). The majority of Meter Gates used by the District do not have a downstream measuring device and include an upstream and downstream head pressure measurement to calculate the flow through the Meter Gate. Please reference Figure 1 for a typical Meter Gate Installation.

The Meter Gates installed in the District are at the upstream end of a smooth concrete, PVC or corrugated metal pipeline. Stilling wells are installed such that an upstream head (h_1) and downstream head (h_2) can be determined. The difference between the two readings is considered the effective operating head across the gate (often referenced as $\triangle h$). The position of the gate is also determined by measuring the amount of gate stem that is above the gate hand wheel (minus the zero gate position). Discharge or flow (cubic feet per second, cfs) is then obtained by utilizing a rating table that has been determined for each size and style of gate. See Figure 2 for a sample Waterman Gate Discharge Table that is used to determine flow through a Meter Gate.

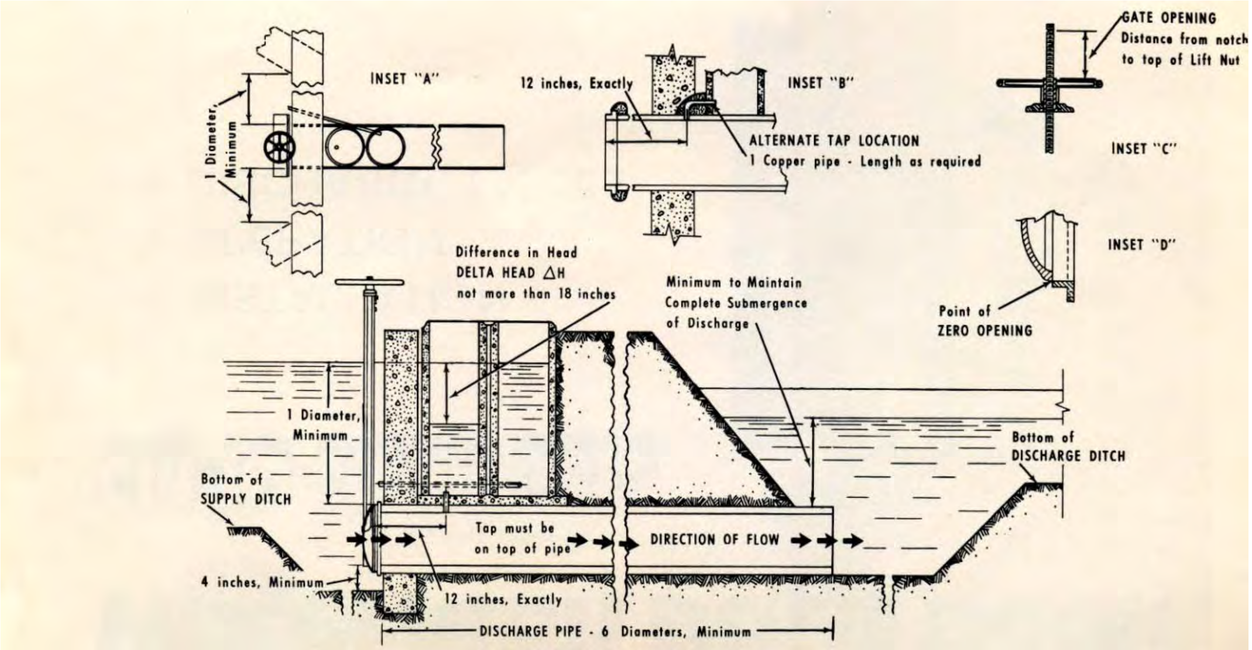


Figure 1. Typical Tulare Irrigation District Meter Gate Installation

DISCHARGE DATA
8" WATERMAN RED TOP CANAL GATES WITH METERING WELLS — MODEL C-10

Head in Inches	Net Gate Opening in Inches / Discharge in Feet Per Second												
	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8
1	0.24	0.30	0.34	0.40	0.46	0.50	0.54	0.58	0.60	0.61	0.63	0.64	0.66
1¼	.26	.33	.38	.44	.51	.55	.60	.64	.66	.68	.70	.71	.73
1½	.29	.36	.41	.48	.56	,60	.65	.69	.73	.75	.76	.78	.80
1¾	.31	.39	.45	.52	.60	.65	.70	.75	.78	.80	.82	.84	.86
2	.33	.41	.48	.55	.64	.69	.75	.80	.83	.85	.88	.90	.92
2¼	.35	.43	.51	.58	.67	.74	.79	.84	.88	.90	.93	.95	.97
2½	.37	.46	.53	.62	.71	.77	.84	.89	.93	.95	.97	1.00	1.03
2¾	.38	.48	.56	.64	.74	.81	.88	.93	.97	1.00	1.03	1.05	1.08
3	.40	.50	.58	.67	.78	.85	.91	.97	1.02	1.04	1.07	1.09	1.12
3¼	.42	.52	.61	.70	.81	.88	.95	1.01	1.06	1.08	1.12	1.14	1.16
3½	.43	.54	.63	.72	.84	.91	.99	1.04	1.09	1.13	1.15	1.18	1.21
3¾	.44	.56	.65	.75	.87	.94	1.02	1.08	1.14	1.17	1.19	1.23	1.25
4	.46	.58	.67	.77	.89	.97	1.05	1.12	1.17	1.20	1.23	1.26	1.28
4¼	.47	.59	.69	.80	.92	1.01	1.08	1.15	1.20	1.24	1.27	1.30	1.33
4½	.49	.61	.71	.82	.95	1.03	1.12	1.18	1.24	1.27	1.30	1.33	1.36
4¾	.50	.63	.73	.84	.97	1.07	1.15	1.22	1.28	1.31	1.34	1.37	1.40
5	.51	.64	.75	.86	.99	1.09	1.17	1.24	1.30	1.33	1.37	1.40	1.43
5½	.54	.67	.78	.90	1.04	1.13	1.23	1.30	1.36	1.39	1.43	1.47	1.50
6	.56	.70	.81	.94	1.08	1.18	1.28	1.36	1.43	1.46	1.49	1.53	1.57
6½	.58	.73	.85	.98	1.13	1.23	1.33	1.41	1.48	1.52	1.55	1.58	1.63
7	.60	.75	.88	1.02	1.17	1.28	1.38	1.47	1.53	1.57	1.61	1.65	1.68
7½	.62	.78	.91	1.05	1.21	1.33	1.43	1.52	1.58	1.63	1.67	1.70	1.74
8	.64	.80	.94	1.08	1.25	1.37	1.47	1.56	1.63	1.68	1.72	1.75	1.79
8½	.66	.83	.96	1.11	1.29	1.40	1.51	1.60	1.68	1.72	1.76	1.81	1.85
9	.68	.85	.99	1.14	1.32	1.44	1.55	1.65	1.73	1.77	1.82	1.86	1.90
9½	.70	.87	1.02	1.18	1.35	1.48	1.60	1.69	1.77	1.82	1.87	1.90	1.95
10	.72	.90	1.05	1.20	1.38	1.52	1.64	1.73	1.82	1.86	1.91	1.95	2.00
11	.75	.93	1.09	1.26	1.45	1.58	1.71	1.81	1.90	1.95	2.00	2.05	2.09
12	.78	.98	1.14	1.32	1.52	1.65	1.78	1.88	1.98	2.04	2.08	2.13	2.18
13	.81	1.02	1.18	1.37	1.58	1.72	1.85	1.96	2.06	2.11	2.17	2.22	2.27
14	.84	1.05	1.23	1.42	1.63	1.78	1.92	2.03	2.14	2.18	2.25	2.30	2.35
15	.87	1.08	1.26	1.46	1.68	1.84	1.98	2.10	2.21	2.26	2.33	2.37	2.43
16	.90	1.12	1.30	1.51	1.72	1.90	2.04	2.17	2.27	2.33	2.39	2.45	2.50
17	.92	1.15	1.34	1.55	1.79	1.96	2.10	2.23	2.34	2.39	2.46	2.52	2.58
18	.95	1.18	1.38	1.59	1.83	2.01	2.16	2.29	2.40	2.46	2.53	2.59	2.65

Figure 2. Typical Waterman Gate Discharge Table

Example:

The Ditchtender reads the upstream head at 12” and the downstream head at 16”. This means that the effective operating head across the gate or the $\triangle h$ is 4”. The Ditchtender also reads the gate position by tape measuring the distance from the top of the hand wheel to the zero-mark at 6”. The Meter Gate is an 8” Waterman C-10 canal gate. Utilizing the chart provided in Figure 2, the instantaneous flow is 1.17 CFS. If the landowner ran for 24 hours, the District would record a total volumetric usage of 2.32 acre-feet and the landowner would be billed based on this value.

Method of Certification

The District intends to develop and achieve the initial Accuracy Certification per the aforecited Regulation by either (a) a rigorous meter field-testing program incorporating an acceptable meter sample size, or (b) a detailed field inspection of all 535 farm-gate turnouts, or some combination thereof. The District’s water/irrigation runs occur during only about 4 months out of the year on average. The ability to field-test a representative sample across the entire service area or to perform field inspections in dry or in operative conditions is limited to such run periods. The uncertainty of the type of irrigation season the District will encounter necessitates the availability to access both methods of certification. Nevertheless, this Master Plan sets forth the protocol to embark on an effort to achieve certification within the time frame as indentified herein (see Schedule on page 7).

Meter Field Inspection

Time permitting the District has the option to inspect all 535 farm-gate turnouts to ensure that the installation of each facility conforms to the recommended and accepted practices that yields the highest accuracy possible. Installation requirements and recommendations have been provided by the manufacturers along with the United State Bureau of Reclamation Water Measurement Manual. The District Engineer and the District Engineering Technician will visually inspect each farm-gate installation to demonstrate that the design and installation standards have been met. The results of the inspections will be provided in the Meter Certification Report.

Critical features to would include, but are not limited to:

- Property rating tables are being used for each Meter Gate.
- Gate position indicators are in good condition and easy to identify and read.

- Stilling wells are clear of debris and accurately reporting water levels.
- Sufficient submergence such that the pipeline downstream of the Meter Gate flows full.
- Meter Gate installation has been installed with the appropriate requirements including minimum distance to side walls, obstructions and any flow disturbances.
- Meter Gate has the minimum amount of downstream pipeline.

Meter Testing Alternatives

Upstream Testing

Upstream Certification involves the use of an upstream flow measurement device to determine the flow rate through the Meter Gate mechanism. The District intends to utilize a flow measurement device manufactured by Rubicon Water called the Flume Meter. The Flume Meter is a measurement device that uses an array of 32 Sonaray acoustic flow measurement sensors that deliver an accurate 3-dimensional representation of the velocity distribution within the flow device. The device has been field verified for an accuracy of +/-2.5%.

Installation of these meters would include the installation of a fabricated mounting bracket that isolates the existing Meter Gate from the flow in the canal. The Flume Meter is placed in the bracket and channels the flow through the meter box chamber past the Sonaray sensors. The sensors are wired to a digital readout and powered by either a solar panel or via a series of batteries.

District staff will transport the Flume Meter to the pre-installed bracket and lower the device into place. Once the Flume Meter is in place the existing Meter Gate will be opened to allow flow into the downstream pipeline. After the flow has stabilized a reading shall be taken of the upstream and downstream head, the gate position, and the flow shall be calculated and recorded (reading shall be recorded as “Measured”). A reading shall also be taken from the Flume Meter and recorded (reading shall be recorded as “Actual”). Both flow readings shall be recorded in units of cubic feet per second. With this information the instantaneous flow accuracy (Percentage) shall be calculated using the formula:

Accuracy (%) = 100 x ((Measured – Actual) / Actual)

Readings shall be taken for approximately 1 hour on 15 minute intervals. All data shall be recorded on a Meter Gate Certification Form and included in the Meter Certification Report.

Downstream Testing

Low-Lift Pump Approach

The District has several landowners that utilize low-lift pumps to deliver water to meet irrigation demands. These pumps typically have flow meters located downstream of the pump. The District intends to utilize these downstream propeller meters to determine the instantaneous flow measurement to benchmark and certify the existing Meter Gate. In some cases the District will have to modify the manifold of the pump to accomplish this test, and in limited cases the District will have to install a downstream meter to perform the test. The District will either use a propeller meter or a mag-meter depending on cost, availability and applicability.

District staff will make arrangements with individual landowners to utilize the low-lift pumps to perform the certification process, which may involve utilizing the pump to directly apply irrigation water to fields or modification of the pump manifold to bypass the landowner irrigation system and return water to the canal. Upon completion of any modifications the Meter Gate will be opened to allow flow to be pumped. After the flow has stabilized a reading shall be taken of the upstream and downstream head, the gate position, and the flow shall be calculated and recorded (reading shall be recorded as "Measured"). A reading shall also be taken from the meter installed downstream of the pump and recorded (reading shall be recorded as "Actual"). Both flow readings shall be recorded in units of cubic feet per second. With this information the instantaneous flow accuracy (Percentage) shall be calculated using the formula:

Accuracy (%) = 100 x ((Measured – Actual) / Actual)

Readings shall be taken for approximately 1 hour on 15 minute intervals. All data shall be recorded on a Meter Gate Certification Form and included in the Meter Certification Report.

Meter Vault Approach

In the circumstance that the District cannot verify the flow through an upstream measurement device and does not have access to a downstream pump, the District will utilize a Meter Vault installation downstream of the Meter Gate. This type of installation involves the installation of a meter (propeller or mag-meter) downstream of the Meter Gate on the pipeline as it continues through the canal embankment. Installation of the downstream meter will be per the manufactures recommended standards, including requirements for unobstructed flow and a fully submerged pipeline.

District staff will perform the installation of the downstream meter, including the installation of a standpipe to access the meter. Upon completion of installation of the downstream meter the Meter Gate will be opened to allow begin the testing procedure. After the flow has stabilized a reading shall be taken of the upstream and downstream head, the gate position, and the flow shall be calculated and recorded (reading shall be recorded as “Measured”). A reading shall also be taken from the downstream meter and recorded (reading shall be recorded as “Actual”). Both flow readings shall be recorded in units of cubic feet per second. With this information the instantaneous flow accuracy (Percentage) shall be calculated using the formula:

Accuracy (%) = 100 x ((Measured – Actual) / Actual)

Readings shall be taken for approximately 1 hour on 15 minute intervals. All data shall be recorded on a Meter Gate Certification Form and included in the Meter Certification Report.

Sample Size and Determination

The District currently utilizes 535 irrigation farm gate turnouts, which include the installation and use of a Meter Gate to deliver water to landowners. To meet the standards for certification under the field inspection alternative, the District is prepared to inspect all 535 farm-gate turnouts to ensure certification. To meet the standards for the certification process under the field-testing alterative, the District intends to develop a statistical method to sample a representative sample of meters. However, the number of Meter Gates sampled shall not exceed 53 (i.e. 10%) but shall be greater than 10.

Staff

The certification process shall be carried out the District Engineer, Aaron Fukuda who is a Professional Engineer (P.E. 65295) in the State of California. The District Engineer shall also be assisted by the District Engineering Technician who has experience in water measurement and shall be trained by the District

Engineer in the verification process. The final Meter Certification Report shall be prepared and certified by the District Engineer.

Schedule

Due to the recent water year conditions, the District has been unable to implement the Initial Certification of existing water measurement devices within the District. Accordingly, the District proposes to conduct the Initial Certification process during the next irrigation season, which will occur in Summer 2013 or during the period when the canal system if dry. The following schedule is provided as a best attempt to outline the process the District will follow, however as each Task is accomplished the Schedule along with the Budget may be modified to reflect findings and accomplishments at each Task:

Task No.	Activity	Date
1	Initial Certification (Field Inspection/Field Testing)	May 2013 – Sept 2013
2	Meter Certification Report Preparation	Sept 2013 – Nov 2013
3	Meter Certification Report – Final	Dec 2013 (Board Mtg.)
4	Phase 1 - Meter Corrective Action	Jan 2014 – Apr 2014
5	Optional – Second Round Certification (As Required)	May 2014 – Sept 2014
6	Phase 2 – Meter Corrective Action	Sept 2014 – Dec 2014
7	Phase 3 – Meter Corrective Action	Jan 2015 – March 2015
8	Phase 4 – Meter Corrective Action	Apr 2015 – June 2015
9	Phase 5 – Meter Corrective Action	Sept 2015 – Nov 2015
10	2015 Agricultural Water Management Plan	December 31, 2015

Variability in the schedule may come at the following Tasks:

- If the Meter Certification Report (Task 3) finds that the existing meters are within a +/-12% accuracy range the Certification Process will conclude that the District has met all regulations and will continue to measure and bill according to volumetric usage.
- If the Meter Certification Report (Task 3) finds that the existing meters do not read within a +/-12% accuracy range the total number of turnouts that reads outside of this accuracy shall be determined. If more than 25% of the turnouts read greater than a +/-12% accuracy the District shall conduct a second round of Meter Certifications (Task 5).

Results (Meter Certification Report)

Once the District has completed the testing or inspection of the Meter Gates identified by the Plan a Meter Certification Report will be created. The report will be prepared by the District Engineer and the District Engineering Technician, with final approval and certification coming from the District Board of Directors and the District Engineer respectively. Included in the Report will be the following information:

- Description of Sample Size Determinations
- Description of Certification Process (including devices and field testing conducted)
- Results of the Certification Process
- Discussion of Future Certification Requirements
- Recommended Meter Modifications (Device Correction Plan)
- Schedule for Meter Modifications
- Budget for Meter Modifications

Device Correction Plan

The Device Correction Plan will be established using the results discovered from the Initial Certification (Task 1). During the certification the District will determine the ability of the existing meters to be modified or calibrated to achieve an accuracy of +/-12%. The District will establish a process to adjust existing meters to meet the accuracy requirements set forth.

If it is determined that the existing meters that are utilized to measure irrigation deliveries within the District cannot meet the +/-12% requirement and cannot be modified to achieve such, the District will strive to identify and create a Water Measurement Replacement Program (Replacement Program). The Replacement program will identify the types of measurement devices to be implemented, the schedule for implementation and the cost to carry out the Replacement Program. If this is required Tasks 4, 6, 7, 8, and 9 will involve the replacement of meters rather than the modification of existing meters.

Budget

The District has estimated the maximum cost to reach compliance at approximately $1.3 million based upon its current understanding of the law. An Engineers Estimate (Budget) is included below. This maximum budget reflects the conservative assumption that all of the District's 50-plus meters will need either replacement or some form of repair. Based on staff's knowledge of the canal system and associated farm-gate turnout configurations, the certification protocol should result in significantly fewer number of turnout in need of alteration. The Budget set forth in this document is subject to changed based upon the findings and necessity to perform meter modifications.

Tulare Irrigation District

Meter Certification and Modification Budget

Engineer's Estimate

Task No.	Description	Quantity	Unit	Unit Price	Total
1	**Initial Certification**				
1a	Rubicon FlumeMeter	1	Each	$8,000	$8,000
1b	Rubicon Mounting Brackets	53	Each	$1,000	$53,000
1c	District Engineer	100	Hours	$75	$7,500
1d	Engineering Technician	150	Hours	$35	$5,250
1e	Boom Truck	100	Hours	$20	$2,000
				Subtotal	*$75,750*
2	**Meter Certification Report Preparation**				
2a	District Engineer	50	Hours	$75	$3,750
2b	Engineering Technician	50	Hours	$35	$1,750
				Subtotal	*$5,500*
3	**Meter Certification Report - Final**				
3a	District Engineer	8	Hours	$75	$600
3b	Engineering Technician	8	Hours	$35	$280
				Subtotal	*$880*
4	**Phase 1 Meter Corrective Action**				
4a	Meter Modification	100	Each	$2,000	$200,000
4b	District Engineer	200	Hours	$75	$15,000
	Engineering Technician	300	Hours	$35	$10,500
				Subtotal	*$225,500*

Task No.	Description	Quantity	Unit	Unit Price	Total
5	**Optional - Second Round Certification**				
5a	Rubicon FlumeMeter	1	Each	$8,000	$8,000
5b	Rubicon Mounting Brackets	53	Each	$1,000	$53,000
5c	District Engineer	100	Hours	$75	$7,500
5d	Engineering Technician	150	Hours	$35	$5,250
5e	Boom Truck	100	Hours	$20	$2,000
				Subtotal	*$75,750*
6	**Phase 2 Meter Corrective Action**				
6a	Meter Modification	100	Each	$2,000	$200,000
6b	District Engineer	200	Hours	$75	$15,000
6c	Engineering Technician	300	Hours	$35	$10,500
				Subtotal	*$225,500*
7	**Phase 3 Meter Corrective Action**				
7a	Meter Modification	100	Each	$2,000	$200,000
7b	District Engineer	200	Hours	$75	$15,000
7c	Engineering Technician	300	Hours	$35	$10,500
				Subtotal	*$225,500*
8	**Phase 4 Meter Corrective Action**				
8a	Meter Modification	100	Each	$2,000	$200,000
8b	District Engineer	200	Hours	$75	$15,000
8c	Engineering Technician	300	Hours	$35	$10,500
				Subtotal	*$225,500*
9	**Phase 5 Meter Corrective Action**				
9a	Meter Modification	100	Each	$2,000	$200,000
9b	District Engineer	200	Hours	$75	$15,000
9c	Engineering Technician	300	Hours	$35	$10,500
				Subtotal	*$225,500*
10	**2015 Agricultural Water Management Plan**				
10a	District Manager	16	Hours	$115	$1,840
10b	District Engineer	200	Hours	$75	$15,000
10c	District Watermaster	200	Hours	$45	$9,000
10d	Engineering Technician	100	Hours	$35	$3,500
				Subtotal	*$29,340*
				Total	**$1,314,720**

Financing

The District is currently expecting to utilize its Infrastructure Rehabilitation Reserve Funds and the ability to seek grants from the Department of Water Resources to achieve the requirements of this Plan. As this Plan is being implemented the District Engineer will be providing financial updates to the District Board of Directors including an initial cost/benefit analysis to determine the feasibility of carrying out the Device Correction Plan. If the District is unable to find suitable existing funds, it shall seek other sources of funding as needed.