

**ATTACHMENT 3: SUPPORTING DOCUMENTATION - 1**  
**GWMP - Excerpts only**  
**Executive Summary, Sections 6 and 7, and Appendices B and C**

# TURLOCK GROUNDWATER BASIN

## Groundwater Management Plan

*Prepared for:*

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**March 18, 2008**

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TABLE OF CONTENTS..... i

LIST OF APPENDICES..... iv

LIST OF FIGURES AND TABLES..... v

ACRONYMS AND ABBREVIATIONS..... vii

**EXECUTIVE SUMMARY**.....1

    The Turlock Groundwater Basin Association..... 1

    Land Use in the Turlock Groundwater Basin Area ..... 1

    Water Resources in the Turlock Subbasin ..... 2

        Hydrogeologic Setting .....2

        Water Balance in the Turlock Basin .....3

        Water Quality in the Turlock Subbasin .....4

    Groundwater Management Plan ..... 5

    Groundwater Protection Measures..... 5

    Implementation of the Groundwater Management Plan..... 6

1 INTRODUCTION .....8

    1.1 Geographic Setting..... 8

    1.2 Local Agencies..... 8

    1.3 Turlock Groundwater Basin Association..... 9

    1.4 Ongoing Groundwater Management-Related Activities ..... 10

        1.4.1 Historical Perspective .....10

        1.4.2 Previous Efforts .....10

        1.4.3 Efforts of Individual Agencies.....10

2 NEED FOR GROUNDWATER MANAGEMENT PLANNING .....13

    2.1 Definition of Groundwater Management..... 13

    2.2 Purpose of the Groundwater Management Plan ..... 13

    2.3 Legal Authority..... 13

        2.3.1 AB 3030.....13

        2.3.2 Other Legislation .....14

    2.4 Groundwater Management Plan Components ..... 14

3 WATER RESOURCES SETTING.....15

    3.1 Land and Water Use within the Basin ..... 15

    3.2 Major Water Purveyors and Other Agencies within the Basin..... 16

        3.2.1 Purveyors of Agricultural Water Supplies.....17

        3.2.2 Purveyors of Municipal Water Supplies.....18

        3.2.3 Other Local Public Agencies Participating in Groundwater  
Management Activities .....23

    3.3 Land Use Planning And Other Related Activities ..... 26

        3.3.1 Agencies’ Spheres of Influence .....26

        3.3.2 Planning for Growth .....26

        3.3.3 Potential Future Annexations.....26

        3.3.4 Other Land Use Planning or Regulatory Activities .....26

4 WATER RESOURCES IN THE TURLOCK SUBBASIN.....28

    4.1 Groundwater Supplies..... 28

4.1.1	Turlock Subbasin Location and Description.....	28
4.1.2	Groundwater Usage .....	33
4.1.3	Groundwater Recharge .....	36
4.1.4	Groundwater Conditions.....	37
4.1.5	Groundwater Quality .....	39
4.2	Surface Water Supplies.....	46
4.2.1	Surface Water Sources.....	46
4.2.2	Surface Water Quality.....	47
4.3	Other Supplies.....	47
4.3.1	Precipitation .....	47
4.3.2	Recycled Water.....	48
4.4	Facilities and Operations.....	49
4.4.1	Facilities Owned by Local Public Agencies .....	49
4.4.2	Other Public Facilities.....	49
4.4.3	Privately Owned Facilities .....	49
5	GROUNDWATER MANAGEMENT PLAN.....	50
5.1	Definition of the Groundwater Basin.....	50
5.2	Agencies Covered under the Groundwater Management Plan, Their Boundaries, and Groundwater Management Areas .....	50
5.3	Basin Management Goals and Objectives .....	50
5.3.1	Maintain Groundwater Levels .....	51
5.3.2	Protect Groundwater Quality .....	52
5.3.3	Land Subsidence .....	52
5.3.4	Conjunctive Use.....	53
5.3.5	Water Conservation .....	53
5.3.6	Alternate Water Supplies .....	53
5.3.7	Cooperation and Coordination.....	54
5.4	Groundwater Management Subareas' Goals and Objectives.....	54
5.5	Groundwater Monitoring Plan .....	54
5.5.1	Groundwater Level Monitoring .....	54
5.5.2	Groundwater Quality Monitoring .....	55
5.5.3	Subsidence Monitoring .....	56
5.6	Facilitating Conjunctive Use Operations.....	56
6	GROUNDWATER PROTECTION MEASURES.....	58
6.1	Identification and Management of Wellhead Protection Areas.....	58
6.1.1	Actions .....	59
6.2	Regulation of the Migration of Contaminated Groundwater.....	60
6.2.1	Actions .....	60
6.3	Identification of Well Construction Policies.....	60
6.3.1	Actions .....	61
6.4	Administration of Well Abandonment and Destruction Programs.....	61
6.4.1	Actions .....	62
6.5	Mitigation of Overdraft Conditions .....	63
6.5.1	Actions .....	63
6.6	Replenishment of Groundwater Extracted by Water Producers .....	63
6.6.1	Actions .....	63

6.7	Construction and Operation of Recharge, Storage, Conservation, Water Recycling, and Extraction Projects .....	64
	6.7.1 Actions .....	64
6.8	Control of Saline Water Intrusion.....	64
	6.8.1 Actions .....	64
<b>7</b>	<b>STAKEHOLDER INVOLVEMENT</b> .....	<b>66</b>
	7.1 Agency Involvement.....	66
	7.2 Advisory Committee.....	66
	7.3 Coordination with Other Agencies .....	66
	7.4 Public Involvement Process.....	66
	7.5 Developing Relationships with State and Federal Agencies .....	67
	7.6 Dispute Resolution Process.....	67
<b>8</b>	<b>PLAN IMPLEMENTATION</b> .....	<b>68</b>
	8.1 Implementation Plan .....	68
	8.1.1 Basin-Wide Management Actions .....	68
	8.2 Groundwater Management Plan Implementation Report .....	72
	8.3 Financial Planning for Recommended Actions/Project Implementation.....	72
	8.3.1 Grant Funding .....	72
	8.3.2 Funding through Local Agency Budgeting.....	73
	8.4 Periodic Review of the Groundwater Management Plan.....	73
<b>9</b>	<b>REFERENCES</b> .....	<b>74</b>

**List of Appendices**

Appendix Letter	Title
A	Figures
B	Tables
C	Memorandum of Understanding Establishing the Turlock Groundwater Basin Association
D	Definitions
E	Table of Standard Conversions
F	Subarea Goals and Objectives for Agencies within the Turlock Groundwater Basin
G	List of Agencies that have Adopted the Turlock Groundwater Basin Groundwater Management Plan, and Copies of the Actions taken to Adopt the Plan
H	Groundwater Management Related California Water Code Sections

**List of Figures Presented in Appendix A**

Figure No.	Title
1	Turlock Groundwater Basin Location and Boundaries
2	Urban Areas, Irrigation Districts, and Non-District Areas within Turlock Groundwater Basin
3	Land Use within the Turlock Groundwater Basin, 1952-2006, for Turlock Irrigation District
4a	Land Use within the Turlock Groundwater Basin, 1952-2006, for Eastside Water District
4b	Land Use within the Turlock Groundwater Basin, 1952-2006, for Ballico-Cortez Water District
4c	Land Use within the Turlock Groundwater Basin, 1952-2006, for Merced Irrigation District
4d	Land Use within the Turlock Groundwater Basin, 1952-2006, for Foothills Non-District Area
4e	Land Use within the Turlock Groundwater Basin, 1952-2006, for Merced River Non-District Area
4f	Land use within the Turlock Groundwater Basin, 1952-2006, for San Joaquin River Non-District Area
4g	Land Use within the Turlock Groundwater Basin, 1952-2006, for Tuolumne River Non-District Area
5	Hydrogeologic Units Represented within the Groundwater Model
6	East-West Cross-Section Showing Hydrogeologic Units within the Groundwater Basin
7	Groundwater Movement within the Basin
8	Annual Pumpage from Supplemental-Source Private and Improvement District Irrigation Wells Within Turlock Irrigation District, 1952-2006
9	Annual Pumpage from Supplemental-Source Private and Improvement District Irrigation Wells Rented Within Turlock Irrigation District, 1977-2006
10	Annual Pumpage from Primary-Source Private Irrigation Wells within Turlock Irrigation District, 1952-2006
11	Annual Pumpage from Private Irrigation Wells within Merced Irrigation District, 1952-2006
12	Annual Pumpage from Private Irrigation Wells within Eastside Water District, 1952-2006
13	Annual Pumpage from Private Irrigation Wells within Ballico-Cortez Water District, 1952-2006
14	Annual Pumpage from Private Irrigation Wells within Non-District Areas, 1952-2006
15a	Annual Pumpage from Municipal Wells for Ceres, 1952-2006
15b	Annual Pumpage from Municipal Wells for Delhi, 1952-2006
15c	Annual Pumpage from Municipal Wells for Denair, 1952-2006
15d	Annual Pumpage from Municipal Wells for Hickman, 1952-2006
15e	Annual Pumpage from Municipal Wells for Hilmar, 1952-2006
15f	Annual Pumpage from Municipal Wells for Hughson, 1952-2006
15g	Annual Pumpage from Municipal Wells for Keyes, 1952-2006

Figure No.	Title
15h	Annual Pumpage from Municipal Wells for South Modesto, 1952-2006
15i	Annual Pumpage from Municipal Wells for Turlock, 1952-2006
16a	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1960
16b	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1974
16c	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1986
16d	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 1998
16e	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 2002
16f	Measured Groundwater Elevations in Intermediate Depth Monitoring Wells, Spring 2005
17	Locations of Intermediate-Depth Monitoring Wells
18a	Measured Temporal Groundwater Levels in Monitoring Well 04S08E22R001M
18b	Measured Temporal Groundwater Levels in Monitoring Well 04S12E07C001M
18c	Measured Temporal Groundwater Levels in Monitoring Well 05S11E25A001M
18d	Measured Temporal Groundwater Levels in Monitoring Well 06S10E16M001M
19	Estimated Turlock Groundwater Basin Water Budget, 1997-2006
20	Local Water Agency Groundwater Level and Water Quality Monitoring Locations in the Turlock Groundwater Basin

**List of Tables Presented in Appendix B**

Table Number	Title
1	Location of TGBA GMP Components
2	Major Programs Affecting Groundwater within the TGBA Agencies' Boundaries
3	Monthly Precipitation in the Turlock Subbasin, 1970-2006
4	2005 Treated Wastewater Effluent Use and Disposal
5	Current Level of Monitoring Efforts

**Acronyms and Abbreviations**

AB	Assembly Bill	EDB	Ethylene dibromide
AF	Acre-feet	EPA	United States Environmental Protection Agency (also U.S. EPA)
AF/yr	Acre-feet per year (1,120 AF/yr = 1 MGD)	EWD	Eastside Water District
BCWD	Ballico-Cortez Water District	ft	feet
BMO	Basin Management Objective	GAMA	Groundwater Ambient Monitoring & Assessment
CCR	California Code of Regulations	GIS	Geographic Information Systems
CEQA	California Environmental Quality Act	GMP	Groundwater Management Plan
cfs	cubic feet per second	GPD	gallons per day
CSD	Community Services District	GPM	gallons per minute
CVRWQCB	Central Valley Regional Water Quality Control Board	GW	groundwater
CWC	California Water Code	HCWD	Hilmar County Water District
CWD	County Water District	ID	Irrigation District
DBCP	Dibromochloropropane	LAFCO	Local Agency Formation Commission
DCWD	Delhi County Water District	MCL	Maximum Contaminant Level
DEH	Division of Environmental Health (Merced Co.)	MGD	million gallons per day (1 MGD = 1,120 AF/yr)
DER	Department of Environmental Resources (Stanislaus Co.)	mg/L	milligrams per liter = ppm
DHS	Department of Health Services	Merced ID	Merced Irrigation District
dS/m	deciSiemens per meter	mmhos/cm	millimhos per centimeter
DWR	California Department of Water Resources	MOU	Memorandum of Understanding
DWSAP	Drinking Water Source Assessment & Protection	mS/cm	milliSiemens per centimeter
EC	Electrical Conductivity	msl	mean sea level
		NAWQA	National Water Quality Assessment

NPDES	National Pollutant Discharge Elimination System	TCE	Trichloroethylene
NRCS	Natural Resources Conservation Service	TDS	Total Dissolved Solids
PBE	Physical Barrier Effectiveness	TGBA	Turlock Groundwater Basin Association
PCA	Potential Contaminating Activity	TID	Turlock Irrigation District
PCE	Perchloroethylene	TMDL	Total Maximum Daily Load
ppb	parts per billion = $\mu\text{g/L}$	$\mu\text{g/L}$	micrograms per liter = ppb
ppm	parts per million = $\text{mg/L}$	$\mu\text{mhos/cm}$	micromhos per centimeter
psi	pounds per square inch	USACE	U.S. Army Corps of Engineers
RWQCB	Regional Water Quality Control Board	$\mu\text{S/cm}$	microSiemens per centimeter
RWQCF	Regional Water Quality Control Facility (City of Turlock)	USGS	U.S. Geological Survey
SB	Senate Bill	UST	Underground storage tanks
SCADA	Supervisory Control and Data Acquisition	VOC	Volatile organic compound
SOI	Sphere of Influence	WPA	Wellhead Protection Area
SMSA	South Modesto Service Area	WSA	Water Supply Assessment
SW	surface water		
SWRCB	State Water Resources Control Board		

## EXECUTIVE SUMMARY

This Groundwater Management Plan (Plan) provides an overview of the local agencies, land uses, and status of groundwater resources in the local groundwater basin, the Turlock Subbasin. The local water agencies, through the Turlock Groundwater Basin Association (TGBA or Association), have taken a cooperative, basin-wide approach to coordinate groundwater management activities and prepare this Plan. The overall goal of the Association is to ensure that groundwater remains a reliable, safe, efficient, and cost-effective water supply for the local area. This Plan presents the basin-wide management objectives proposed to achieve this goal, and concludes with recommended measures that can be drawn from to meet the basin management objectives and the long-term goal of ensuring the viability of the groundwater supply.

### THE TURLOCK GROUNDWATER BASIN ASSOCIATION

Many local agencies are eligible to participate in groundwater management within the local groundwater basin. These agencies include the Turlock and Merced irrigation districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi county water districts; the Keyes, Denair and Ballico community services districts; the Eastside and Ballico-Cortez water districts; and Stanislaus and Merced counties. These agencies have been cooperating on groundwater management activities in the Turlock Groundwater Basin since the mid-1990s.

A formal group for coordinating groundwater management activities, the Turlock Groundwater Basin Association (TGBA or Association), was initiated in 1995. The TGBA developed the first basin-wide Groundwater Management Plan in 1997. Although the founding Memorandum of Understanding expired upon completion of the Groundwater Management Plan, TGBA members continued to meet and discuss basin-wide planning activities. In 2001 the TGBA was formally reestablished to provide a mechanism to implement groundwater management activities and provide guidance for the management, preservation, protection, and enhancement of the Turlock Subbasin.

The TGBA has prepared this updated Plan to reflect current knowledge and to comply with changes to the Groundwater Management Act (California Water Code Section 10750 et seq.) resulting from the enactment of Senate Bill 1938 in 2002.

### LAND USE IN THE TURLOCK GROUNDWATER BASIN AREA

The Turlock Subbasin lies on the eastern side of California's San Joaquin Valley, and encompasses portions of both Stanislaus and Merced counties. The groundwater system is bounded by the Tuolumne River on the north, the Merced River on the south, and the San Joaquin River on the west. The eastern boundary of the system is the western extent of the outcrop of crystalline basement rock in the foothills of the Sierra Nevada. Land uses in the Turlock Subbasin are diverse and include agriculture, urban, and commercial or industrial uses distributed in a mosaic throughout the region.

The Turlock Subbasin underlies an area of approximately 347,000 acres, with irrigated crops (245,000 acres), native vegetation (69,000 acres), and urban development (20,000 acres) as the predominant land uses. The general trend in land use throughout the Subbasin has been an increase in urbanization from less than 4,000 acres in 1952 to approximately 20,000 acres in

2006. The majority of this urbanization has occurred within the cities and unincorporated urban areas within the Turlock Irrigation District boundary. Lands in the Eastside Water District, Ballico-Cortez Water District, and Merced Irrigation District have not seen the substantial increase in urbanization that has occurred in other portions of the Subbasin. However, in the Eastside Water District, there has been a shift from non-irrigated lands to irrigated agriculture as the principal land use. The majority of this agricultural development occurred between 1952 and 1984; land use patterns in the Eastside Water District have generally stabilized since the mid-1980s. The shift to irrigated agriculture has occurred to a lesser extent in the Ballico-Cortez Water District. Land use patterns in the foothill areas in the eastern portion of the Subbasin have also shifted from non-irrigated to irrigated agriculture, but most of this shift has occurred in recent years. Between 1952 and 1992, irrigated agriculture in the foothills non-district area increased gradually from 8,600 acres to 10,800 acres. Following 1992, the irrigated area nearly doubled, reaching 19,500 acres in 2006.

Urban land uses, irrigators in the Eastside and Ballico-Cortez water districts, and irrigators in the foothills and other non-District areas depend on groundwater for water supply. Increases in these types of land uses throughout the Turlock Subbasin increase the demands on the groundwater supply. Consequently, evaluating the status of the groundwater supply and continuing coordination of water agencies are essential for maintaining the viability of the groundwater basin.

## WATER RESOURCES IN THE TURLOCK SUBBASIN

Both surface water and groundwater supplies are used to meet the water needs in the management area. The local groundwater source is the Turlock Subbasin, which is a subunit of the San Joaquin Valley Groundwater Basin. The Turlock Subbasin lies in the eastern portions of Stanislaus and Merced counties and has an areal extent of approximately 347,000 acres. As described above, the Subbasin is bounded by the Tuolumne River to the north, the Merced River to the south, the San Joaquin River to the west, and by crystalline basement rock of the Sierra Nevada foothills to the east. Groundwater supplies municipal, industrial, and agricultural demands of the region. Surface water from the Tuolumne River and to a lesser extent, the Merced River, supplies a large proportion of agricultural irrigation demands within the Turlock Subbasin. The following sections summarize the Subbasin hydrogeology, water balance, and water quality issues described in the Groundwater Management Plan.

### Hydrogeologic Setting

The primary hydrogeologic units in the Turlock Subbasin consist of either consolidated or unconsolidated sedimentary deposits. The consolidated deposits include the Ione Formation, the Valley Springs Formation, and the Mehrten Formation. The Ione and Valley Springs formations lie beneath the Mehrten Formation and typically contain saline water of marine origin. These consolidated deposits are found at shallower depths in the eastern portion of the Subbasin and generally yield small quantities of water to wells. The Mehrten Formation, however, yields greater quantities of water and is an important water source for the eastern portion of the Turlock Subbasin.

The unconsolidated deposits of the Turlock Lake, Riverbank, and Modesto formations overlie the consolidated deposits. These deposits generally yield moderate to large quantities of water to wells and are the main water-yielding units of the Subbasin. Fine grained deposits within the

Modesto and Turlock Lake formations do not transmit substantial quantities of water and function as aquitards. In the western portion of the Subbasin, where surface deposits are of the Modesto Formation, a discontinuous shallow aquitard creates areas of shallow groundwater. The Corcoran Clay aquitard also occurs in the western portion of the Subbasin within the Turlock Lake hydrogeologic unit. The Corcoran Clay aquitard separates groundwater in the Turlock Subbasin into an upper, unconfined aquifer and a lower, confined aquifer.

The unconfined aquifer is generally 150 feet in thickness and is the water-table aquifer, except in western portions of the Subbasin that are locally confined by the shallow aquitard. The unconfined aquifer is used for both private domestic supply and agricultural supply in the western part of the Subbasin. Wells less than 200 feet in depth draw from this aquifer. The confined aquifer, which is contained under pressure by the Corcoran Clay, occurs in the deeper hydrogeologic units of the Subbasin. In the eastern part of the Turlock Subbasin, the confined aquifer is only semi-confined. The confined aquifer provides extensive municipal and agricultural supplies to the Subbasin. Wells greater than 200 feet deep draw from the confined aquifer, but also may receive flow from the unconfined aquifer.

Below the principal water bearing units of the Turlock Subbasin is a deeply buried confined aquifer that contains saline brine. This saline confined aquifer is under sufficient hydraulic pressure to push water up toward the land surface. This phenomenon results in the migration of saline brines in certain areas (e.g., in groundwater wells or along cracks, fissures, and faults), sometimes as far upward as the unconsolidated sediments. Upwelling also occurs near the San Joaquin River, resulting in elevated concentrations of total dissolved solids (TDS) in groundwater near the river. The saline confined aquifer can be found from depths as shallow as 100 feet in the western portion of the Subbasin to as deep as 1,500 feet in the eastern portion of the Subbasin. Although the saline confined aquifer is not used as a source of supply, migration of the saline brines results in high TDS groundwater that may not be of sufficient quality for agricultural or municipal use where mixing occurs.

### Water Balance in the Turlock Basin

A water balance study of the Turlock Subbasin was prepared in 2003 and updated in 2007 to estimate the inflows and outflows from the Subbasin between 1952 and 2006. Outflows from the Subbasin result from municipal, domestic, and agricultural supply and drainage well pumping, discharge to the local rivers, discharges from subsurface agricultural drains, and consumption by riparian vegetation. The estimated average total outflow for the 1997-2006 period is 541,000 AF/yr. The majority of outflow comes from estimated agricultural, municipal and rural residential, and drainage well pumping, which collectively averaged 457,000 AF/yr for the 1997-2006 period.

Inflows to the Subbasin result primarily from deep percolation of agricultural and landscape irrigation water and infiltration of precipitation. The estimated average total inflow for the 1997-2006 period is 519,000 AF/yr. Approximately 72 percent of this quantity occurs on 245,000 irrigated acres of cropland within the Subbasin.

Most of the inflows and outflows can be estimated for the Turlock Basin. The net discharge to rivers is an unknown outflow and must be derived through a mass balance calculation of the known inflows, outflows, and storage change in the Basin. Storage change is calculated from the

groundwater contour maps derived from local monitoring data, and confirmed using the groundwater model.

The contour maps used in the water budget study indicate that estimated groundwater storage decreased by approximately 21,500 AF/yr between 1997 and 2006. Recent reductions in the California Department of Water Resources (DWR) monitoring network have introduced uncertainty in the measurement of groundwater levels. Uncertainty in the estimated groundwater elevation translates into uncertainty in storage estimates. Therefore, the magnitude and direction of changes in groundwater storage cannot be fully characterized through an analysis based solely on the groundwater contours. The Turlock Subbasin groundwater model was used to supplement this analysis and confirm that groundwater storage has decreased slightly in recent years, particularly between 2002 and 2006.

The estimated reduction in storage between 2002 and 2006 suggests that the Subbasin may no longer be in the equilibrium state that existed in the 1990s. Increases in land use types that rely on groundwater for supply have increased the net discharge from the Subbasin. Slight decreases in storage are likely to continue if urban or irrigated land uses are developed in areas dependent upon groundwater.

In any groundwater basin, groundwater storage will fluctuate both seasonally and annually, depending upon the water year classification, distribution of rainfall, and numerous other physical and biological factors. Alternating periods of decline and recovery in groundwater levels are a response to this natural variation. Long-term declines in storage without recovery could be a concern and represent net declines in storage. Continued monitoring by the local public agencies will be important for tracking changes in groundwater conditions and evaluating whether additional management actions should be considered. As part of the Association's goals and objectives, the Association should consider the need to evaluate changes in land use patterns to understand the range of potential impacts to the groundwater supply. The TGBA has initiated a study to evaluate future land use change scenarios and the potential impacts to groundwater resources. This study will help the Association understand how groundwater storage may change in the future and what types of management actions may be appropriate for maintaining adequate storage in the groundwater basin.

Deep percolation of irrigation water is the largest inflow to the groundwater basin and plays an important role in maintaining groundwater storage. Surface water from the Turlock Irrigation District, and to a lesser extent, the Merced Irrigation District is used to supply more than half of the total irrigation water applied within the Basin. Hence, under current conditions the continued use of surface water for agricultural irrigation is vital for sustaining recharge in the Subbasin. Future changes to inflows or outflows resulting from shifts in land use patterns have the potential to reduce recharge and create reductions in groundwater storage.

### **Water Quality in the Turlock Subbasin**

Groundwater quality in the Turlock Subbasin remains high throughout most of the region. Current knowledge indicates that salinity, nitrates, iron and manganese, boron, arsenic, radionuclides, bacteria, pesticides, trichloroethylene, and other trace organics have been found in the Turlock Subbasin. The U.S. Geological Survey, in coordination with numerous state and federal agencies, is conducting an extensive investigation of groundwater quality in the local area

through the Groundwater Ambient Monitoring and Assessment Program. This study evaluates a broader range of constituents and will provide additional information on water quality issues in the Subbasin.

Some of the constituents described above and in detail in this Groundwater Management Plan occur naturally, while others have been introduced into groundwater from anthropogenic sources. Where the constituent concentrations have exceeded drinking water limitations, the municipal water purveyors have implemented actions ranging from wellhead protection to well closure to maintain viable supplies.

Protecting water quality is as important to maintaining the local groundwater supply as sustaining groundwater recharge. The Groundwater Management Plan is intended to create a framework for coordinating actions among different agencies with management authority to protect both the quality and quantity of groundwater resources.

## GROUNDWATER MANAGEMENT PLAN

The local agencies within the Turlock Subbasin agree that groundwater and surface waters within the Turlock Subbasin are vitally important resources that provide the foundation for maintaining current and future water needs. Preservation of these resources is essential to maintaining the economic viability and prosperity of the Subbasin area. It is the overall goal of the local water agencies that groundwater will continue to be a reliable, safe, efficient, and cost-effective water supply. This Groundwater Management Plan includes seven Basin Management Objectives (BMOs) to meet this goal. The BMOs serve as targets to guide the groundwater management actions of the local water agencies. **The BMOs described in this Groundwater Management Plan include:**

- 1. Maintain an adequate water level in the groundwater basin.**
- 2. Protect groundwater quality and implement measures, where feasible, to reduce the potential movement of existing contaminants.**
- 3. Monitor groundwater extraction to reduce the potential for land subsidence.**
- 4. Promote conjunctive use of groundwater and surface waters.**
- 5. Support and encourage water conservation.**
- 6. Develop and support alternate water supplies, and educate users on the benefits of water recycling.**
- 7. Continue coordination and cooperation between the TGBA members and customers.**

Water agencies in the Turlock Subbasin, individually and collectively, are pursuing water management strategies under each of the BMOs to ensure that groundwater continues to be a reliable, safe, efficient, and cost-effective water supply.

## GROUNDWATER PROTECTION MEASURES

The water agencies within the Turlock Subbasin are committed to protecting the quantity and quality of groundwater resources. The TGBA has assembled a number of activities of the local water agencies that can be coordinated through the TGBA to support the BMOs of protecting groundwater quality and quantity. These groundwater protection measures are ongoing activities

that local agencies may be engaged in, or that agencies may implement in the future. Although the TGBA does not have authority for implementing these actions, the TGBA can serve as a forum for sharing and researching information, and members can provide feedback and guidance to the local agencies involved with these actions. The groundwater protection measures described in the Plan include:

1. Identification and management of wellhead protection areas.
2. Regulation of the migration of contaminated groundwater.
3. Identification of well construction policies.
4. Administration of well abandonment and destruction programs.
5. Mitigation of overdraft conditions.
6. Replenishment of groundwater extracted by water producers.
7. Construction and operation of recharge, storage, conservation, water recycling, and extraction projects.
8. Control of saline water intrusion.

#### IMPLEMENTATION OF THE GROUNDWATER MANAGEMENT PLAN

The Groundwater Management Plan is intended to provide a flexible, adaptive plan for achieving the overall goal that groundwater will continue to be a reliable, safe, efficient, and cost-effective water supply. The Plan presents numerous potential actions that can be undertaken by local water agencies and coordinated through the TGBA. The following measures are proposed as suggested management actions that the local agencies may draw from to achieve the Basin Management Objectives:

1. **Protection of natural recharge areas** through mapping and identification, education of the public and planning entities, and encouraging the maintenance of land use practices that promote groundwater recharge.
2. **Feasibility evaluation of artificial recharge projects**, by building upon mapping efforts to protect natural recharge and investigating additional water supplies for percolation, and promoting in-lieu recharge.
3. **Management and optimization of well field operations** to reduce well interference, control the migration of contaminant plumes, and optimize supply blending programs.
4. **Support of public health programs** to protect water quality through proper well construction and destruction.
5. **Water quality management**, beginning with conducting a hydrogeologic assessment to identify contaminant sources and develop strategies to control the migration and movement of poor quality water into or within the Basin.
6. Continue the **groundwater monitoring and subsidence monitoring program** and evaluate the effectiveness of the groundwater level and quality monitoring programs as well as the database used to store and manipulate the data.

7. Provide a forum for **policy assessment** and coordination of regional programs with policy implications or requirements.
8. Continue **promoting coordination and cooperation between water agencies** on regional issues, outreach programs, and actions to implement the BMOs.
9. **Identification and feasibility study of conjunctive use projects** to increase supply flexibility and promote recharge in years when water is available.

The implementation of several of these recommended actions is contingent upon securing funding. Both grant funding and local funding options will be evaluated. Local funding may be especially important for grant eligibility because of matching or local contribution requirements. Availability of funding for groundwater management activities, as well as future regulatory requirements, will influence the speed and level to which each of the measures is evaluated and implemented.

Progress on implementing the BMOs will be evaluated through periodic reports. The reports will also summarize the condition of the groundwater basin and discuss groundwater management activities. The reports may be prepared by the TGBA as a group or by individual agencies. The reporting process will also provide an opportunity to review the Groundwater Management Plan and determine whether the Plan requires modification to meet the goal of ensuring the viability of groundwater resources in the Turlock Basin.

## 7 STAKEHOLDER INVOLVEMENT

### 7.1 AGENCY INVOLVEMENT

The TGBA was formed to facilitate agency involvement in groundwater management activities within the Turlock Subbasin. The majority of local agencies with jurisdiction in the Subbasin have joined the TGBA. Those that have elected not to join are encouraged to participate in TGBA activities. The MOU utilized to form the TGBA provides a process for additional entities to join (A copy of the MOU is provided in Appendix C). Any local public agency, whose service area includes land located within the Subbasin, which uses groundwater, or is authorized to provide groundwater, groundwater quality management, or groundwater replenishment within its service area, and whose service area includes all or a portion of the Turlock Subbasin, may apply for membership. Application is subject to approval by existing TGBA members, and the joining entity must pay any back contributions, if any, as determined by the TGBA governing body.

### 7.2 ADVISORY COMMITTEE

TGBA representatives currently serve in an advisory role for groundwater management activities within the Subbasin. Additional committees, including an Advisory Committee, will be formed as necessary. The MOU includes language specifying that the TGBA Board may establish any committees it deems as necessary or desirable.

### 7.3 COORDINATION WITH OTHER AGENCIES

The TGBA provides a mechanism for local public agencies to coordinate groundwater management activities. Meetings are scheduled on a monthly basis to work through groundwater management issues. In addition to action items included on the agenda, time is allotted at each meeting for participants to provide updates on groundwater and related issues not specifically identified.

In addition, TGBA member agencies have coordinated the planning process with other neighboring water agencies and subbasins. The City of Modesto and Stanislaus County participate in the groundwater management efforts within the Modesto Subbasin. Similarly, Merced ID and Merced County participate in groundwater management efforts occurring within the Merced Subbasin. These agencies have communicated with the associations and other agencies within the Merced and Modesto subbasins, to help to facilitate the coordination of groundwater management efforts taking place within the adjacent subbasins. Additional coordination efforts include development of ongoing and future relationships with State and Federal agencies. These activities are described in Section 7.5 below.

### 7.4 PUBLIC INVOLVEMENT PROCESS

Prior to developing this plan, local agencies held public hearings, noticed pursuant to Section 6066 of the Government Code. As noticed, the intent of these meetings was to inform the public that an update of the Plan was being developed and to provide an opportunity for the public to provide input on the issues that should be considered in the Plan. All comments received in this process were reported back to the TGBA and considered in the development of the Plan.

All TGBA meetings are open to the public and held pursuant to the Brown Act. Agendas are posted and available for public review. Agendas are submitted directly to interested individuals upon request, as well as each of the local public agencies within the Subbasin. As noticed on the agendas, and documented in meeting minutes, the update of the Plan was discussed regularly during TGBA meetings, providing additional opportunities for interested individuals to participate in the process.

A second public hearing, noticed pursuant to Section 6066 of the Government Code is required for a local public agency to adopt a groundwater management plan. Each agency that adopted this Plan was required to conduct this public hearing independently before adopting the Plan. This hearing created an additional opportunity for the public to provide input on whether or not the agency should adopt the updated Plan.

In addition to these opportunities, the public can participate in the ongoing groundwater management activities of the TGBA. A public comment period is included at each TGBA meeting, where time is allotted for any interested parties to raise issues or concerns. Due to specific Brown Act requirements, items discussed during the public comment period may not be acted upon at that time. However, those issues identified through this forum may be brought back to the TGBA for consideration and action at a future meeting.

#### 7.5 DEVELOPING RELATIONSHIPS WITH STATE AND FEDERAL AGENCIES

Local public agencies that make up the TGBA have relationships with various State and Federal agencies. These individual relationships will continue to be fostered and utilized, as necessary, to implement subarea and Subbasin groundwater management activities.

The TGBA will periodically develop a report documenting its activities, which will be submitted to the DWR. This process will assist in fostering an ongoing relationship with DWR. Additional relationships will be developed with other State and Federal agencies, as necessary.

#### 7.6 DISPUTE RESOLUTION PROCESS

The TGBA has been used effectively as a tool for the resolution of groundwater management issues in the Basin. Discussion of issues in the TGBA meetings is an open and transparent process, which has resulted in cooperative relationships between water agencies representing the various water users within the Basin. The TGBA will continue to provide a forum for discussion and early resolution of the Basin's groundwater issues.

## 8 PLAN IMPLEMENTATION

Key features of the plan are the linkages that have been established among program actions. These linkages provide a cohesive program in which the whole is greater than the sum of its parts. These linkages are described throughout the text, including Sections 5 and 6, which provide a discussion of groundwater management measures and activities, and in the implementation measures described below.

The Implementation Plan presents suggested management actions that can assist the TGBA in meeting the Basin Management Objectives (Section 5.3). The overarching purpose of the BMOs and associated actions is to encourage a balance of surface water and groundwater use to protect the resources of the Basin and maximize the reliable supply of high quality water to meet the Subbasin's current and future needs.

It is also important to note that groundwater management requirements and responsibilities, as dictated by the California Code of Regulations, may change over time. Individual agencies, as well as the TGBA, will evaluate regulatory changes and determine how best to address those changes, when and if they occur. The recommendations and implementation priorities may change over time, to accommodate the changing regulatory framework.

### 8.1 IMPLEMENTATION PLAN

#### 8.1.1 Basin-Wide Management Actions

The following Basin-wide management actions are provided as suggested measures for facilitating the achievement of the BMOs described in Section 5.3:

- Protection of natural recharge areas
- Feasibility evaluation of artificial recharge projects
- Management and optimization of well field operations
- Support of public health programs
- Water quality management
- Groundwater monitoring and subsidence monitoring program
- Policy assessment
- Promoting coordination and cooperation between water agencies
- Identification and feasibility study of conjunctive use projects

The following discussion provides additional information regarding each of the suggested implementation measures to support each management action. Availability of funding for groundwater management activities, as well as future regulatory requirements, will influence the speed and level to which each of the measures is evaluated and implemented.

### 8.1.1.1 Protection of Natural Recharge Areas

Groundwater recharge will likely diminish as a result of continued urban expansion and further use of more advanced agricultural irrigation practices. New irrigation technologies reduce the amount of irrigation water applied, and consequently reduce the deep percolation of applied irrigation water. These land use influences on percolation illustrate the need to identify and map the remaining natural recharge areas so that these areas can be protected. The objective is to develop specific planning actions that offer varying degrees of protection, depending on an area's significance as a source of recharge. Types of protection could include:

- Programs to educate the public and planning entities about the importance of protecting recharge areas.
- Pricing and incentive programs to encourage the continued use of surface water for flood irrigation. Because irrigation of agricultural land is currently the largest contributor to groundwater recharge within the Subbasin, pricing and incentive programs could encourage the continuation of this type of recharge within the Basin.

The first steps in implementing this management action would be to identify recharge areas within the cities and counties, develop a GIS-based map of natural recharge areas, inform planning entities of the importance of these areas, and make recommendations for the protection of these areas.

### 8.1.1.2 Feasibility Evaluation of Artificial Recharge Projects

If future studies or updates of the Subbasin groundwater budget indicate that the Subbasin is in overdraft or is likely to fall into overdraft, two broad options are available for sustaining and enhancing recharge. The first option is to maintain natural recharge by protecting the natural recharge areas. This option is described above in Section 8.1.1.1.

The second option is to augment natural recharge through an artificial recharge program. The evaluation of artificial recharge projects would begin by mapping potential recharges sites, building upon the mapping of natural recharge sites described previously. Existing planning efforts are evaluating using surface water supplies in artificial recharge basins; however, using stormwater flows for artificial recharge also could be evaluated.

An enhanced recharge management action also would evaluate in-lieu recharge projects. These projects would look at opportunities to reduce groundwater demand by supplying surface water to areas now served by groundwater. Such projects could include incentives for TID or Merced ID irrigators to continue irrigating with surface water instead of groundwater, or other approaches available to the irrigation districts to promote groundwater recharge and reduce overdraft.

Additional projects that could be evaluated include development or expansion of conjunctive use projects in urban areas with poor groundwater quality (i.e., supplement the urban water supply with surface water in order to reduce its reliance on groundwater, improve groundwater levels and reduce the movement of contaminants in the basin) as well as a program to evaluate the potential for stormwater recharge.

### 8.1.1.3 Management and Optimization of Well Field Operation

A component of improved groundwater management could be the optimization of well operations to accomplish specified management objectives. For example, each well in a well field could be instrumented and controlled so that the group of wells is operated to meet single or multiple objectives. Examples of potential implementation measures for this management action include:

- Minimize the overall pumping costs
- Maintain groundwater levels within specified ranges
- Reduce or eliminate well interference
- Control the migration of contaminant plumes
- Enhance control of pumping into irrigation canals in response to delivery and cutoff orders, hence creating opportunities to conserve water by reducing spillage

In addition, well field optimization can be used to support management of water quality within irrigation canals, by controlling the quantity of poorer-quality water discharged from wells that blends with surface water deliveries. TID uses groundwater pumping to lower groundwater levels and supplement surface water supplies. Groundwater is blended with surface water supplies and utilized for irrigation supply. Urban wells that do not meet drinking water standards could potentially be used to supplement agricultural supplies while helping to manage contaminant migration. The agencies within the Basin could evaluate modifications to the blending program to lower the high groundwater table, manage contaminant migration, and provide good quality water for irrigation supply.

### 8.1.1.4 Support of Public Health Programs

Well construction and demolition standards are designed specifically to protect groundwater quality. Implementation measures to assist local agencies in complying with public health standards may include:

- Installation of sanitary well seals on all new wells in accordance with the California Well Standards (or a more strenuous standard as determined necessary by the County or other applicable water agency to protect groundwater quality)
- Abandonment of wells in accordance with the California Well Standards (or a more strenuous standard as determined necessary by the County or other applicable water agency to protect groundwater quality)

This management action is particularly valuable in unincorporated areas not served by a water purveyor.

### 8.1.1.5 Water Quality Management

The protection of groundwater quality is an increasing concern because the Basin's population is continuing to grow. This management action would involve conducting a detailed hydrogeologic assessment of the Basin, focusing on the areas with poor water quality to identify the sources of contaminants. This assessment would result in a GIS-based map of areas with poor water quality. The information could be used in conjunction with the recharge area

mapping described above and used to develop strategies to control the migration and movement of poor quality water into and/or within the Basin.

#### 8.1.1.6 Groundwater Monitoring and Subsidence Monitoring Program

Groundwater monitoring, data analysis, and archiving of collected data are essential for any groundwater management plan. Data are needed to understand conditions within the Basin, evaluate trends, facilitate the implementation of management actions, and evaluate their effectiveness.

As described in Section 4.1.4, reductions in DWR groundwater monitoring have resulted in greater uncertainty in the measurement of groundwater levels in the Basin. These data are required to estimate groundwater storage and changes in storage over time. The TGBA should evaluate the current condition and effectiveness of the groundwater level and quality monitoring programs, the database used to store and manipulate the data, and make improvements as necessary.

In addition, the TGBA could consider monitoring inelastic land surface subsidence within the Basin. Given that there have not been subsidence issues in the past, it appears unlikely that inelastic land subsidence would occur if current groundwater conditions are maintained. The ongoing efforts within the Basin to prevent groundwater overdraft further reduce the potential for subsidence. However, the TGBA could consider monitoring and documenting any future changes in land surface elevations. If subsidence is observed, appropriate actions could be recommended.

#### 8.1.1.7 Policy Assessment

Several of the technical management actions introduced above have clear policy requirements and implications. The development of consistent policies could be assisted by a regional groundwater forum, such as the TGBA. This forum would foster coordination and cooperation among participating agencies that manage the Turlock Basin, and would provide a framework for formulation of regional projects and programs for the protection and use of groundwater resources.

For example, TGBA members are mutually concerned about protecting natural recharge areas from pollutants. Local water agencies could work through the TGBA forum to inform other members about land use practices that may contribute to groundwater degradation.

#### 8.1.1.8 Promoting Cooperation and Coordination Between Water Entities

The TGBA will continue to coordinate water management activities within the Basin and work cooperatively to implement the agreed-upon BMOs. The local water agencies also may work together to develop a coordinated outreach program to educate Subbasin residents and groundwater users on groundwater management issues.

#### 8.1.1.9 Identification and Feasibility Study of Conjunctive Use Programs

Conjunctive use programs optimize the use of groundwater resources in combination with surface water supplies to maximize water supply and minimize the potentially adverse effects of using a single source. The overall strategy in conjunctive use is to store water in the

groundwater basin for use in drier years by recharging the basin during years when water is more abundant. Groundwater storage activities can include both active (e.g., recharge basins) and passive (e.g., in-lieu recharge) projects.

Many of the implementation measures described in this section of the Plan can be viewed as components of a broader conjunctive management program. The goal of this program would be to balance surface water and groundwater uses to support the BMOs. Implementation of this management action will involve continuing the current conjunctive management activities described in Section 5.6, in addition to the identification and feasibility study of the implementation measures described throughout this section. Ongoing monitoring coordinated through the TGBA provides a means of tracking the success of existing conjunctive management strategies and identifying if additional or alternative strategies should be evaluated.

## 8.2 GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION REPORT

Periodic reports will be produced, as necessary, to comply with groundwater management requirements. Reports will be designed to summarize groundwater basin conditions, and describe groundwater management activities. These reports may be prepared by the TGBA as a group, or by individual agencies. Reports generated by individual agencies will be coordinated through the TGBA.

The periodic reports may include the following types of information:

- A summary of monitoring results, including historical trends;
- A summary of management actions implemented;
- A summary, supported by monitoring results, of whether management actions are meeting the management goals and objectives;
- A summary of proposed management actions; and
- A summary of any proposed changes to this Plan, including addition or modification of management measures.

## 8.3 FINANCIAL PLANNING FOR RECOMMENDED ACTIONS/PROJECT IMPLEMENTATION

Progress toward the implementation of recommended actions is contingent upon securing funding for elements of this Plan. Two avenues that are available for funding include grant programs and funds generated internally by the TGBA members.

### 8.3.1 Grant Funding

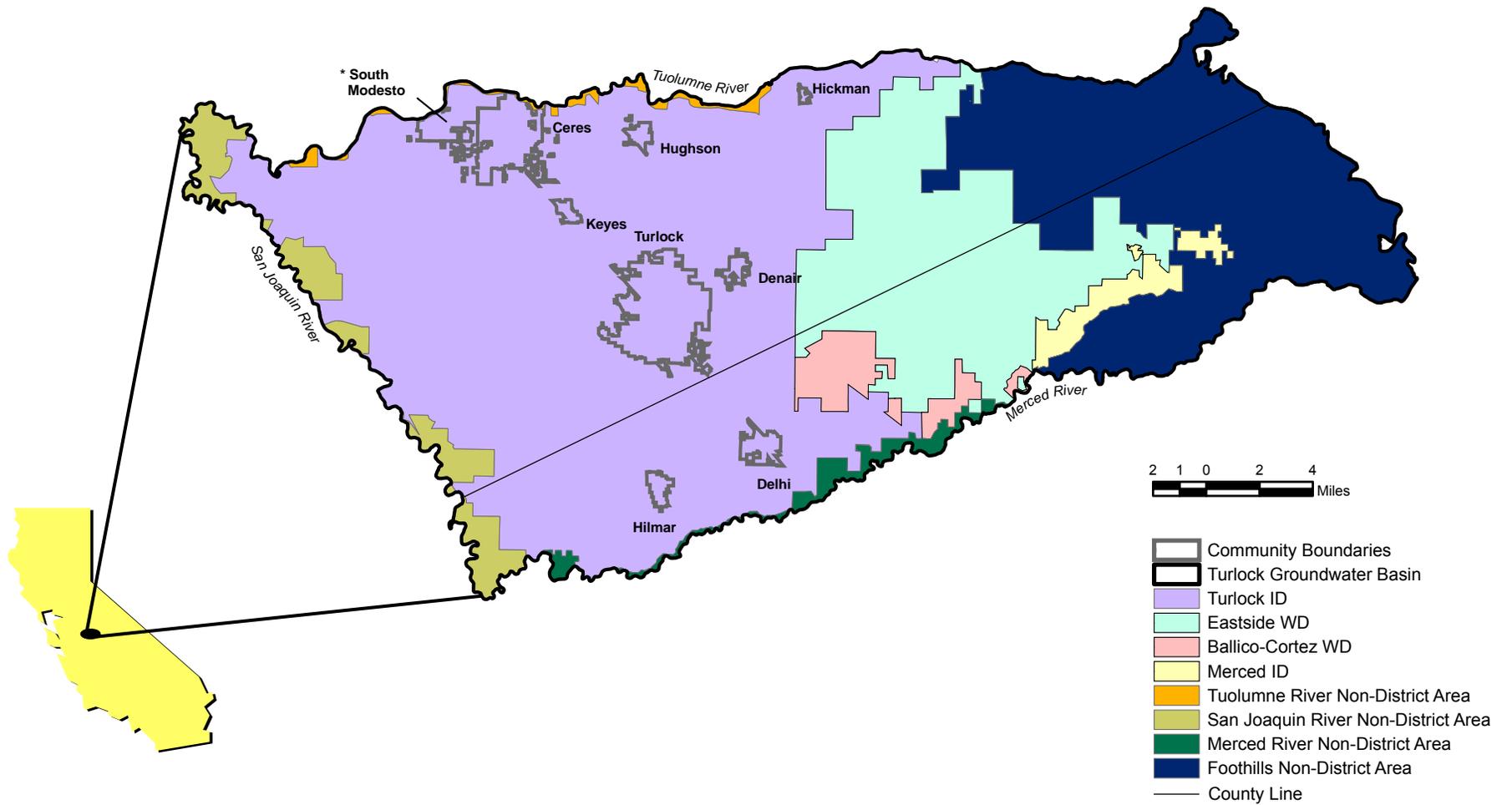
Grant funding programs are continually changing. As the TGBA and/or individual agencies implement the recommended actions, funding sources will be evaluated. Grant funding may be secured by the TGBA (likely under the management of a member agency on behalf of the TGBA), or by individual agencies. As has been the practice in the past, the TGBA also will continue to support efforts by local agencies to secure grant funding that is consistent with the TGBA's goals and objectives and furthers groundwater management related issues within the Basin.

### 8.3.2 Funding through Local Agency Budgeting

Funding from local agencies is a second source of funding available for implementation of the plan. The ability to fund plan implementation locally will be dependent upon available resources and is subject to an individual agency's budgetary process. It is important to note, however, that local financial support or contributions are often required by state grant programs or other sources of outside funding. Therefore, local contributions may aid in the acquisition of outside funding to implement the plan.

## 8.4 PERIODIC REVIEW OF THE GROUNDWATER MANAGEMENT PLAN

As indicated in Section 8.2, one of the issues to be evaluated in the periodic reports is whether this Plan requires modification. Hence, when the TGBA develops periodic summary reports, it will also consider whether or not an update of the Plan is warranted. To maintain consistency and encourage coordination among local water agencies, it is the intent of the TGBA that updates of the Plan continue to be a Basin-wide activity.



\* South Modesto represents the City of Modesto Service Area South of the Tuolumne River

**Figure 1. Turlock Groundwater Basin Location and Boundaries**

## **Appendix B**

### **Tables**

**Table 1. Location of TGBA GMP Components**

Description	Section(s)
<b>CWC Section 10750 et seq. Mandatory Components</b>	
1. Documentation of public involvement statement.	7.4
2. Basin Management Objectives (BMOs).	5.3
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping.	5.5-5.6 & 6.1-6.8
4. Plan to involve other agencies located within groundwater basin.	7.1-7.3 & 7.5
5. Adoption of monitoring protocols by basin stakeholders.	5.5-5.6
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	1.1-1.2 & 4.1.1
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	N/A
<b>DWR Suggested Components</b>	
1. Manage with guidance of advisory committee.	7.2
2. Describe area to be managed under GMP.	5.2
3. Create link between BMOs and goals and actions of GMP.	8.1
4. Describe GMP monitoring program.	5.6
5. Describe integrated water management planning efforts.	3.3 & 5.7
6. Report on implementation of GMP.	8.2
7. Evaluate GMP periodically.	8.4
<b>CWC Section 10750 et seq. Voluntary Components</b>	
1. Control of saline water intrusion.	6.8
2. Identification and management of wellhead protection areas and recharge areas.	6.1
3. Regulation of the migration of contaminated groundwater.	6.2
4. Administration of well abandonment and well destruction program.	6.4
5. Mitigation of conditions of overdraft.	6.5
6. Replenishment of groundwater extracted by water producers.	6.6
7. Monitoring of groundwater levels and storage.	5.5-5.6
8. Facilitating conjunctive use operations.	5.7
9. Identification of well construction policies.	6.3
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	6.7
11. Development of relationships with state and federal regulatory agencies.	7.5
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	3.3

## Appendix C

### **MEMORANDUM OF UNDERSTANDING ESTABLISHING THE TURLOCK GROUNDWATER BASIN ASSOCIATION**

**MEMORANDUM OF UNDERSTANDING  
ESTABLISHING THE TURLOCK GROUNDWATER BASIN ASSOCIATION**

1. PARTIES:

The parties to the Memorandum of Understanding (“MOU”) are: City of Ceres, a California Public Agency; Keyes Community Services District, a California Public Services District; Denair Community Services District, a California Public Services District; City of Turlock, a California public agency; Hilmar County Water District, a California Public Services District; Delhi County Water District, a California Public Services District; City of Hughson, a California public agency; City of Modesto, a California public agency; Merced Irrigation District, a California Irrigation District; Ballico Community Services District, a California Public Services District; County of Merced, a Political Subdivision of the State of California; County of Stanislaus, a Political Subdivision of the State of California; Eastside Water District, a California Water District; Ballico-Cortez Water District, a California Water District; and Turlock Irrigation District, a California Irrigation District.

2. RECITALS:

This MOU is entered into with regard to the following facts and circumstances, among others:

2.1 Groundwater and surface water resources within the Turlock Groundwater Basin are vitally important resources, in that they provide the foundation to maintain current and fulfill future agricultural, domestic, municipal and industrial needs, as well as other needs, and to maintain the economic viability and prosperity of the Basin area.

2.2 The Stanislaus/Merced County area is one of the world's foremost agricultural areas; and the agricultural industry has played a major role in the development of the economy of Stanislaus/Merced County area. In an era of increasing competition for the area's finite water resources, it is important to understand and plan for the utilization of all the area's water resources in order to preserve all elements of the local economy vital to the area's well-being.

2.3 The Parties entered into a Memorandum of Understanding on or around July 14, 1995, for the purposes of studying and evaluating the condition of the Basin, and developing a groundwater management plan for the preservation, protection and enhancement of the Basin. The Turlock Groundwater Basin Groundwater Management Plan was adopted by the Parties on or about October 1997. The 1995 Memorandum of Understanding terminated by its own terms on December 31, 1997.

2.4 The Parties desire to form an association, which will be known as the Turlock Groundwater Basin Association, to provide a mechanism for the Parties

to collectively implement the Plan and the purposes and goals of this Memorandum of Understanding.

2.5 Purposes and Goals: The purposes and goals for the formation of the Association are:

2.5.1 To provide a mechanism to coordinate the implementation of the Plan and other groundwater management activities;

2.5.2 To create an association of the Parties to enhance the ability to obtain funding to carry out the Plan and related groundwater management projects; and

2.5.3 Provide information and guidance for the management, preservation, protection and enhancement of the Basin.

2.6 The Parties believe that non-coordinated action by water providers and users within the Basin could result in counter productive competition for finite resources resulting in adverse impacts to the groundwater and surface water supplies within the Basin.

2.7 The Parties believe that creation of an Association for water suppliers within the Basin is important to protect the groundwater and surface water

resources and will assist in meeting the needs of all users of such resources within the Basin.

2.8 Because of the enactment of Water Code Sections 10750 et seq., it is clear to the Parties that local management of water resources is desirable in order that local control be maintained over such resources.

2.9 The Parties hereto desire to enter into this MOU in order to form an association to promote the stated goals and provide coordinated implementation of the Plan to make the best use of available water resources to meet the needs of their respective constituents and service territories.

2.10 In forming the Association, it is the Parties' desire that the Association not be formed as a separate governmental entity, nor have any enforceable regulatory authority over any Party's facilities or any Party's respective surface water or groundwater supplies or rights, nor duplicate any services, duties or authority of any other agency.

3. AGREEMENT:

The Parties agree as follows:

4. DEFINITIONS:

The following terms, whether in the singular or the plural, and when used herein with initial capitalization, shall have the meanings specified in this Section 4:

4.1 **Basin:** The Turlock Groundwater Basin, which is geographically defined as that area in the State of California bounded on the west by the San Joaquin River; on the north by the Tuolumne River, on the east by the base of the Sierra Nevada foothills; and on the south by the Merced River, and includes the area of land overlying that basin and all tributaries therein.

4.2 **Board:** That body, consisting of one representative from each of the Parties, which governs the Association, as established pursuant to Section 5.2 of this MOU.

4.3 **Chairperson:** The presiding officer of the Association as elected by the Board.

4.4 **Governing Bodies:** The legislative bodies of the governmental Parties to this MOU.

4.5 **MOU:** This Memorandum of Understanding Establishing the Turlock Groundwater Basin Association.

4.6 **Parties:** Each of those entities named in Section 1 of this MOU, or those Parties added pursuant to Section 5.4 of this MOU.

4.7 **Plan:** The Turlock Groundwater Basin Groundwater Management Plan, adopted on or about October 1997.

5. THE ASSOCIATION:

5.1 **Powers and Purposes:** The Parties to this MOU hereby form the Turlock Groundwater Basin Association.

5.1.1 The purpose of the Association is to provide a forum in which the Parties can work cooperatively; to combine the available talent of the Parties' respective staffs; and to accomplish the purposes described in Section 2 of this MOU.

5.1.2 This Association shall have no enforceable regulatory authority over any person or entity, including Parties or Parties' facilities or rights.

5.2 **Board:** The Association shall be governed by a Board whose membership, duties and responsibilities are set forth herein.

5.2.1 Each Party shall designate one person to serve as a member of the Board, and one or more alternates. Each member of the board, and each alternate, shall serve at the pleasure of the Party appointing such member. A Party's alternate may serve in the place of that Party's member in the absence of such member and, in such case, the alternate shall have the powers of the member.

5.2.2 The Board, at its first meeting, shall elect a chairperson and vice-chairperson from its members. Such officers shall serve at the pleasure of the Board and in such capacities until the first meeting of the Board in 2002 at which time the Board shall elect new officers. Thereafter, the Board shall elect a chairperson and vice-chairperson from its members at the first meeting of each even numbered calendar year. The Chairperson shall be responsible for presiding over meetings of the Board, and shall notify committee members of meetings of the Board. The Board shall establish a date, time and place for its regular meetings, and may hold special meetings when required for the proper transaction of business. All meetings of the Board shall be held in accordance with the provisions of the Brown Act, California Government Code §54950 et seq. The Board shall prescribe such procedures for the conduct of its business as it deems appropriate.

5.2.3 A quorum shall consist of a majority of the Voting Members of the Board, except that less than a quorum may adjourn meetings of the Board. Alternatively,

the Chairperson may adjourn a meeting of the Board to a specified time, date and place if there is less than a quorum of members present for a meeting.

5.2.4 The Board shall have the following duties and responsibilities:

- a. Develop and implement the activities, including work schedule, designated to achieve the objectives of the Association as set forth in Section 2 of this MOU.
- b. Monitor work activities of the Association.
- c. Establish such committees as may be necessary or desirable to carry out the purposes of the Association, and to exercise general supervision over such committees.

5.2.6 Except for actions for which a different approval standard is set forth in this MOU, all actions of the Board shall be approved by a majority of the members present.

5.3 **Staff; Employees:** The Association may have employees upon a decision by the Board, and/or may obtain staff and support services through the Parties.

5.4 **New Parties:** New Parties may join the Association, provided that they meet the requirements set forth in this Section 5.4.

5.4.1 Any local public agency, whose service area includes land located within the Basin, which uses groundwater, or is authorized to provide groundwater, groundwater quality management, or groundwater replenishment within its service area, and whose service includes all or a portion of the Basin, may apply for membership in the Association.

5.4.2 Application for membership shall be subject to approval by the Governing Bodies of the Parties; approval shall require the affirmative vote of the Governing bodies of two-thirds (2/3) of the Parties.

5.4.3 Any new Party to this Agreement shall, as a condition of admission to the Association, be required to first pay its proportionate share of back contributions, if any, as determined by the Board.

6. COMMITTEES:

The Board may establish any committees it determines are necessary or desirable.

7. ASSOCIATION COSTS:

7.1 Costs incurred by any Party in connection with any functions of the Association, or any committee established by the Board, and expenses of a Party's personnel including, without limitations, the regular and alternate members appointed by a party to

any committee while performing such functions, shall not be reimbursed by the Association except upon approval of the Board.

8. FUNDING AND VOTING PERCENTAGES:

8.1 It is anticipated that the Parties will fund their own staff work. However, outside funding may be available or the Parties, or any subgroup of the Parties, may make additional funding contributions, if necessary, upon agreement of those Parties participating in the funding.

8.2 **Voting Rights:** Each Party's representative on the Board shall be entitled to one vote.

8.3 **Modification by Party:** Funding percentages and/or voting percentages as indicated in Section 8.1 and 8.2 respectively, may be changed only upon the approval of the Governing Bodies of two-thirds (2/3) of the Parties.

9. RELATIONSHIP OF THE PARTICIPANTS:

9.1 **Each Party's Action is Independent of the Other:** The obligation of each Party to make payments under the terms and provisions of this MOU is an individual and several obligation and not a joint obligation with those of the other Parties. Each Party shall be individually responsible for its own covenants, obligations and liabilities under

this MOU. No Party shall be under the control of or shall be deemed to control any other Party or the Parties collectively. No Party shall be precluded from independently pursuing any of the activities contemplated in this MOU. No Party shall be the agent of or have the right or power to bind any other Party without such Party's express written consent, except as expressly provided in this MOU.

9.2 **No Creation of a Joint Powers Agency:** The Parties agree that by this MOU they do not intend to provide for the creation of an agency or entity which is separate from the Parties pursuant to Chapter 5 (commencing with §6500) of Division 7 of Title 1 of the Government Code, relating to the joint exercise of powers.

10. **TERMS OF THIS MOU:** The term of this MOU shall commence on November 15, 2001 and shall continue until terminated by Board action.

Upon termination of this MOU, the Board shall determine the assets and liabilities of the Association; make every effort to satisfy all obligations within sixty (60) days of the termination of the MOU; and distribute the remaining fund balance equitably to each Party in proportion to each Party's funding contribution to the Association.

11. **GENERAL PROVISIONS GOVERNING MOU:**

11.1 **Invalidity of Any Term Not to Invalidate the Entire Memorandum:** In the event that any of the terms, covenants or conditions of this MOU or the application of

any such term, covenant or condition shall be held invalid as to any Party, person or circumstance by any court of competent jurisdiction, all other terms, covenants or conditions of this MOU and their application shall not be affected thereby, but shall remain in full force and effect unless any such court holds that those provisions are not separable from all other provisions of this MOU.

11.2 **Construction of Terms:** This MOU is for the sole benefit of the Parties and shall not be construed as granting rights to any person other than the Parties or imposing obligations on a Party to any person other than another Party.

11.3 **Good Faith:** Each Party should use its best efforts and work wholeheartedly and in good faith for the expeditious completion of the objectives of this MOU and the satisfactory performance of the terms and provisions contained herein.

11.4 **Withdrawal or Termination of Membership:** Except in the event of the termination of this MOU pursuant to Section 10, a party who withdraws or terminates its membership in the Association shall not be entitled to a refund of its funding contributions. Any Party may terminate membership and withdraw from this Association upon thirty (30) days written notice of termination to the Association. If a Party withdraws from the Association when the Party is in arrears as to its funding contributions to the Association, that Party's entitlement to use any work product of the Association as provided for herein shall be determined by the Board.

11.5 **Amendment:** An amendment to this MOU must be approved by the affirmative vote of the Governing Bodies of two-thirds (2/3) of the Parties.

11.6 **Counterpart Execution:** This MOU may be executed in counterparts each of which shall be deemed an original but all of which together shall constitute one and the same instrument.

11.7 **Governance:** This MOU is made under and shall be governed by the laws of the State of California.

11.8 **Reasonable Delivery of Documents:** Each Party agrees upon request by the Chairperson or by the Board, to make, execute and deliver any and all documents reasonably required to implement this MOU.

IN WITNESS WHEREOF, the Parties have caused this MOU to be executed, each signatory hereto represents that he has been appropriately authorized to enter into this MOU on behalf of the Party for whom he/she signs.