CDM *in association with the*
California Department of Water Resources, Northern District

Tehama County Flood Control and Water Conservation District

Water Inventory and Analysis

September 2003

Report

Executive Summary

Growing demand for water throughout California has placed increasing pressure on water supplies, creating a limited and more expensive source in many areas. With surface water supply reliability decreasing and costs increasing, many water users have turned to groundwater supply, without fully understanding the effects on local groundwater basins. Effective water planning and management requires an understanding of many aspects of water resources, including management practices, water rights and contracts, water quality conditions and environmental requirements, and the interrelationship between surface water use, groundwater use, aquifer recharge, and groundwater levels.

Irrigated Agriculture in Tehama County

The need for documentation of current water use, supply, and management in Tehama County, and the resultant improved understanding of the resource led the Tehama County Flood Control and Water Conservation District (FCWCD) to complete this Water Inventory and Analysis report. The FCWCD received an AB 303 grant from the California Department of Water Resources (DWR) to complete this study, and received technical assistance from DWR Northern District staff.

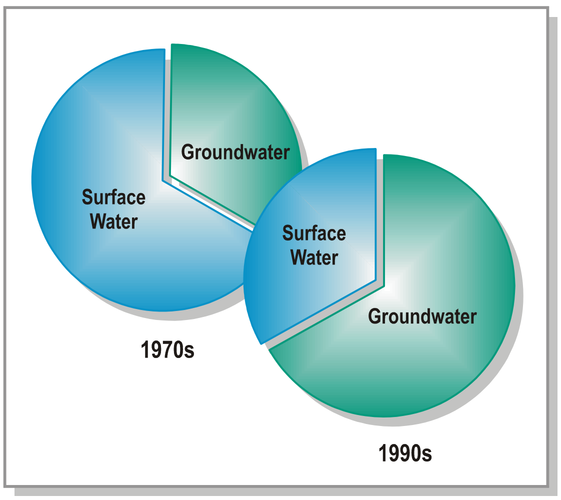
The purpose of the Water Inventory and Analysis project is to provide: 1) a supplementary tool for water management; 2) a reference and educational tool; and 3) a stepping-stone toward full implementation of Tehama County's AB 3030 Groundwater Management Plan. In a time when water resource reliability is uncertain in many areas of California, the FCWCD is working with local stakeholders toward a common goal of ensuring a reliable future supply by documenting the current status of water use and supply, identifying areas of need, and developing recommendations that will ensure a supply of high quality water into the future.

This document was developed with input and assistance from Tehama County's AB 3030 Technical Advisory Committee, DWR Northern District, County water suppliers, conservation groups, and the general public. DWR Northern District developed groundwater storage data and County water supply and demand data used in Section 3 and Section 5 of this document. The success of any document is partially defined by its utility at the time it is produced and into the future. The document 1) provides information that can be used to support water management decisions, 2) serves as a reference and educational tool on countywide water resource issues and conditions, and 3) advances implementation of the County's AB 3030 Groundwater Management Plan.

ES.1 County Water Use History

The history of water use in Tehama County directly corresponds to population and economic growth, the development of regional water storage and supply projects, and water supply pricing and reliability. Because agriculture is an economic driving force in the county, much of the water use history is directly tied to the development and use of water sources to satisfy agricultural needs.

In the early 1900s, Tehama County relied primarily on surface water. The Sacramento River and its tributaries provided water needed for irrigation. Surface water runoff may have been stored locally for later use, but large-scale storage projects did not exist. Shallow groundwater wells were likely developed for domestic supplies during this time. As the county's population and agricultural production continued to increase throughout the first half of the century, groundwater use continued to expand, representing a significant agricultural supply for the time but a relatively small volume compared to today's use (FCWCD 1996).



Changes in Surface Water and Groundwater Use Between the 1970s and the 1990s

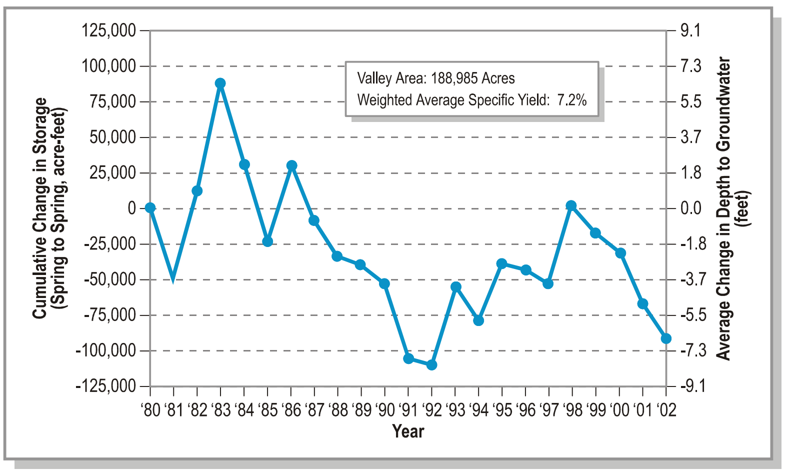
Reliable surface water supplies became available to areas of Tehama County west of the Sacramento River following authorization of the Central Valley Project (CVP) in 1935 and the subsequent construction of Shasta Dam and the Corning Canal. Surface water use increased significantly following the completion of CVP facilities and the organization of water districts. By the 1970s, two-thirds of irrigation water used in the county was derived from surface water supplies. However, many water users in other parts of the state were also dependant upon CVP water supplies, which resulted in demand for stored CVP water that exceeded available supply in some years. The cost of CVP water also increased over time, resulting in a reduced demand for CVP surface water and an increased demand for groundwater as a primary supply. Groundwater use for irrigated agriculture increased to two-thirds of the irrigated agriculture supply in the 1990s and continues at a similar rate to the present day (FCWCD 1996).

Other factors have also contributed to an increasing reliance of groundwater, including local and statewide population growth, changing land use patterns, increased environmental water use, and water supply reliability. Increased municipal and industrial uses within the County rely almost entirely on groundwater as a water source.

ES.2 Geology and Hydrogeology

Tehama County has several water-bearing geologic formations. The Tuscan Formation on the west side of the county is the main aquifer for groundwater storage in the county, supplying water to shallow wells at the edge of the valley, and deep wells in the center of the valley. The Tehama Formation on the east side of the county supplies groundwater to deep wells. The Riverbank Formation occurs in patches throughout Tehama County, and provides water to shallow wells in the valley. The Modesto Formation is near the Sacramento River and also supplies water to shallow wells in the valley.

Groundwater levels in the County show seasonal drawdown because of summer crop and landscape irrigation demands. Groundwater levels decrease during the summer with larger seasonal variations in areas that use groundwater. Areas that use groundwater as the primary supply typically show increased seasonal drawdown. These areas include the Aaction Tree Farm and El Camino Irrigation District. Areas that use more surface water supplies, such as Kirkwood Water District and the east side of the Sacramento River, show relatively small seasonal variation.



Source: DWR 2003

Figure ES-1
Estimated Cumulative Change in Spring-to-Spring Storage
Sum of Valley Inventory Units

The Inventory and Analysis includes an assessment of groundwater in storage from 1980 to the present. Figure ES-1 shows the groundwater in storage for the entire County as a comparison to the year 1980. This figure shows that overall groundwater in storage has a decreasing trend, especially over the past five years. This trend is found on the figures for most of the Inventory Units as well. The decrease over the past five years does not appear to be tied to a dry weather pattern because the past years have been close to normal rainfall. Therefore, this decrease appears to be tied to changes in land use (increased development) or water use (conversion from surface water to groundwater supply).

ES.3 Water Management

Residents throughout the County have grouped together to form agricultural and municipal water supply agencies. These agencies were interviewed as part of the Inventory and Analysis to learn more about the agency history, the water demands and water sources, and any issues and concerns. Table ES-1 includes these agencies, their customers, and their water sources.

Table ES-1 ***Summary of Water Supplier and Water Source***					
Water Supplier	***Municipal***	***Agricultural***	***Groundwater***	***Surface Water***	***Mixed Source***
City of Red Bluff	X		X		
Proberta Water District		X		X	
El Camino Irrigation District		X	X		
Thomes Creek Water District		X		X	
City of Tehama	X		X		
Gerber-Las Flores CSD	X		X		
City of Corning	X		X		
Corning Water District		X		X	
Stanford Vina Ranch Irrigation Company		X			X
Deer Creek Irrigation District		X			X
Los Molinos MWC		X		X	
Rio Alto Water District	X				X
Anderson Cottonwood Irrigation District		X		X	
Mineral County Water District	X				X
Golden Meadows Estates CSD	X		X		
Los Molinos CSD	X		X		
Thomes Creek Water Users Association		X		X	

ES.4 Land and Water Use

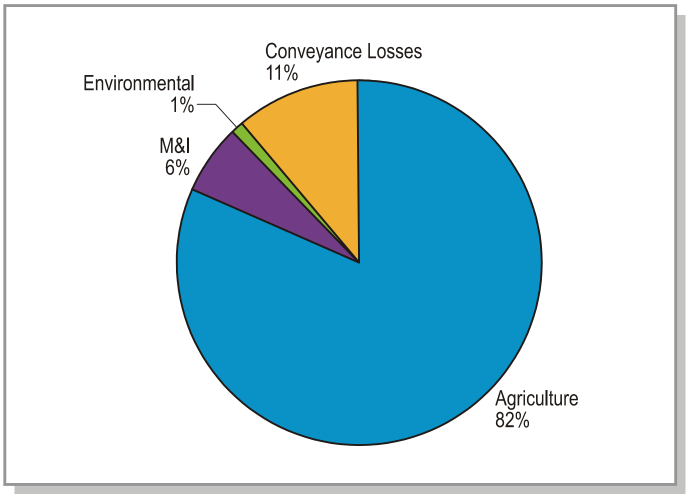
The Inventory and Analysis includes calculations of the water supplies and demands within the County based on the types of land use and the water demands generated by those uses. These calculations were performed for an average year and a dry year to determine how hydrologic factors affect the ability of water supplies to meet water demands. The sections below discuss the results of this analysis.

ES.4.1 Average-year Hydrologic Scenario Conclusions

Figures ES-2 and ES-3 illustrate the average year water demand and water supply, respectively. Agriculture is the largest user of water in the County. Conveyance losses are included in demand because they increase the amount of water needed within districts that have these losses.

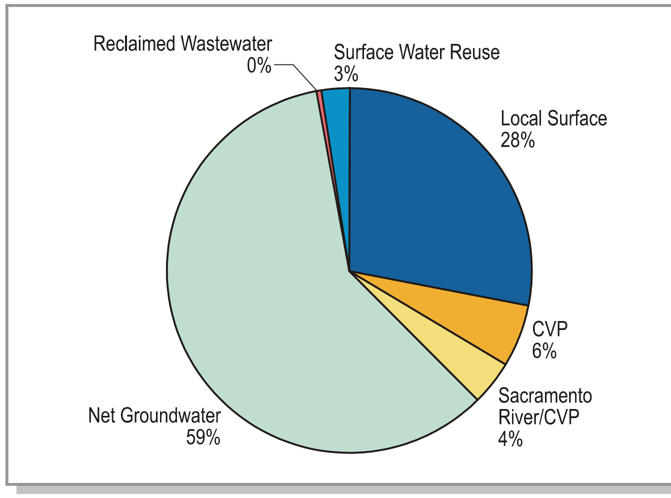
Groundwater sources represent the majority of supply, followed by local surface water. The Sacramento Valley has the most demand and supply for water because most of the agricultural and municipal and industrial development is in this area.

During an average water year, Tehama County would not experience any water shortages. The water supply is generally larger than the water demand. During an average water year the County would have a surplus of about 2,500 acre-feet. All inventory units in the County have enough water supplies to meet their needs.



Source: DWR 2003

Figure ES-2
Average Year Water Demand

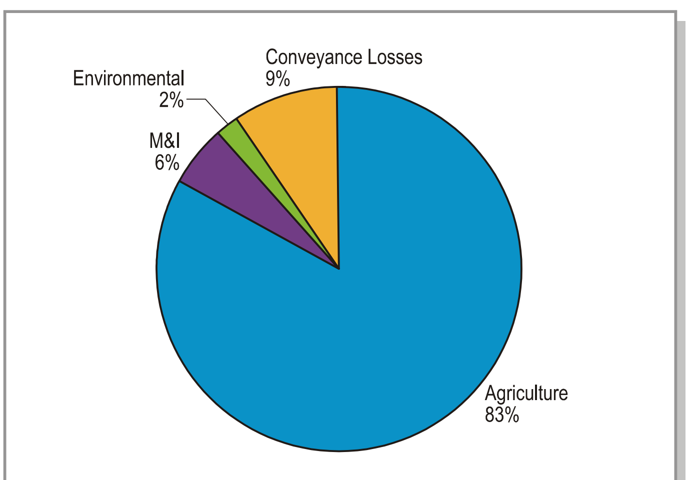


Source: DWR 2003

Figure ES-3
Average Year Water Supplies

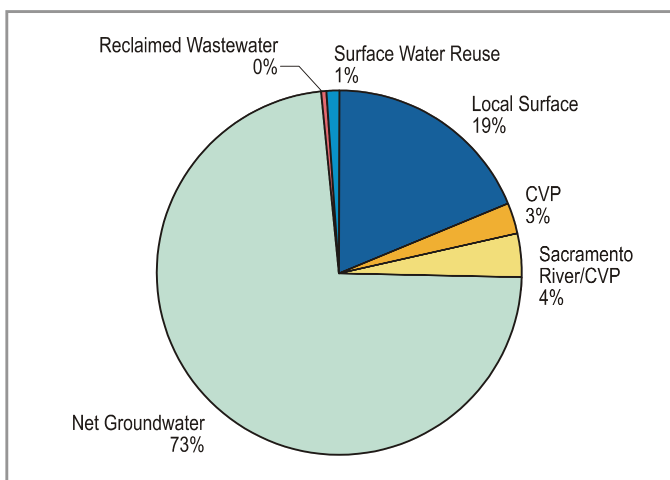
ES.4.2 Dry-year Hydrologic Scenario Conclusions

Figures ES-4 and ES-5 illustrate the dry year water demands and supplies, respectively. Relative to an average water year, water demand in a dry year from all sectors increases by 63,800 acre-feet (17 percent). Agricultural water demand and M&I demands increase during a dry year because of higher demand for irrigation of crops and landscape during summer months. Environmental water demand doubles in the areas near Mill and Deer Creeks, mainly because these areas participate in dry year programs to benefit the environment. Conveyance losses decrease during a dry year



Source: DWR 2003

Figure ES-4
Dry Year Water Demands



Source: DWR 2003

Figure ES-5
Dry Year Water Supplies

because of the smaller surface water supply and less potential for percolation, evaporation and spillage.

The composition of water supplies also changes during a dry year. Local surface water supplies decrease by 26 percent and CVP supplies decrease by 47 percent, relative to an average year, because of lower precipitation and snowmelt in local rivers and creeks. Groundwater use increase by approximately 32 percent to compensate for increased water needs and smaller surface water supplies. Sacramento River Settlement Contractors and riparian water right holders' supplies also increase in a dry year relative to an average year because of increased demands and strong water rights.

Supply shortages total approximately 31,000 acre-feet under the dry-year scenario. Increased groundwater use mitigates a portion of the shortage; however, the county does not have adequate groundwater infrastructure to cover all water shortages. In general, inventory units with greater reliance on surface water supplies and relatively higher conveyance losses experience the larger shortages. Without the infrastructure, the cutbacks in CVP supply during a dry year create water shortages in the Valley areas to the west of the Sacramento River. The areas to the west of the Sacramento River face larger water shortages than most other areas because dry year conditions and high conveyance losses deplete these areas' surface water supplies to the point of a shortage. Water suppliers to the west of the Sacramento River also do not have the groundwater facilities to extract more water to cover the shortages.

ES.5 Water Quality and Environmental Activities

Surface water and groundwater within Tehama County are generally of high quality, with only a few exceptions. The only river with water quality concerns is the Sacramento River, which the Regional Water Quality Control Board has classified as impaired because of an unknown toxicity. The primary groundwater quality concern is in the Antelope area, just to the east of Red Bluff. In the Antelope area, recent groundwater testing has indicated increased levels of nitrate (a precursor to a condition that prevents blood from carrying oxygen to the body) and coliform (an indicator of wastewater in the groundwater). Area septic systems are the likely cause of the contamination, and the residents are examining options for cleaner drinking water and alternative wastewater treatment methods.

Tehama County has multiple conservation and watershed groups that undertake a variety of environmental activities. Table ES-2 includes a list of these groups, and their websites (when available).

Table ES-2 Watershed Groups and Resource Conservation Districts		
Organization	***Address***	***Website***
Battle Creek Watershed Conservancy	P.O. Box 606 Manton, CA 96059	http://www.battle-creek.net
Cottonwood Creek Watershed Conservancy	P.O. Box 1198 Cottonwood, CA 96022	http://www.eusd.tehama.k12.ca.us/Watershed.html
Deer Creek Watershed Conservancy	580 Paseo Comtenaros Chico, CA 95928	http://deercreekconservancy.com
Mill Creek Conservancy	P.O. Box 188 Los Molinos, CA 96055	
Tehama County RCD	2 Sutter Street, Suite D Red Bluff, CA 96080	http://tehamacountyrcd.org
Vina RCD	P.O. Box 274 Vina, CA 96092	

ES.6 Recommendations

The Tehama County Flood Control and Water Conservation District makes the following recommendations based on information contained in the Water Inventory and Analysis report and information from other ongoing efforts:

- The FCWCD will continue to implement the County's AB 3030 Groundwater Management Plan as developed in an effort to promote groundwater management activities that will result in an adequate supply of high quality water into the future.

- The FCWCD will continue to encourage active participation by local stakeholders in both groundwater planning and groundwater monitoring efforts. The District will encourage groundwater monitoring partnerships with local groundwater users.

- The FCWCD will promote cooperative planning and groundwater management with other local neighboring plans and will participate in coordinated regional and statewide groundwater monitoring and planning efforts.

- The FCWCD will continue investigation into locally-led development of groundwater trigger levels as a method for groundwater management as required under SB 1938 and as discussed in "Trigger Levels to Define Management Involvement" in the AB 3030 Plan.

- The FCWCD will pursue the installation and monitoring of additional groundwater monitoring wells in areas of data gaps and in areas where increasing groundwater demand is anticipated in the future. Adequate groundwater level information is not available at some locations in the County, resulting in an incomplete understanding of groundwater levels, movement, and response to extraction. These areas include 1) east-southeast of the City of Corning where a groundwater depression is indicated in an area with little extraction, 2) east of the Aaction Tree Farm where little data exists and increased groundwater demand is anticipated, 3) the eastern portion of the Bowman inventory unit where gaps in monitoring locations exist, and 4) near the boundary between El Camino Irrigation District and Elder Creek Irrigation District where seasonal groundwater drawdown is experienced.

- The FCWCD will support additional studies focused on furthering the understanding of the potential for groundwater recharge. Groundwater recharge, to supplement current groundwater supplies, may be feasible in areas where surface water bodies are located proximal to outcrops of major fresh groundwater-bearing units, including the Tuscan Formation, Tehama Formation, Riverbank Formation and Modesto Formation.
- The FCWCD will support efforts to better understand surface water flow and temperature requirements associated with transport flows for fishery recovery.
- The FCWCD will pursue a more coordinated effort with Tehama County Planning Department with respect to development and water supply.
- The FCWCD will coordinate review of the AB 3030 Plan for compliance with SB 1938.
- The FCWCD will assist in the study of fish passage programs to understand the effects of decreased stream diversions and increased groundwater pumping on the environment and local water users.
- The FCWCD will assist the Tehama County Department of Environmental Health to cooperatively develop plans to improve water quality in the Antelope area.

References

Tehama County Flood Control and Water Conservation District. *Coordinated AB 3030 Groundwater Management Plan*. 1996.

Tehama County Water Inventory and Analysis Report
Contents

Appendices

Figures

Tables

Section 1
Introduction and Overview

1.1 Introduction

Growing demand for water throughout California has placed increasing pressure on water supplies, creating a limited and more expensive source in many areas. With surface water supply reliability decreasing and costs increasing, many water users have turned to groundwater supply, without fully understanding the effects on local groundwater basins. Effective water planning and management requires an understanding of many aspects of water resources, including management practices, water rights and contracts, water quality conditions and environmental requirements, and the interrelationship between surface water use, groundwater use, aquifer recharge, and groundwater levels.

Deer Creek at Leininger Road

The need for documentation of current water use, supply and management in Tehama County and the resultant improved understanding of the resource led the Tehama County Flood Control and Water Conservation District (FCWCD) to complete this Water Inventory and Analysis report. The FCWCD received an AB 303 grant from the California Department of Water Resources (DWR) to complete this study, and received technical assistance from DWR Northern District staff.

1.2 Tehama County Flood Control and Water Conservation District

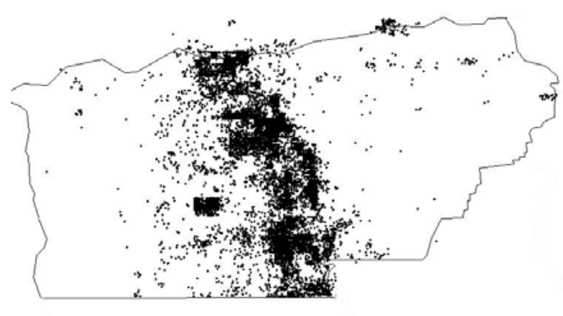
By definition, the FCWCD has a broad range of authorities and responsibilities. The 1957 Tehama County Flood Control and Water Conservation FCWCD Act was established to, "Provide for control and disposition of storm and flood waters of the district; provide water for any present or future beneficial use or uses of lands or inhabitants within the district, including acquisition, storage and distribution for irrigation, domestic, fire protection, municipal, commercial, industrial, recreational and all other beneficial uses." The Water Inventory and Analysis project reflects the FCWCD's interest in supporting activities that will result in a sustainable supply of high quality water to meet the current and future needs of residents and the local economy.

The FCWCD encompasses all of Tehama County. Figure 1-1 is a general location map of Tehama County that reflects the sphere of influence of the FCWCD. The current water resources manager, Ernie Ohlin, manages the activities of the FCWCD. FCWCD staff members report to the FCWCD Board of Directors who governs the activities of the FCWCD. Board members currently include:

- Bill Borror, Chair;
- Barbara McIver;
- George Russell;
- Ross Turner; and
- Charles Willard.

In 1992, Tehama County residents were concerned about the potential export of groundwater; this concern spurred the Board of Supervisors to enact two urgency ordinances followed by a permanent ordinance to require permits to export groundwater. The FCWCD worked with other water agencies in the County to create a Groundwater Management Plan, or AB 3030 plan, which developed a strategy to manage groundwater within the County. This history is described in detail in Section 2.3.1. The AB 3030 Groundwater Management Plan Technical Advisory Committee (TAC) provides technical input and guidance to FCWCD staff. The TAC was established following the adoption of the Countywide AB 3030 Groundwater Management Plan in 1998. The FCWCD Board appoints the nine-member TAC. Each of the nine members represents a general interest category. TAC members and their general interest category for 2003 include:

- Gary Antone - City of Red Bluff;
- Kevin Borror - Agricultural Pumpers;
- Tom Heffernan - Agricultural Pumpers;
- Steve Kimbrough - City of Corning;
- Jim Lowden - Agricultural Districts;
- Walt Manzell - Natural Resources;
- William Richardson - Agricultural Pumpers;
- Roger Sherrill - Domestic Water Suppliers; and
- Robert Steinacher - Agricultural Districts.



Distribution of Groundwater Wells

1.3 Water Inventory and Analysis Project Purpose

The FCWCD Board of Directors, staff, and the TAC recognize the opportunity to provide relevant and accurate water resource information to the citizens of Tehama County. In an effort to accomplish this task, the FCWCD applied for and received AB 303 grant funds to complete this project. This document represents progress in the

FCWCD's efforts to more fully understand the water resources and potential management opportunities in the county.

The purpose of the Water Inventory and Analysis project is to provide: 1) a supplementary tool for water management; 2) a reference and educational tool; and 3) a stepping-stone toward full implementation of Tehama County's AB 3030 Groundwater Management Plan. In a time when water resource reliability is uncertain in many areas of California, the FCWCD is working with local stakeholders toward a common goal of ensuring a reliable future supply by documenting the current status of water use and supply, identifying areas of need, and developing recommendations that will ensure a supply of high quality water into the future.

The following section provides an overview of the history of surface water and groundwater use in Tehama County. Historic and recent groundwater use trends reflect the importance of groundwater management in Tehama County.

1.4 County Water Use History

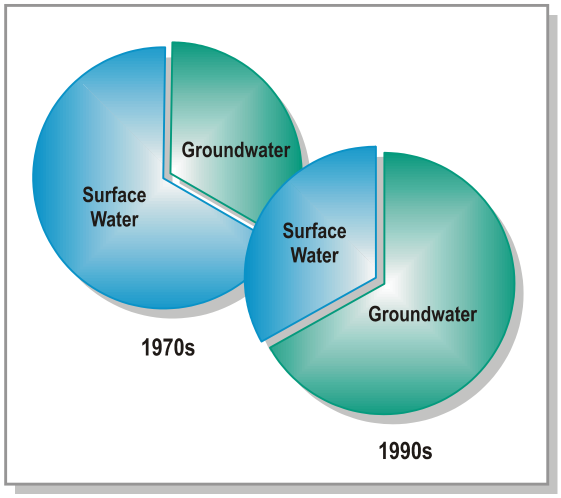
The history of water use in Tehama County directly corresponds to population and economic growth, the development of regional water storage and supply projects, and water supply pricing and reliability. Because agriculture is an economic driving force in the county, much of the water use history is directly tied to the development and use of water sources to satisfy agricultural needs.

In the early 1900s, Tehama County relied primarily on surface water. The Sacramento River and its tributaries provided water needed for irrigation. Farmers worked together to build facilities to divert water from area waterways and convey this water to local farms. These farmers formed groups on the east side that still divert from Deer, Mill, and Antelope Creeks. Surface water runoff may have been stored locally for later use, but large-scale storage projects did not exist. Shallow groundwater wells were likely developed for domestic supplies during this time. As the county's population and agricultural production continued to increase throughout the first half of the century, groundwater use continued to expand, representing a significant agricultural supply for the time but a relatively small volume compared to today's use (FCWCD 1996).

Red Bluff Diversion Dam

Reliable surface water supplies became available to areas of Tehama County west of the Sacramento River following authorization of the Central Valley Project (CVP) in 1935 and the subsequent construction of Shasta Dam and the Corning Canal. Shasta Dam was constructed during the period from 1938 – 1945, with a total storage capacity of 4,552,000 acre-feet of water. Shasta Lake performs several duties for the CVP, including water storage, releases for irrigation and salinity control in the Delta, flood control, protection of communities along the Sacramento River, and power generation. The CVP authorized construction of the Corning Canal in 1950; the canal was completed in 1959. Beginning at the Red Bluff Diversion Dam, the unlined Corning Canal travels 21 miles south and ends approximately 4 miles south of the City of Corning. The original 5 districts served by the Corning Canal in Tehama County are Proberta, Thomes Creek, Corning, Rawson, and Elder Creek.

Establishment of these and other water districts allowed for the organized management of surface water supplies made available by the CVP. In 1951, Water Code Sections 34000-38501 established the California Water District Law. The purpose of the law was to establish water districts to "...acquire, plan, construct, maintain, improve, operate, and keep in repair the necessary works for the production, storage, transmission, and distribution of water for irrigation, domestic, industrial, and municipal purposes, and any drainage or reclamation works connected therewith or incidental thereto" (California Water Code Section 35401).



Changes in Surface Water and Groundwater Use Between the 1970s and the 1990s

Surface water use increased significantly following the completion of CVP facilities and the organization of water districts. By the 1970s, two-thirds of irrigation water used in the county was derived from surface water supplies. However, many water users in other parts of the state were also dependant upon CVP water supplies, which resulted in demand for stored CVP water that exceeded available supply in some years. The cost of CVP water also increased over time, resulting in a reduced demand for CVP surface water and an increased demand for groundwater as a primary supply. Groundwater use for irrigated agriculture increased to two-thirds of the irrigated agriculture supply in the 1990s and continues at a similar rate to the present day (FCWCD 1996).

Other factors have also contributed to an increasing reliance of groundwater, including:

- Local and statewide population growth;
- Changing land use patterns;
- Increased environmental water use; and
- Water supply reliability.

An increasing population, both in the Sacramento Valley and statewide, requires additional water for residential and industrial uses. Groundwater will supply much of the increasing water use because most local stream flow has already been appropriated and new surface water supplies are not being developed at a pace equal to increasing water demand.

Changing land use patterns will also increase the reliance on groundwater. Non-irrigated land brought into irrigated production will rely principally on groundwater due to lack of surface water availability and irrigation system technology. Many orchards are converting to microsprinkler or drip irrigation. High quality water free of algae and sediment is required to prevent plugging of emitters. Orchard irrigation using these systems is completed with low volume, frequent irrigation. Groundwater is preferred because it generally provides higher quality water and is available on demand, while surface water deliveries may be restricted to a set schedule where the interval between deliveries is too long for efficient use of this irrigation technology (University of California Agriculture and Natural Resources 2002).

Increased environmental water use for fisheries requires sufficient and timely stream flows for fish migration and spawning. Water that is committed for environmental uses results in less surface water being diverted to meet agricultural uses. Groundwater must be used for agricultural irrigation during times of reduced surface water diversion to maintain the same level of agricultural land use.

Local water supply reliability is increasingly accomplished through use of groundwater. Stream flow and water allocations from surface water storage projects vary annually, resulting in groundwater extraction to make up for surface water reductions. On a statewide level, water transfers from the Sacramento Valley to Southern California are becoming an increasingly important tool for water supply reliability in Southern California.

1.5 Document Development, Contents, and Potential Uses

Water use history in Tehama County reflects changes in supply over time based on available infrastructure, pricing, and reliability. The FCWCD recognizes that future planning that results in a long-term sustainable supply requires an understanding of current water supplies and uses. The Water Inventory and Analysis includes baseline water supply and use information that facilitates an understanding of how water is currently used and the sources of that water throughout the entire county. With this knowledge, water managers will better be able to understand countywide water management practices on a “big picture” level and will better be able to consider how their actions may benefit or impact others in surrounding areas. The following sub-sections describe the document development process, document contents and potential uses of the document.

1.5.1 Document Development

In order to generate a valuable document, thorough public input was needed to ensure local water resource stakeholders accept the document as an accurate representation of the current water resource status in Tehama County. Public input helped shape the type and depth of information contained in the document and helped identify topics of interest to area stakeholders. The Water Inventory and Analysis report includes input from the TAC, County water suppliers, DWR Northern District, conservation groups, and the general public.

Technical Advisory Committee

The TAC provided technical support and guidance throughout the project process. Before the project began, the TAC provided input on the information that should be included in the Water Inventory and Analysis report based on their knowledge of local conditions and needs. The TAC then helped define the project methodology, identify data gaps, and offered feedback on the analysis results. The TAC also provided recommendations and guidance on the content of this report.

County Water Suppliers and Conservation Groups

County water suppliers were interviewed to document their issues, water supplies, and water demands. The Water Inventory and Analysis report incorporates information from the interviews including district size, types of water use, water sources, history, infrastructure, and district concerns.

Conservation groups were interviewed to document their past and present activities. Information included in the document reflects the group's objectives, areas of the county where the groups are active, the organization history, projects being completed by the groups, and their main issues of concern.

Los Molinos Mutual Water Company staff leads a tour of company facilities

An introduction letter explaining the Water Inventory and Analysis project was sent to agricultural, urban, and environmental stakeholders in early September. The letter described the purpose of the document and informed the stakeholders that their expertise and assistance would be requested in order to make the document more complete and useful. Interviews were conducted beginning in October 2002 and continued through March 2003. Interview topics for water suppliers included agency history, service area, water sources, water demands, and water rights. Interviews with conservation groups included discussions on the group's history, environmental supplies and demands, and local water resource concerns. Summaries of the interviews were returned to the stakeholders to provide them with the opportunity to verify the collected data and supply any additional comments.

Organizations included in Table 1-1 participated in the interview process. Next to each organization is a reference to the sections in the document that contain information on the individual organization.

Table 1-1
References to Interviewed Organizations

Organization	Document Section
Anderson-Cottonwood Irrigation District	4.2.10
Battle Creek Watershed Conservancy	6.3
City of Red Bluff	4.2.1
City of Tehama	4.2.1
City of Corning	4.2.3
Corning Water District	4.2.3
El Camino Irrigation District	4.2.1
Gerber-Las Flores CSD	4.2.1
Golden Meadows Estates	4.2.2
Los Molinos Community Services District	4.2.8
Los Molinos Mutual Water Company	4.2.6
Mill Creek Conservancy	6.3
Mineral County Water District	4.2.14
Rio Alto Water District	4.2.10
Thomes Creek Water District	4.2.1
Thomes Creek Water Users Association	4.2.2
Tehama County Resource Conservation District	6.3

Data collected during the interviews was supplied to DWR for use in their water balance calculations. Information, such as how water suppliers operate their systems, their surface water rights or groundwater sources, and current land uses within district boundaries, was helpful to DWR for determining whether the water supplies are adequate to meet demands. Chapter 4 presents the information collected from the above-listed water providers, Chapter 5 discusses the results of the water balance calculations and resultant water supply and use data, and Chapter 6 presents the information collected from conservation groups.

General Public

A public workshop was held on October 2, 2002 in Red Bluff to inform the public and receive comments on the Water Inventory and Analysis project. Notices were published inviting the public to the workshop to learn about the project, and to share ideas about the types of information that would be most useful to them. In addition, the FCWCD sent letters to stakeholders describing the purpose of the project and encouraged the public to attend the workshop as it would be an opportunity to provide suggestions and ideas that could assist the FCWCD in developing a comprehensive, accurate project report.

A second public workshop was held in June 2003 during which the results of the Water Inventory and Analysis project were presented. Notices were published inviting the general public to attend and all stakeholders identified as potential informational contacts were sent a flyer encouraging their participation in the workshop.

In addition to workshops, all TAC and Board of Directors meetings are noticed and open to the public.

1.5.2 Document Contents

The following is a list of sections included in the Water Inventory and Analysis report and a brief statement regarding each section's contents.

- Section 2 presents an overview of water resources activities at the statewide, regional, and county levels;
- Section 3 describes the existing physical setting, including topography, climate, hydrology, and hydrogeology;
- Section 4 lists the 14 Inventory Units and discusses the water rights and water management activities within the Inventory Units and Sub-units;
- Section 5 describes water use and supply during average and dry years and water use trends;
- Section 6 discusses water quality and environmental issues; and
- Section 7 presents conclusions and recommendations.

In addition to the Water Inventory and Analysis report, the project also includes development of supplemental geographic information system (GIS) coverages within Tehama County. The coverages depict water Inventory Unit and Inventory Sub-unit boundaries, water district boundaries, surface water gauging stations, precipitation stations, geology, soils, and potential groundwater recharge areas.

1.5.3 Document Uses

The success on any document is partially defined by its utility at the time it is produced and into the future. The document 1) provides information that can be used to support water management decisions, 2) serves as a reference and educational tool on countywide water resource issues and conditions, and 3) advances implementation of the County's AB 3030 Groundwater Management Plan.

Use of the Document for Water Management

The Tehama County Water Inventory and Analysis project provides the FCWCD, local water purveyors, and local stakeholders with baseline data that supports resource management. As an example, an enhanced understanding of water demand, potential yield of the groundwater basin, and water supply changes in different year types would facilitate future decisions regarding irrigation with surface water or groundwater. The document also provides detailed information that could be utilized for submittal or review of plans for a wide range of activities, such as large housing developments, casinos, dairies, conjunctive management projects, groundwater recharge projects, and additional monitoring well siting.

Use of the Document as a Reference and Educational Tool

The Water Inventory and Analysis document represents information collected through literature review, personal interviews, and analysis of water use and supply. This information is organized and presented under common themes in the various document sections. The document presents a snapshot of the physical setting, current water management practices, water management agencies, and political and regulatory activities that affect water management in the county. The document is available for public use at the Tehama County Flood Control and Water Conservation District office at 9380 San Benito Avenue in Gerber.

The Water Inventory and Analysis describes surface and groundwater use and supply for all areas within Tehama County, including use by agricultural, urban, and environmental water consumers. The document represents a single, useful reference tool summarizing information regarding recent events in California water; regional and local water-related activities; the existing environmental setting; water use and supply during average and dry years; water use trends; and water quality and environmental activities.

Advancing Implementation of Tehama County's Coordinated AB 3030 Plan

The FCWCD, coordinating with participating entities, is responsible for implementation of the County's Coordinated AB 3030 Groundwater Management Plan. The participating entities signed a Memorandum of Understanding (MOU) recognizing that they have a vested interest and are jointly implementing the activities described in Phase I of the adopted plan. The Plan includes Phase I, Phase II and Phase III. Phase I, or "Passive Management," consists of priority management components that are non-intervening. The Water Inventory and Analysis advances many of the goals and objectives presented in Phase I of the Groundwater Management Plan. The following bullets identify goals outlined in Phase I that are addressed through the completion of this document:

- Data Inventory and Evaluation – Studies and Investigations;
- Coordination with Other Governmental Agencies and/or Other Regulatory Mechanisms;
- Monitoring of Groundwater Conditions;

- Technical Advisory Committee document development and review; and
- Public Education and Community Relations.

Implementation of Phase I activities will continue into the future. If needed, both Phase II and Phase III activities would be implemented under separate agreement between the FCWCD and participating entities signatory to the MOU. Additional detail is provided in Section 2.3.1 of this document.

1.6 Development of Inventory Units

Representatives of the FCWCD, DWR Northern District, and the AB 3030 TAC helped develop the regions and data for this inventory and analysis. DWR Northern District calculated water supplies and demands for each region, and studied groundwater by region. DWR Northern District data is presented in Section 3 and Section 5 of this document. The representatives examined geographic, hydrologic, and political boundaries to form the regions delineated below.

For the purposes of this report, Tehama County was divided into four regions based on mountainous areas and groundwater basins. The four regions of Tehama County are as follows:

- Mountain Region West;
- Mountain Region East;
- Redding groundwater basin; and
- Sacramento Valley groundwater basin.

Mountain Region West and Mountain Region East account for approximately two-thirds of the county's total 1.9 million acres. The middle third of the county represents lands overlying groundwater basins and is bisected by the Sacramento River. The Redding groundwater basin encompasses lands overlying the basin in the northern portion of the county, and the Sacramento Valley groundwater basin encompasses lands overlying the basin in the central and southern portion of the county (see Figure 1-2). A geologic feature known as the Red Bluff arch separates the groundwater basins.

The regions are subdivided into Inventory Units based on groundwater sub-basin boundaries. Tehama County includes 10 groundwater sub-basins, in addition to the Mountain Region West and Mountain Region East. Two groundwater sub-basins (Red Bluff and Corning) located on the west side of the Sacramento River were further subdivided into east and west portions to reflect differences in soils, geology, and land use in the sub-basin. The eastern side of the subdivided groundwater sub-basins is closer to the Sacramento River and has greater water use associated with agriculture and municipal activities principally due to the location of population centers and soils conducive to crop production. The western side of the subdivided groundwater sub-basins is more sparsely populated and has soils less conducive to agricultural uses.

Many of the Inventory Units have been further divided into Inventory Sub-units; based primarily on political boundaries, of which many represent irrigation or water districts. Areas that serve water within a defined area, such as Aaction Tree Farm and Rancho Tehama Reserve are also labeled as Inventory Sub-units. Areas within an Inventory Unit that are not defined as a specific Inventory Sub-unit are represented as Independent Inventory Sub-units. The Tehama County regions, Inventory Units and Inventory Sub-units are listed in Table 1-2 and shown on Figure 1-2.

Table 1-2
Tehama County Water Inventory Study Areas

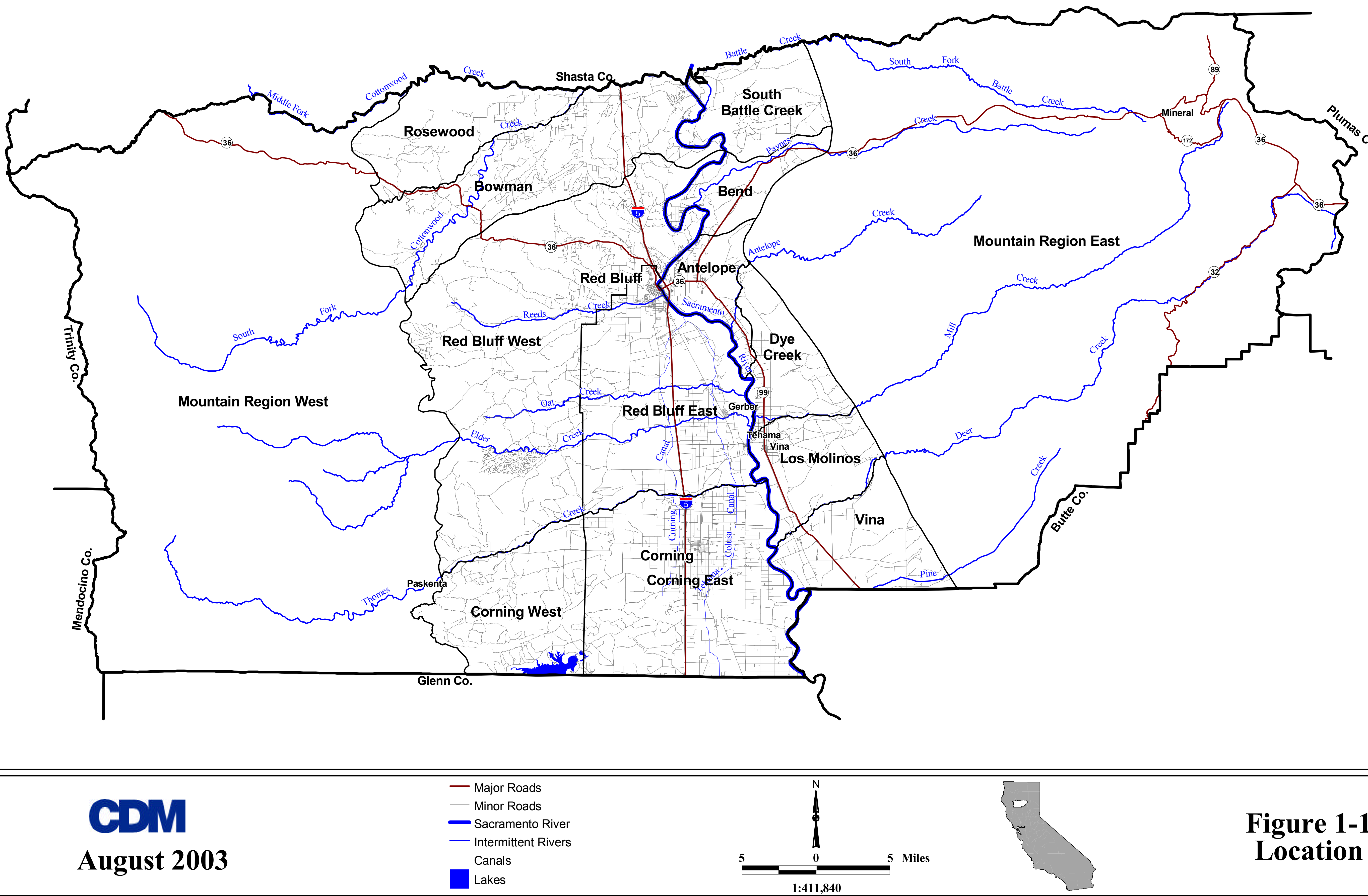
Regions	***Inventory Units***	***Inventory Sub-units***
Sacramento Valley GW Basin	1. Red Bluff East	City of Red Bluff
		Proberta Water District
		Elder Creek Water District
		El Camino Irrigation District
		Thomes Creek Water District
		Red Bluff East Independent
	2. Red Bluff West	Rancho Tehama Reserve
		Red Bluff West Independent
	3. Corning East	City of Corning
		Thomes Creek Water District
		Corning Water District
		Kirkwood Water District
		Aaction Tree Farm
		Corning East Independent
	4. Corning West	
	5. Bend	
	6. Antelope	City of Red Bluff (Antelope Area)
		Los Molinos Mutual Water Co.
		Antelope Independent
	7. Dye Creek	Los Molinos Mutual Water Co.
		Dye Creek Independent
	8. Los Molinos	Los Molinos Mutual Water Co.
		Stanford Vina Ranch Irrigation Co.
		Los Molinos Independent
	9. Vina	Stanford Vina Ranch Irrigation Co.
		Deer Creek Irrigation District
		Vina Independent
Redding GW Basin	10. Bowman	Anderson Cottonwood Irrigation Dist.
		Rio Alto Water District
		Bowman Independent
	11. Rosewood	Anderson Cottonwood Irrigation Dist.
		Rosewood Independent
	12. South Battle Creek	
West Mountain	13. West Mountain	
East Mountain	14. East Mountain	Mineral County Water District
		East Mountain Independent

Chapter 4 and 5 discuss water rights and management as well as water budgets and associated water use and supply information for each Inventory Sub-unit listed in Table 1-2. Water use and supply information from each of the Inventory Sub-units within the larger Inventory Unit are summed to arrive at water use and supply information at the Inventory Unit level of detail. Similarly, water use and supply information for each of the Inventory Units are summed to develop the countywide water budget and water use and supply data.

References

Tehama County Flood Control and Water Conservation District. *Coordinated AB 3030 Groundwater Management Plan.* 1996.

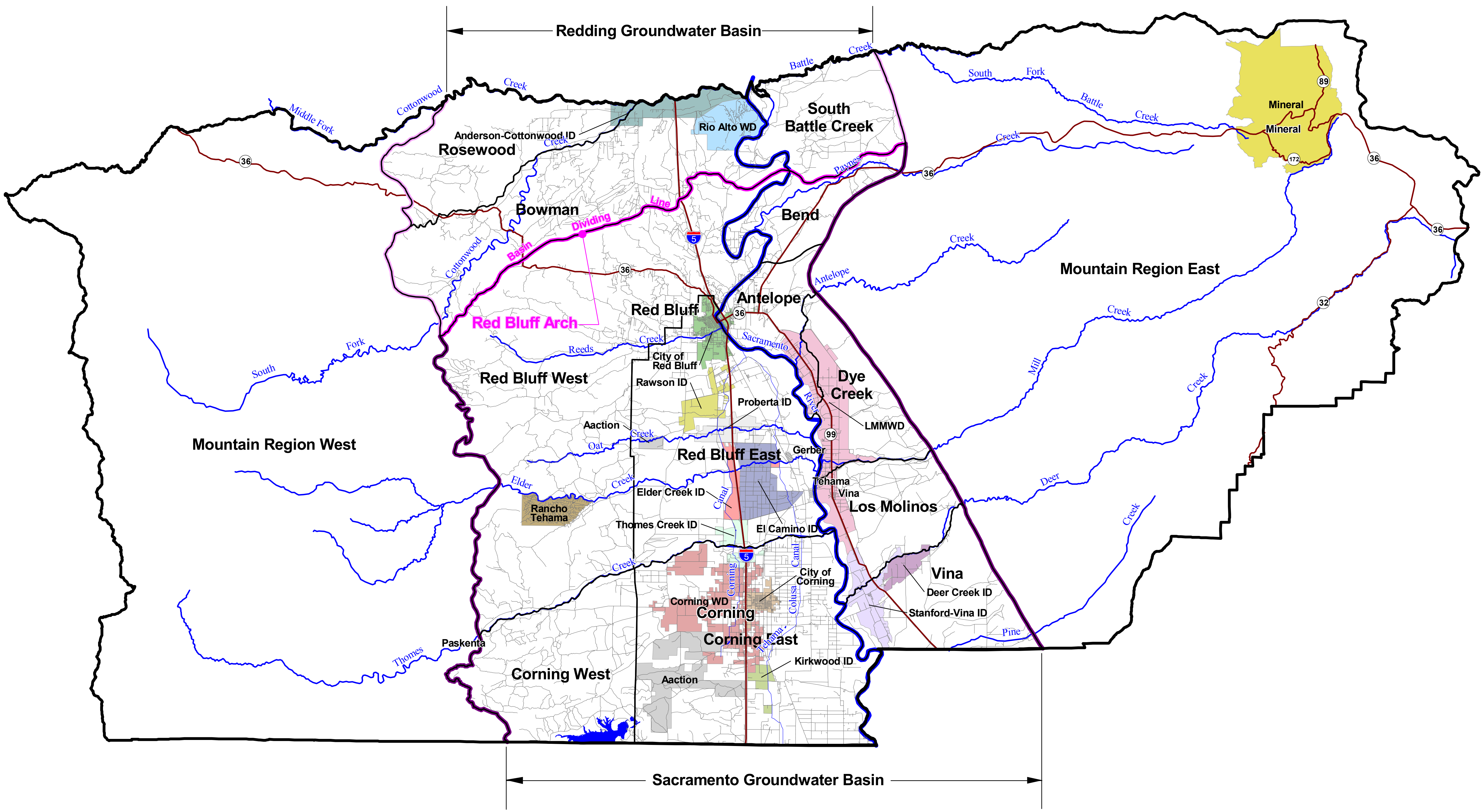
University of California Agriculture and Natural Resources, *Incentives for Groundwater Management in the Northern Sacramento Valley*, Newsletter 2 of 6, 2002.



August 2003

Figure 1-1 Location

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 1-1 Location
DATE: Aug 18, 2003 4:35 PM



Data Source: Department of Water Resources, Northern District

CDM

August 2003

- Redding Groundwater Basin
- Basin Dividing Line
- Sacramento Groundwater Basin
- Inventory Unit Boundary
- Inventory Sub-Unit Boundary

N

5 0 5 Miles

1:411,840

Figure 1-2
Water Inventory Units and Inventory Sub-Units

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 1-2 Inventory Units
DATE: Aug 18, 2003 4:34 PM

Section 2
Water Resource Overview and Current Issues

Water resource management in California is at a critical juncture as evolving policies and physical limits of the State's water supply and infrastructure collide. The attitude toward managing the State's natural resource has gone through many changes and become more environmentally sensitive as the demands for its use continue to rise. Urban, agricultural, and environmental interest groups are working together towards solutions that should benefit all Californians and their environment.

California is the nation's most populous state, increasing in population by 11 percent over the past ten years to more than 33 million residents. The population is projected by the Department of Finance to increase an additional 30 percent between 2000 and 2020 (State of California 2001). The state's continuing population growth will place additional demands on California's water supply. Much of the state's supply originates in northern California, while the majority of use and the new demand occur in southern California.

In addition to the demands from an increasing population, the competition for water continues to expand as changes in water management results in increased environmental water use. Actions such as the Endangered Species Act, Bay-Delta Accord, Central Valley Project Improvement Act (CVPIA), and the implementation of CALFED result in increased dedication of water for environmental purposes. These changes have reduced water supplies historically available to agricultural and urban water users. As a result, additional efforts to improve water supply reliability will focus on existing water management practices and implementation of new water management programs.

As local and statewide competition for the resource has increased over time, state and federal actions now play a much larger role in water resource management decisions. Many of these actions are discussed in the following sections. The Tehama County Water Inventory and Analysis was triggered by the events and actions described within this section, wherein local policy-makers discovered the need to understand the technical information as well as the political climate. When the information discussed in this section is considered in conjunction with the water inventory results discussed in Section 5, water resource stakeholders are presented with a summary of both current issues and an inventory of how the county's water resources are currently allocated. This information provides valuable tools to assist in planning for future water resource management.

2.1 State and Federal Programs

Multiple state and federal actions have affected how state and local agencies in California manage water. The sections below describe several programs that affect urban, agricultural, or environmental water within Tehama County. The CALFED Bay-Delta Program is attempting to address conflicts between environmental and water supply needs within the Sacramento/San Joaquin River Delta-San Francisco Bay region, and this program affects the entire watershed area of these regions. The CVPIA changed the way that the U.S. Bureau of Reclamation (Reclamation) operates the Central Valley Project, which affects several water agencies as well as environmental programs within Tehama County. California has also passed multiple legislative measures related to water issues, which often provide financial incentives to engage in water programs.

2.1.1 CALFED Bay-Delta Program

The CALFED Bay-Delta Program, established in 1994, is a collaborative effort of over 20 federal and state agencies to improve water supplies in California and the health of the Bay-Delta watershed. These agencies started by signing the Framework Agreement, which identified the need to address three issues: water quality standards formulation; coordination of State Water Project (SWP) and Central Valley Project (CVP) operations with existing Federal Endangered Species Act and Clean Water Act regulatory requirements; and long-term solutions to problems in the Bay-Delta estuary. The agencies formed the CALFED Bay-Delta Program to address this last issue.

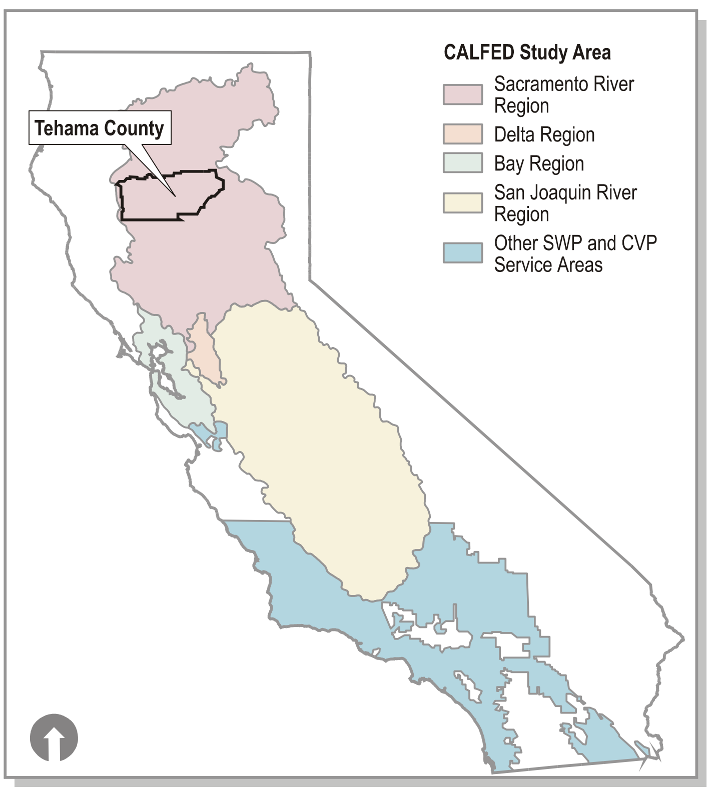


Figure 2-1
CALFED Study Area

The CALFED Program includes the entire Delta watershed (including the Sacramento and San Joaquin River watersheds) as well as the areas that receive water supply from the Delta; Figure 2-1 shows the CALFED study area. Tehama County is within the Sacramento River Region. The CALFED agencies identified four primary objectives to help address long-term solutions to Bay-Delta problems.

- "**Ecosystem Quality** – Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.

- **Water Supply** – Reduce the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system.
- **Water Quality** – Provide good water quality for all beneficial uses.
- **Vulnerability of Delta Functions** – Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of levees." (CALFED 2002)

The CALFED Program is following a three-phase process to achieve long-term goals. Phase I, concluded in September 1996, included the development of a range of alternatives for achieving long-term solutions to the problems of the Bay-Delta estuary. During Phase II, the CALFED agencies conducted a comprehensive programmatic environmental review process. Phase II completed with the release of the final Programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR) in July 2000, followed by the Record of Decision (ROD) on August 28, 2000. The CALFED Program is now in Phase III, implementation of the preferred alternative. CALFED agencies intend to implement the Preferred Alternative over a 30-year timeframe.

In the implementation phase, the CALFED agencies aim to reduce conflicts and achieve objectives. To address these objectives, CALFED agencies developed eleven program elements: Science, Storage, Conveyance, Water Management, Water Use Efficiency, Water Transfers, Ecosystem Restoration Program, Environmental Water Account, Watershed Management, Drinking Water Quality, and Levee System Integrity (CALFED 2003).

On January 1, 2003 the California Bay Delta Authority Act (Senate Bill (SB) 1653) established the California Bay-Delta Authority, housed within the California Resources Agency. The Authority consists of state and federal agencies, public members, and members of the State and Assembly water committees and Legislature. Prior to the Authority, the Program functioned under a group of state and federal agencies operating under their independent statutory authorities to implement various elements of the CALFED Plan. Under the Authority, the agencies have a more formalized role in carrying out the programs, projects, and activities necessary to implement the CALFED Bay-Delta Program (California Bay-Delta Authority 2002).

Many of the CALFED program elements could affect water, land and aquatic resources of Tehama County. CALFED funding is available for county and local governments and water agencies in Tehama County to implement programs to achieve CALFED goals. Several programs likely to affect Tehama County include the:

- Ecosystem Restoration Program (ERP): the ERP is working to restore anadromous fisheries, and several waterways within Tehama County, including Mill, Deer, Antelope and Battle Creeks, which are major spawning grounds;

- Environmental Water Program (EWP): the EWP is purchasing water rights to meet the flow-related objectives within the ERP, and may purchase water within Tehama County; and the

- Environmental Water Account (EWA): the EWA is taking actions to reduce conflicts between fish and water users in the Delta, which may include water purchases within Tehama County.

Ecosystem Restoration Program

The CALFED ecosystem quality objective is to improve and increase aquatic and terrestrial habitats and improve ecological function in the Bay-Delta system to support sustainable populations of diverse and valuable plant and animal species. The ERP identifies programmatic actions throughout the Bay-Delta watershed designed to restore, rehabilitate, or maintain important ecological processes, habitats, and species within 14 ecological management zones.

A scientific review panel was convened in 1997 to review the three-volume ERP plan. According to the review panel, the ERP plan did not include an approach for implementation. The Strategic Plan for Ecosystem Restoration (Strategic Plan) was developed to "provide the conceptual framework and process that will guide the refinement, evaluation, prioritization, implementation, monitoring, and revision of ERP actions" (CALFED 2000). The goals and objectives outlined in the Strategic Plan reflect the CALFED Ecosystem Restoration goals. ERP Strategic Goal 1 focuses on the recovery of endangered and other at-risk native species and native biotic communities. Based on this and five other goals and their associated objectives, the Strategic Plan presents a process for implementing the ERP.

The ERP has adopted an approach that encourages local participation. The ERP releases grant packages, and local groups apply for these grants to help fund projects that help achieve ERP objectives. Table 2-1 shows the projects within or affecting Tehama County that have received ERP funding. Thus far, total funding is about $35 million.

Table 2-1
ERP Funded Projects within Tehama County

Year	*Applicant*	*Title*	*Funding ($)*	*Description*
2002	Cottonwood Creek Watershed Group	*Kids for Our Creeks*	164,579	To develop environmental education curriculum for K-8
2002	The Nature Conservancy	*Mill and Deer Creek Protection and Stewardship*	4,700,000	Acquire conservation easements and protect habitat critical to salmon and steelhead
2001	Department of Water Resources	*Real-Time Flow Monitoring*	418,700	Flow monitoring to assess and manage base instream flows in 5 tributaries (Antelope, Mill, Deer, Big Chico, and Butte Creeks
2001	The Nature Conservancy	*Battle Creek Riparian Protection*	1,000,000	Acquisition of conservation easements on 3 riparian properties on the North and South Forks of Battle Creek

Table 2-1
ERP Funded Projects within Tehama County (continued)

Year	Applicant	Title	Recommended Funding ($)	Description
2001	U.S. Forest Service	*Lassen National Forest Watershed Stewardship Within the Anadromous Watersheds of Butte, Deer, and Mill Creeks*	849,845	Continue the restoration of three watersheds by implementing sediment reduction projects, meadow surveys, and education programs
2001	California State University, Chico Research Foundation	*Sacramento River Conservation Area*	326,991	Hiring staff for 3-yr period to assist in developing and implementing site-specific plans in the Area
2001	Natural Resources Conservation Service	*Digital Soil Survey Mapping and Digital Orthoquad Imagery Development for the Bay-Delta Region*	502,100	Digitize county-based soil maps focusing on Glenn and Tehama Counties, and Madera, Merced, and East Stanislaus areas
2001	U.S. Fish and Wildlife Service	*Estimating the abundance of Sacramento River Juvenile Winter Chinook Salmon with Comparison to Adult Escapement*	1,081,638	Correlation of juvenile production indices with adult escapement counts at Red Bluff Diversion Dam
2001	U.S. Fish and Wildlife Service	*Battle Creek Anadromous Salmonid Monitoring Projects*	1,576,152	Three project to provide monitoring information for the Battle Creek Salmon and Steelhead Restoration Program
2001	Tehama-Colusa Canal Authority	*Fish Passage Improvement Project at the Red Bluff Diversion Dam*	1,574,000	Reduce impacts at dam on upstream and downstream migration of juvenile and adult anadromous fish
2001	Battle Creek Watershed Conservancy	*Battle Creek Watershed Stewardship Phase 2*	268,817	Continue to implement projects, watershed information system and assess watershed conditions
2001	University of California, Davis	*Using Molecular Techniques to Preserve Genetic Integrity of Endangered Salmon in a Supplemental Program*	400,000	Identify winter run Chinook adults; develop molecular markers for pedigree analysis, genotype adult carcasses, and assist naturally spawning populations in Battle Creek
2000	The Nature Conservancy	*Subreach/Site-Specific Management Planning on the Sacramento River*	519,000	To purchase land along the Sacramento River within Sacramento River Conservation Area
2000	Cottonwood Creek Watershed Group	*Cottonwood Creek Watershed Monitoring and Assessment*	350,000	Development of a watershed assessment
1999	Tehama-Colusa Canal Authority	*Fish Passage Improvement Project at Red Bluff Diversion Dam (RBDD)*	1,000,000	Continue feasibility analysis of long term goal of eliminating need to lower gates at RBDD
1999	U.S. Fish and Wildlife Service	*Improve the Upstream Ladder and Barrier Weir at Coleman Hatchery*	1,663,400	Improvements at hatchery to restore naturally spawning steelhead and salmon to Battle Creek
1999	California Conservation Corps	*Lake Red Bluff Riparian Area Restoration and Education Support Project*	29,114	Construct a boardwalk along a portion of the Sacramento River riparian area adjacent to Red Bluff
1999	U.S. Bureau of Land Management	*Riparian Corridor Acquisition and Restoration Project*	2,175,000	Protects 4.5 miles of Battle Creek/1mile of Anderson Creek frontage through conservation easements

Table 2-1
ERP Funded Projects within Tehama County (continued)

Year	Applicant	Title	Recommended Funding ($)	Description
1999	Department of Fish and Game	*Central Valley Steelhead Genetic Evaluation*	70,636	Collect more genetic information for steelhead to help restoration decisions (ex donor stock to repopulate habitats such as Battle Creek and Clear Creek)
1999	Sacramento River Discovery Center	*Sacramento River Discovery Center CALFED 1999 Proposal*	174,150	Funds work at Sacramento Discovery Center in Red Bluff
1998	Institute for Fisheries Resources	*Expanding California Salmon Habitat Through Non-governmental and Nonregulatory Mechanisms to Alter Dams and Diversions*	49,000	Identify sites for acquisition/modification of dams in the Central Valley (Battle Creek and Butte Creek) develop template for resolutions of issues (PSP98)
1998	Department of Water Resources	*Anadromous Fish Passage at Clough Dam on Mill Creek*	1,280,000	Final design and construction of fish passage facilities on Clough Dam and Mill Creek near Los Molinos
1998	Tehama-Colusa Canal Authority	*Fish Passage Improvement Project at the Red Bluff Diversion Dam*	340,600	Identify alternatives to operation at dam to maximize fish passage
1998	The Nature Conservancy	*Deer and Mill Creeks Acquisition and Enhancement*	1,000,000	Acquisition, re-vegetation and management of ~ 2500 aces
1998	US Fish and Wildlife Service	*Spawning areas of green sturgeon in the upper Sacramento River*	60,801	Gain better understanding of species life history (Red Bluff Diversion Dam to Anderson-Cottonwood ID)
1998	US Fish and Wildlife Service	*Monitoring adult and juvenile spring and winter chinook salmon and steelhead in Battle Creek, CA*	150,000	Obtain information on the life history of these species
1998	Cottonwood Creek Watershed Group	*Cottonwood Creek Watershed Group Formation*	161,000	Management and Planning for watershed stewardship for Cotton wood Creek Ecological Zone
1998	Battle Creek Watershed Conservancy	*Battle Creek Watershed Stewardship*	145,000	Direct ecosystem restoration
1998	Sacramento River Discovery Center	*Sacramento River, Headwaters to the Ocean, Public Information and Education*	49,640	Funding for programs through the Sacramento River Discovery Center (Red Bluff Diversion Dam)
1997	Department of Water Resources	*Upper Sacramento River Fisheries and Riparian Habitat Management Program*	200,000	Watershed management planning for the Sacramento River Riparian Program from Keswick Dam to Verona (G195)
1997	WCB, USFWS, The Nature Conservancy	*Sacramento River Floodplain Acquisition and Management Policy*	9,879,800	Sacramento River floodplain between Keswick and Verona (G261)
1997	WCB, USFWS, The Nature Conservancy	*Ecosystem and Natural Process Restoration on the Sacramento River*	1,292,500	Sacramento River riparian forest restoration of 300 acres between Keswick and Verona (G278)
1997	The Nature Conservancy	*Natural Process Restoration on the Sacramento River*	898,700	Sacramento River meander restoration, acquire 80 acres between Red Bluff and Colusa in for Sacramento River National Wildlife Refuge near Elder Creek (G291)

Table 2-1
ERP Funded Projects within Tehama County (continued)

Year	Applicant	Title	Recommended Funding ($)	Description
1997	US Forest Service	*Watershed Improvements Lassen National Forest Lands*	371,000	Watershed improvements/ sediment stabilization (Deer, Mill, Antelope Creeks)
1997	Department of Water Resources	*Engineering Investigation of Anadromous Fish Passage in Upper Battle Creek*	395,000	Battle Creek Screens and Fish Passage
1997	Graham Matthews & Associates	*Cottonwood Creek Geomorphic Analysis*	61,000	Cottonwood Creek channel restoration
1997	Deer Creek Watershed Conservancy, CSU research Foundation	*Deer Creek Watershed Management/ Implementation Plan*	196,554	Watershed planning (Deer Creek)
1997	Mill Creek Conservancy, The Nature Conservancy	*Mill Creek Riparian Restoration Project – Phase II*	69,000	Lower Mill Creek riparian restoration

Source: CALFED 2003

Environmental Water Program

CALFED agencies created the EWP to carry out flow-related goals of the ERP. The EWP intends to acquire water rights and water from sources throughout the Bay-Delta watershed and provide flows to facilitate:

- Improvement in habitat conditions for fishery protection and recovery;
- Restoration of critical instream and channel-forming flows in Bay-Delta tributaries;
- Improvement in Delta outflow during critical periods; and
- Improvement of salmon spawning and juvenile survival in upstream tributaries as defined by the ERP and ERP Strategic Plan, by purchasing up to 100,000 acre feet of water per year by the end of Stage 1 (EWP 2003).

Deer Creek at Highway 99E

CALFED agencies intend to first try the program with pilot water acquisitions. CALFED agencies will then evaluate the results to determine the program effectiveness and to refine the EWP framework (CALFED 2002). Several waterways in Tehama County, including Battle, Mill, Deer, and Antelope Creeks, provide spawning and rearing habitat for anadromous fisheries; therefore, the EWP may choose to take actions on these creeks as the program moves forward. The EWP could seek to acquire water in Tehama County from surface and groundwater sources for these actions. The FCWCD Board of Directors and the Board of Supervisors continue to be actively involved in reviewing any proposed water acquisitions to assess potential impacts throughout the County.

Environmental Water Account

The EWA is another CALFED water acquisition program defined in the CALFED ROD. The EWA addresses two major water resource issues: declining fish populations and unreliable water supplies. The EWA's purpose is to provide protection to the fish of the Bay-Delta through environmentally beneficial changes in the operations of the CVP and SWP at no uncompensated water cost to the CVP and SWP project users. The EWA is managed collectively by the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NOAA Fisheries), California Department of Fish and Game (DFG), Reclamation, and DWR.

The EWA program obtains water-assets by purchasing water from willing sellers or diverting surplus water when safe for fish. The EWA then banks, stores, transfers and releases the water as needed to protect fish and compensate water users. For example, EWA managers might coordinate with water project operators to curtail pumping at specific times to avoid harming fish, and then provide water to cities and farms to compensate for the reduced pumping (EWA Agencies 2003).

The EWA agencies planned to acquire 230,000 – 450,000 acre-feet (AF) of water in 2003, depending on hydrology (EWA Agencies 2003). These amounts are likely typical of acquisition amounts in future years. In 2003, Sacramento Valley contributions to the EWA include 175,000 acre-feet from Yuba County Water Agency and 7,000 acre-feet from Oroville Wyandotte Irrigation District (CALFED Ops Group 2003). The EWA agencies have used approximately 110,000 acre-feet of water to take actions to protect fish and the environment (California Bay–Delta Authority 2003).

At this time, the EWA agencies have not purchased water in Tehama County; however the EWA agencies could seek to acquire water in Tehama County in the future. Anderson Cottonwood Irrigation District (ACID), in northern Tehama County, is one district identified that could potentially sell water to the EWA in the future (CALFED 2003b). The draft environmental document does not identify other Tehama County water agencies as potential willing sellers, but the EWA may purchase from more agencies in the future.

2.1.2 The Central Valley Project Improvement Act

In October 1992, Congress passed the CVPIA[1]. The CVPIA mandates changes in management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife. Section 3404 identifies the objectives of the CVPIA, including:

1 Title 34 of Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992.

- To protect, restore and enhance fish, wildlife and associated habitats in the Central Valley and Trinity River basins of California;
- To address impacts of the CVP on fish, wildlife and associated habitats;
- To improve operational flexibility of the CVP;
- To increase water-related benefits provided by the CVP through expanded use of voluntary water transfers and improved conservation;
- To contribute to the state's interim and long-term efforts to protect the Bay-Delta, and
- To achieve a reasonable balance among competing demands for use of CVP water."

To meet these objectives, Reclamation identified potential changes to CVP management and operations. The CVPIA dedicated 800,000 acre-feet of CVP water annually to fish and wildlife for environmental restoration purposes. The CVPIA also authorized construction of a temperature control device at Shasta Dam and implementation of fish passage measures at Red Bluff Diversion Dam to improve fishery resources along the Sacramento River. The CVPIA also initiated development of the Anadromous Fish Restoration Program to restore anadromous fish populations in the Central Valley.

Meeting the environmental objectives of the CVPIA could affect water resource supply and management in Tehama County. The sections below discuss several aspects of CVPIA implementation that could affect Tehama County.

CVPIA Contract Renewal Process

The CVP provides water through contracts to agricultural and urban users across the Central Valley. CVPIA Section 3404(c) requires that "the Secretary shall renew any existing long-term repayment or water service contract... for a period of 25 years... [after] appropriate environmental review, including the preparation of the environmental impact statement..." In 2003, Reclamation is negotiating the renewal of 111 CVP long-term water service contracts. Reclamation also plans to negotiate the renewal of 55 interim water service contracts (Reclamation 2003). In Tehama County, Kirkwood, Corning, Proberta, and Thomes Creek Water Districts (see Figure 2-2) have CVP water service contracts and use the water as supplemental supplies to local surface water and groundwater supplies (Reclamation 2003).

Reclamation is also initiating negotiations for the renewal of approximately 145 existing Sacramento River Settlement Contracts,[2] which total approximately 2.2 million acre-feet. Reclamation executed these CVP contracts in 1964 for a 40-year term; they expire on March 31, 2004 (Reclamation 2003). ACID, in Tehama and Shasta Counties, has a settlement contract up for renewal.

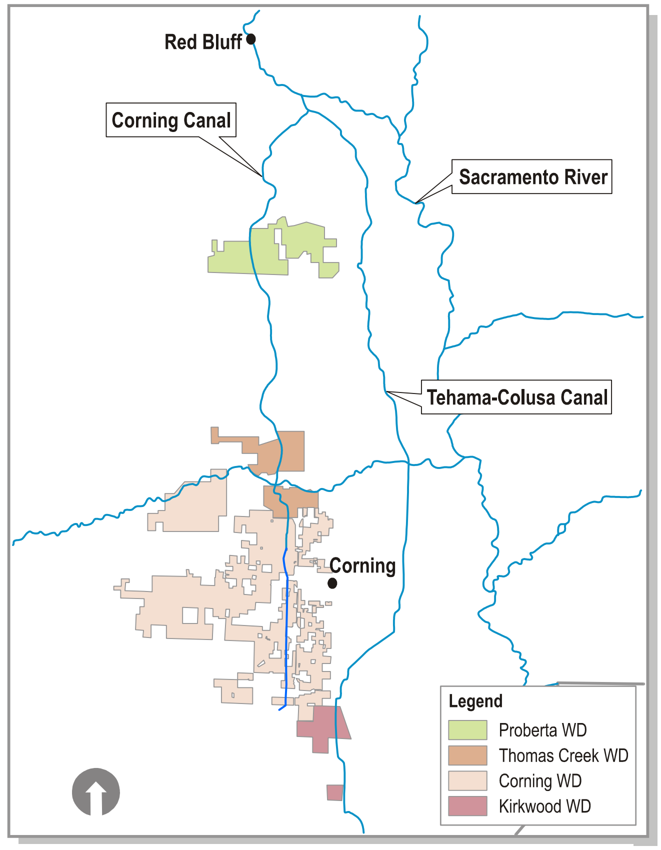


Figure 2-2
Tehama County CVP Contractors

CVPIA Water Acquisition Program

The CVPIA requires the acquisition of water to protect, restore, and enhance fish and wildlife populations above the level that could be achieved with the 800,000 acre-feet of CVP yield dedicated to the environment. To meet water acquisition needs under the CVPIA, the U.S. Department of the Interior (Interior) has developed a joint Reclamation and USFWS Water Acquisition Program.

The CVPIA sections 3406(d)(1) and 3406(d)(2) require the provision of firm water supplies to specified National Wildlife Refuges, State Wildlife Areas, and private wetlands in the Grassland Resource Conservation District for the purpose of optimum habitat management on the refuge lands. These supplies are referred to as Level 2 supplies and Level 4 supplies.[3] CVPIA Section 3406(d)(1) required that refuges receive Level 2 supplies upon enactment of the CVPIA. Section 3406(d)(2) required that refuges receive full Level 4 supplies within 10 years. Reclamation and Interior entered into long-term water supply agreements/contracts with USFWS and DFG to purchase Level 2 supplies. Reclamation purchases Level 4 supplies on a short-term basis from willing sellers. In 2002, Reclamation acquired a total of 85,390 acre-feet to meet refuge Level 4 requirements (Reclamation 2003a).

Corning, Proberta, and Thomes Creek Water Districts sold 4800 acre-feet to Reclamation in 1998 for Level 4 supplies and agreed in 1999 to a long-term sale of 6,300 acre-feet per year (Reclamation 2003a).

---

2 Landowners and water agencies with water rights that diverted from the Sacramento River prior to construction of the CVP are guaranteed more reliable water supplies than other contractors (Water Education Foundation 1995).

3 The Reclamation Report on Refuge Water Supply Investigations (March 1989) defined four levels of refuge water supplies: existing firm water supply (Level 1), current average annual water deliveries (Level 2), full use of existing development (Level 3), and to permit full habitat development (Level 4). CVPIA Section 3406(d) committed to providing firm water through long-term contractual agreements for Level 2 refuges.

2.1.3 Recent Legislative Actions

The sections below summarize selected state and federal legislation affecting water resources. Many of these legislative actions provide state or federal funding for water resources actions to encourage local areas to undertake projects previously found to be cost prohibitive. By offering financial assistance to fund local water initiatives, the government is raising awareness of these issues while helping to work towards solutions. Tehama County could apply for funds from these sources to complete local water resource projects. The County has received funding under AB 303 to conduct this study and to install multi-completion monitoring well and data loggers in each of the ten countywide sub-basins.

Proposition 50

In November 2002, California voters approved the "Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002." The Act authorizes $3.4 billion general obligation bonds to fund a variety of water projects to improve water use efficiency, water quality, water systems security, and to restore wetlands. The bond allocates the following funds, subject to appropriation by the legislature through the State Budget process:

- Water Quality $955 million
- CALFED Bay-Delta Program $825 million
- Regional Projects $710 million
- Coastal Protection $950 million
  (Californians for Clean Water and Coastal Protection 2002)

Competitive grants and loans will be available for the appropriated funds from multiple agencies, including the State Water Resources Control Board (SWRCB), the California Resources Agency, CALFED, and DWR.

Proposition 40

In March 2000, California voters approved Proposition 40, the "California Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002." This $2.6 billion park bond measure has the several objectives:

- Conserve natural resources (land, air, and water);
- Acquire and improve state and local parks and
- Preserve historical and cultural resources.

The California Department of Parks and Recreation will administer competitive grants and loans that will be available to cities, communities, public agencies, and nonprofit organizations (Chang 2001). Proposition 40 includes $100 million for

CALFED-related programs in the 2002-03 fiscal year (Legislative Analysis Office 2003).

Proposition 13

In March 2000, California voters also approved Proposition 13 (2000 Water Bond), which authorizes the state to sell $1.97 billion of general obligation bonds to support safe drinking water, water quality, flood protection and water reliability projects throughout the state. The following areas received allocations:

- Supply, reliability, and infrastructure — $630 million
- Watershed protection — $468 million
- Clean water and water recycling — $355 million
- Flood protection — $292 million
- Water conservation — $155 million
- The Safe Drinking Water Program — $70 million

This money is allocated through grants and loans to local water districts through multiple state agencies, including the SWRCB, Department of Health Services, DWR, and CALFED. Approximately $77 million is available for 2002-2003 Groundwater Storage Construction Program grants (DWR 2003).

Proposition 204

In 1996, California voters passed Proposition 204, the "Safe, Clean, Reliable Water Supply Act," which authorizes $995 million for water and environmental restoration. The Act includes $600 million for the state share of costs associated with projects to benefit the Bay-Delta and its watersheds; $390 million of that total is allocated to implement CALFED's ERP. A portion ($117 million) of Proposition 204's total was designated for water supply reliability projects (Camp Dresser & McKee 2001). For the 2002–03 fiscal year, the CALFED Program was to be funded with $155 million of Proposition 204 funds (Legislative Analysis Office 2003).

AB 303

The objective of AB 303, the "Local Groundwater Management Assistance Act of 2000," is to assist local public agencies better understand effective management of groundwater resources to ensure the safe production, quality, and proper storage of groundwater in California. It authorizes grants for local public agencies to conduct groundwater studies or to implement groundwater monitoring and management activities that contribute to basin and subbasin management objectives.

Only local public agencies, including city, county, water district, regional agency, board, commission or other political subdivisions of the State, may apply for funding under AB 303 and no single applicant may receive more than $250,000.

In 2001, FCWCD successfully pursued funding for this report under AB 303. The Legislature reestablished this fund for fiscal year 2002-03, which will likely include $5 million in funds. FCWCD is seeking grant funding of $249,867 for the installation of dedicated multi-completion monitoring wells and groundwater monitoring systems. Public agencies have submitted 69 applications with requests totaling more than $15 million (DWR 2003).

Tehama County received a second AB 303 grant to fund the installation of several multi-completion groundwater wells throughout the County.

AB 3030 - Groundwater Management Plans

In September 1992, the California Legislature passed AB 3030, the "Groundwater Management Act," which became law in January 1993. The law addressed the lack of coordinated groundwater management in California and enabled local agencies to produce a groundwater management plan, or "AB 3030 plan," if their service area includes all or part of a groundwater basin. The plan outlines the agency's proposed management activities and encourages coordinated management of the groundwater basin. Participation in this voluntary program allows local public agencies greater management authority over local groundwater issues. (Section 2.3.1 discusses Tehama County's AB 3030 plan.)

Groundwater management is defined in AB 3030 from DWR's Bulletin 118-80 as:

- Protection of natural recharge and use of artificial recharge;
- Planned variation in amount and location of pumping over time;
- Use of groundwater storage conjunctively with surface water from local and imported sources;
- Protection and planned maintenance of groundwater quality."

DWR is currently preparing the Bulletin 118-2003 update. Of interest to Tehama County is the proposed "Model Groundwater Management Ordinance" that attempts to combine a management plan and ordinance.

SB 1938

In September 2002, Governor Gray Davis approved SB 1938 which modifies Water Code Section 10750 et. seq.[4] This bill requires local agencies seeking certain state

[4] Water Code Section 10750 includes provisions of AB 3030, the Groundwater Management Act. SB 1938 amends Sections 10753.4 and 10795.4, amends and renumbers Sections 10753.7, 10753.8, and 10753.9, and adds Sections 10753.1 and 10753.7 to the Water Code.

funding to develop a groundwater management plan that includes these specific components:

- Public and local agency involvement;
- Basin management objectives;
- Hydrogeologic monitoring; and
- Mapping.

AB 599

In October 2001, the Governor approved AB 599 establishing the "Groundwater Quality Monitoring Act of 2001." The goal of AB 599 is to improve comprehensive groundwater monitoring and increase the availability of information about groundwater quality to the public. AB 599 requires that the SWRCB, in coordination with an Interagency Task Force and Public Advisory Committee, integrate existing monitoring programs and design new program elements, as necessary, to establish a comprehensive statewide groundwater quality monitoring program.

The Comprehensive Water Quality Monitoring Program presents a plan for monitoring and assessing the quality of groundwater basins/subbasins in the state. The plan includes the following five integrated elements:

- Acceleration of the monitoring and assessment program already established by the State Water Resource Control Board pursuant to the Budget Act of 1999;
- A monitoring and assessment program that will be implemented in accordance with the prioritization of basins/subbasins. Priority is based on water use; basins most heavily used for drinking water are highest priority.
- Increased coordination among groundwater agencies. Multiple agencies and departments monitor groundwater; efforts must be made to coordinate their roles and share data.
- Maintenance of groundwater information from monitoring and assessments in a single depository that uses the SWRCB's Geotracker database.
- Provides useful access of database information by the public while maintaining appropriate security measures.

FCWCD will actively review their adopted AB 3030 plan to assure compliance with SB 1938.

AB 3616, AB 1658 - Agricultural Water Management Plans

The California Agricultural Water Management Planning Act of 1986 (AB 1658) and the Federal Reclamation Reform Act of 1982 historically governed agricultural water management. The Reclamation Reform Act of 1982 required federal water contractors to prepare Water Conservation Plans. AB 1658 focused on opportunities to conserve water or reduce the quantity of saline or toxic drainage water through improved irrigation water management within districts delivering over 50,000 acre-feet of water per year.

The "Agricultural Water Suppliers Efficient Water Management Practices Act", or AB 3616, replaced AB 1658 in 1990. AB 3616 established an advisory committee composed of representatives from agricultural communities, DWR, the Department of Food and Agriculture, the University of California, the California State University, and other public interests. This committee develops and reviews Efficient Water Management Practices (EWMPs) to increase agricultural water conservation.[5] The committee has considered approximately 29 practices, which focus on irrigation management, physical improvement, and institutional adjustments. Water management plans developed under AB 3616 identify water conservation opportunities and set a schedule for implementation. Local agency participation is voluntary, but it helps agencies by recognizing, on a larger scale, the conservation efforts they undertake. DWR cooperates with many local agencies to implement measures that are potentially included on the list of EWMPs.

AB 797 - Urban Water Management Plans

The Urban Water Management Planning Act, passed in 1983, requires urban water agencies to prepare a management plan if they serve more than 3,000 customers or deliver more than 3,000 acre-feet of water per year. The management plan must identify existing water supplies and demands, project demands 20 years into the future, and identify potential additional supplies to meet future demands. Plans are completed every 5 years; the most recent plans were due on December 31, 2000. Within Tehama County, the City of Red Bluff has prepared an Urban Water Management Plan.

2.2 State and Regional Issues

The following section describes various water resource issues affecting the Sacramento Valley. Water demand within the region is increasing, creating conflicts between urban, agricultural, and environmental water uses. Several issues of concern include water supply, water quality in the Delta, fish passage and migration in the Sacramento River and tributaries, and groundwater basin overdraft. Water use in Tehama County relates to these regional issues, as discussed below.

2.2.1 Surface Water and Groundwater Supply and Management

Colorado River

In 1922, seven western states (Wyoming, Colorado, Utah, Arizona, Nevada, California, and New Mexico) signed the Colorado River Compact, which determined water supply apportionment to the states. California's basic Colorado River

[5] Efficient water management practices, defined in Water Code Section 10902, are reasonable and economically justifiable programs to improve the delivery and use of water used for agricultural purposes.

apportionment is 4.4 million acre-feet (MAF); however, California has supplemented this amount in the past with 0.8 MAF of unused apportionments from Arizona and Nevada. Because Arizona and Nevada have developed additional facilities to use their Colorado River apportionments, the amount of available supplemental water available to California has been reduced. This action requires California areas dependent on the Colorado River to reduce their water demands or find alternate supplies.

California's Draft Colorado River Water Use Plan (June 2, 2000) proposes reduction in Colorado River use to 4.4 MAF by 2015, if conservation plans were ratified by December 31, 2002. The agencies involved could not reach agreement, but are currently considering several options, including a transfer from Imperial Irrigation District to San Diego; transfers from Northern California water users; implementation of the All American and Coachella Canal Lining Projects; construction of storage and conveyance facilities for Hayfield/Chuckwalla, Upper and Lower Coachella; and Arizona Water Bank Storage and Conjunctive Use Programs.

In 1999, four Southern California water agencies, Metropolitan Water District (MWD), Imperial Irrigation District, Coachella Valley Water District, and San Diego County Water Authority, negotiated the Quantitative Settlement Agreement (QSA) as an effort to reduce Colorado River water use. The San Diego Water Authority, a member agency of MWD, has offered to purchase 200,000 acre-feet of water from Imperial Valley farmers. Farmers would supply water from canal lining, land retirement and other water conservation measures (Gardner 2003). Conflict with the QSA resides in the responsibility for the Salton Sea,[6] the Colorado River environmental health, and the term length of the agreement. As of 2003, the parties involved are still negotiating to resolve these conflicts.

The reductions in Colorado River supply have also prompted Southern California urban water agencies to look for additional water supplies in the Sacramento Valley. MWD has negotiated with Sacramento Valley water districts to purchase 110,000 acre-feet of water (Reclamation 2003b). Districts are working with individual growers to implement crop idling, crop shifting, and groundwater programs to generate additional surface water supplies to transfer to MWD in the 2003 irrigation season. Water suppliers from Tehama County did not sell water to MWD in 2003, but they could potentially transfer water in the future.

The Sacramento Valley Water Management Agreement

In 1995, The SWRCB adopted its Water Quality Control Plan (WQCP) for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, which identifies the beneficial uses of the Bay-Delta that are to be protected and includes water quality objectives that are intended to protect the beneficial uses. Over the past several years, the SWRCB has engaged in proceedings to determine the responsibility of various water

[6] The Salton Sea is maintained primarily by agricultural return flows from the Imperial, Coachella, and Mexicali Valleys. The Sea is a key stop on the Pacific flyway for many species of migratory birds and provides important habitat for several endangered species. Reducing return flows may reduce the inflow into the Sea.

users within the Delta watershed to meeting the flow-related water quality standards within the Delta WQCP. The SWRCB has fully implemented the 1995 Delta WQCP through Decision 1641, which is the water rights decision implementing the water quality standards on the San Joaquin and Mokelumne Rivers and Cache and Putah Creeks.

The final phase of implementation focused on how water right holders in the Sacramento Valley should contribute to meeting the 1995 Delta WQCP objectives. A negotiated settlement resolved this issue by creating the Sacramento Valley Water Management Agreement (SVWMA). DWR, Reclamation, Sacramento Valley water interests, and export water users entered into this agreement in April 2001, providing an alternative to potentially controversial water rights hearings. The SVWMA establishes a process by which local parties are to develop and implement a variety of local water management projects that will increase water supplies cumulatively, meeting both in-basin demands and the Delta water quality requirements set forth in the Delta WQCP.

Under the SVWMA, regional water management efforts will continue with emphasis on:

- Facilitating groundwater planning;
- Providing for unmet demands in the Sacramento Valley;
- Providing for water use efficiency measures; and
- Developing local water management projects for local use and for Water Quality Control Plan Relief (Northern California Water Association 2002).

North-of-the-Delta Offstream Storage Investigation

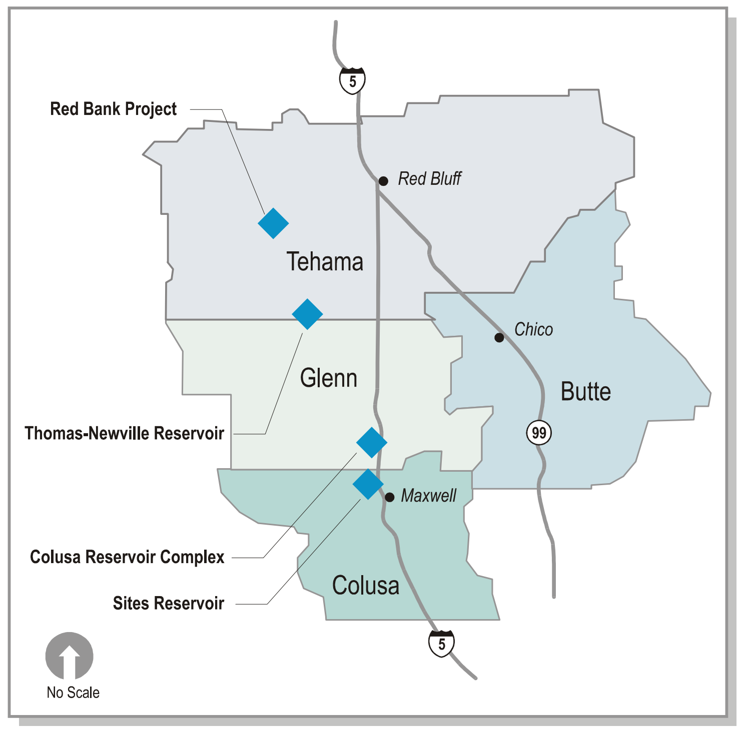
DWR, local, regional, state, and federal agencies, and stakeholders formed a partnership to study North-of-the-Delta Offstream Storage opportunities.[7] An off-stream storage project north of the Delta is a key component of the long-term SVWMA (Northern California Water Association 2002) and was identified in the CALFED ROD. Project proponents intend for this storage to provide additional water quality benefits to the Delta and provide additional storage space to benefit the environment. The North-of-the-Delta Offstream Storage Investigation has focused on four potential projects: Sites Reservoir, Colusa Project, Thomes-Newville Project, Red

[7] An offstream storage reservoir is typically constructed on a small and generally seasonal stream that contributes a minor share of the water supply of the reservoir. Offstream storage involves diverting water out of a major stream and transporting the water through various conveyance systems to a reservoir that may be miles away from the point of diversion. Therefore, offstream storage investigations include extensive evaluation of diversion and conveyance facilities to carry the water to the reservoirs. Storing water in offstream reservoirs can provide opportunities to increase dry year water supply reliability and improve the timing of its availability for multiple uses in an environmentally sensitive manner. Storing water during times of high flow may provide flood control benefits, improve water quality during dry periods, and increase water supplies for environmental, urban, and agricultural water uses.

Bank Project. All projects are within the Coast Range foothills along the western edge of the northern Sacramento Valley.

The proposed Sites Reservoir is in north-central Colusa County and south-central Glenn County, approximately 10 miles due west of the community of Maxwell. The proposed reservoir inundation area includes most of Antelope Valley and the small community of Sites. The reservoir is in the Funks Creek and Stone Corral Creek watersheds (59,700 acres). A mean full pool elevation of 520 feet would inundate 14,000 acres and could store a maximum of 1.8 MAF (Integrated Storage Investigation 2000). DWR and CALFED have identified the proposed Sites as one of the most cost-effective and environmentally beneficial new facilities for north-of-the-Delta storage (Northern California Water Association 2002).

Figure 2-3 shows the remaining projects, which are also within Glenn, Colusa, and Tehama Counties. The Colusa Project would store an additional 1.2 MAF, although it could have a maximum storage of 3.0 MAF if combined with Sites Reservoir. The Thomes-Newville Project studies evaluate alternative reservoir sizes of 1.9 and 3.0 MAF. Lastly, the Red Bank Project, in northwest Tehama County would consist of three reservoirs, the largest storing 250,000 acre-feet (Integrated Storage Investigation 2000).



Source: Integrated Storage Investigations 2000

Figure 2-3
North-of-the-Delta Offstream Storage Alternatives

DWR and Reclamation, in coordination with the Planning Partnership[8], are working on various levels of environmental inventory, engineering and economic analysis, and geological explorations. The efforts are focused to complete the final feasibility report and EIS/EIR by June 2005 (Integrated Storage Investigation 2000).

Integrated Regional Water Management Planning Act of 2002

On September 20, 2002, the Governor signed SB 1672, the "Integrated Regional Water Management Planning Act of 2002". The bill authorizes regional water management

[8] The Planning Partnership members include 17 state and federal agencies, regional water agencies, and stakeholders groups. Tehama-Colusa Canal Authority is a member, representing districts within Tehama County.

groups[9] to prepare and adopt regional plans in accordance with certain procedures that address programs, projects, reports, or studies relating to water supply, water quality, and flood protection. This regional plan may include groundwater management, water use efficiency programs, urban water management planning, fish passage improvements (supplemented by AB 2469), flood management, and water recycling[10]. A regional water management group with a defined regional plan would receive a priority for funding under Proposition 50 and other measures.

Sacramento and San Joaquin River Basins Comprehensive Study

In January 1997, major storms throughout the State caused record flows in many Central Valley rivers, resulting in flooding and property damage. In Tehama County, the Sacramento River at Tehama Bridge reached eight feet over flood stage (DWR 2003). Over 1,000 feet of broken levee at Deer Creek resulted in $2 million in damages and an additional $1 million to repair private levees (Gould 1997).

In response to extensive flooding and damages experienced throughout the Central Valley, the U.S. Congress authorized the U.S. Army Corps of Engineers, Sacramento District (Corps) to conduct a comprehensive analysis of the Sacramento and San Joaquin River Basin flood management systems and to develop comprehensive plans for flood management.

The Sacramento and San Joaquin River Basins Comprehensive Study (Study) is a joint effort by the State of California Reclamation Board and the Corps, in coordination with federal, state, and local agencies, interested organizations, and individuals. The objective of the Study is to develop a system wide, comprehensive flood management plan for the Central Valley that integrates flood damage reduction and ecosystem restoration. In December 2002, the Study team issued an interim report for the Study.

The Report outlines guiding principles that should be applied to any proposal that may affect the flood management system. The guiding principles include:

- Recognize that public safety is the primary purpose of the flood management system;
- Promote effective floodplain management;
- Recognize the value of agriculture;
- Avoid hydraulic and hydrologic impacts;
- Plan system conveyance capacity that is compatible with all intended uses;

---

9 A regional water management group comprises three or more local public agencies, at least two of which have statutory authority over water supply, a Joint Powers Authority, Memorandum of Understanding, or other written agreement approved by the governing bodies of the local public agencies.

10 AB 2469, a companion bill to SB 1672, adds the construction of fish screens and fish passage improvements to the list of approved regional planning elements.

- Provide for sediment continuity;
- Use an ecosystem approach to restore and sustain the health, productivity, and diversity of the floodplain corridors;
- Optimize use of existing facilities;
- Integrate efforts with the CALFED Bay-Delta Program and other programs;
- Promote multi-purpose projects to improve flood management and ecosystem restoration; and
- Protect infrastructure.

The Final Comprehensive Study Report will recommend programmatic authorization for projects to be completed in stages. The Report will identify projects that meet the objectives of the Study and have federal and non-federal sponsor support for immediate implementation. The Comprehensive Study will spin-off such projects to another applicable program for immediate implementation by the Corps, state, or other entity (State Reclamation Board and Corps 2002).

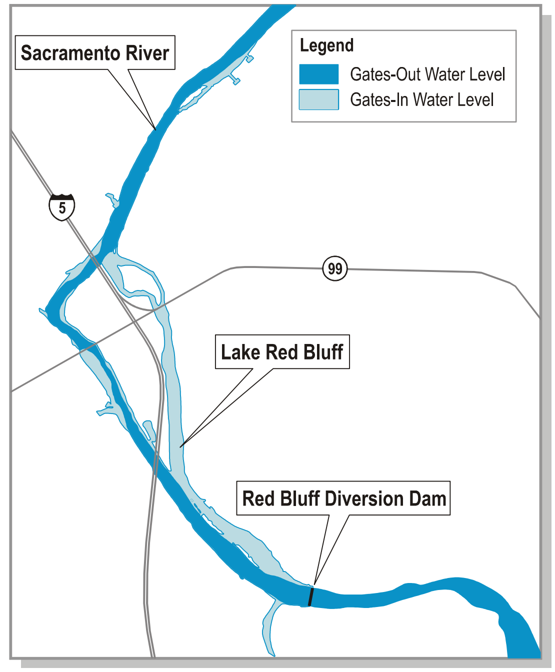
FCWCD in cooperation with DWR Northern District has monitored the development of the management plan for opportunities to identify and propose projects that meet the Study goals and that may be part of the early implementation or spin off programs. As a result of this Study, the Sacramento River floodplain region within Tehama County has been extensively mapped using advanced technology. This information will be incorporated into the Kopta Slough/ Woodson Bridge Restoration and River Bridge Protection Project currently in progress by the Corps for Tehama County.

2.2.2 Environmental and Agricultural Water Issues

Red Bluff Diversion Dam Fish Passage Improvement

The Red Bluff Diversion Dam (RBDD), constructed in 1964, is on the Sacramento River just downstream of the City of Red Bluff. It is owned and operated by Reclamation to deliver water to the Tehama-Colusa (TC) and Corning Canals. The Tehama-Colusa Canal Authority (TCCA), a Joint Powers Authority of irrigation districts, operates and maintains the TC and Corning Canals of the CVP under a long-term contract with Interior. Through these canals, the TCCA delivers CVP water to 17 districts, which serve approximately 300,000 acres of farmland in Tehama, Glenn, Colusa and Yolo Counties (TCCA 2003). In Tehama County, approximately 6,000 acres are irrigated with CVP water from the Tehama-Colusa and Corning Canals.

RBDD has 11 gates that the TCCA raises and lowers to control the water levels and diversions to the TC canal. Under current operations, the gates are in the water between May 15 and September 15. When the RBDD gates are in the water, they raise water levels in the river and water flows into the TC and Corning Canals by gravity for delivery to irrigation districts. The lowered gates also form Lake Red Bluff, which extends approximately six miles upstream through the City of Red Bluff and is used for boating and other recreational activities. Figure 2-4 shows the area inundated when the gates are in the water.



Source: TCCA 2003

Figure 2-4
Area Inundated by Lowering Red Bluff Diversion Dam Gates

The RBDD has created numerous issues concerning migration of anadromous fish in the Sacramento River. Four runs of Chinook salmon and steelhead pass RBDD on their migration to spawning areas upstream.[11] With the gates lowered, the fish ladders become operational and allow passage around the dam. The dam operators adjust gate heights to allow flows to pass under each of the gates in a specific flow-related pattern to enhance attraction flow to the fish ladders. This strategy, however, has had limited success in attracting adult fish to the existing fish ladders. Additionally, the tailrace and lake created by the dam provide habitat for species that prey on juvenile salmonids, reducing their overall survival rates.

The CVPIA section 3406(b)(10) directs the Interior to develop and implement measures to minimize obstructions to fish passage. The Fish Passage Improvement Project on the Sacramento River at RBDD is a cooperative effort of Reclamation, USFWS, NMFS, DFG, DWR, and TCCA to address fishery concerns. The objectives of the project include:

- Improving fish passage for transport (downstream) of juveniles salmonids;
- Improving immigrating (upstream) passage of adult salmonids;
- Delivering water at the time and in the quantities required by users of the TC and Corning Canals; and
- Maintaining Lake Red Bluff and other authorized uses of the CVP while meeting other objectives listed.

[11] The reach of the Sacramento River upstream of RBDD is the primary spawning habitat for the endangered winter-run Chinook and the fall-and late-fall-run Chinook salmon.

Currently the project is focusing on four operational alternatives that include various combinations of new pumping facilities and the current gravity feed water diversions. The pumping facilities would incorporate fish screens, which have been used widely throughout the state as an effective means of protecting aquatic species. Gravity diversions, however, are more cost-effective and preserve Lake Red Bluff. Therefore, a combination of both facilities may likely be the preferred solution to the fish passage problem. Specifically, the four alternatives include:

1. Gates in the water for four months, improve the fish ladders, and build a 1700 cfs pumping plant;

2. Gates in the water for two months, improve the fish ladders, and build a 2000 cfs pumping plant;

3. Gates in the water for two months, improve the fish ladders, and build a new ladder at the center of the dam and a 2000 cfs pumping plant; and

4. Eliminate the diversion gates and build a 2500 cfs pumping plant (Reclamation 2002).

The group of agencies released a Draft EIS/EIR for the Fish Passage Improvement Project in August 2002. The report considered the four alternatives equally. TCCA identified the fourth alternative as the Preferred Alternative, and Reclamation did not identify a Preferred Alternative (Tehama Colusa Canal Authority 2003). In August 2003, Reclamation proposed to leave operations at RBBD as they currently exist. Reclamation noted that the salmon population is increasing in places south of the RBBD, such as Butte Creek, though north of the dam populations remain low. Reclamation further stated that changes in operations have been tried and have been unsuccessful. Therefore, the agency believes no change is necessary. A final decision is expected late 2003 (Brinkley 2003).

Federal and State Land Acquisition

In recent years, state and federal agencies and non-profit entities have acquired land in the Sacramento Valley for various environmental restoration and enhancement goals. Because of increasing agricultural and urban development along the Sacramento River, much of the natural riparian vegetation has disappeared. The Nature Conservancy, USFWS, DFG, and the California Wildlife Conservation Board have acquired 14,000 acres along the Sacramento River, and have restored about 3,000 acres thus far to native riparian forest (Nature Conservancy 2003).

Historically, the areas around the Sacramento River included half a million acres of riparian habitat, which provided a home to many plant and animal species (more than any other river in California). Land acquisition efforts aim to restore some of this area to protect these plants and animals (Nature Conservancy 2003). Groups are also acquiring land in the foothills to protect areas with vernal pools (seasonal ponds that attract unique wildlife).

Land acquisition can result in economic and social effects. Because the state and federal agencies are exempt from paying property taxes, county tax revenue decreases if these agencies purchase land. In addition, private landowners pay less county taxes if they convert land to a conservation easement under a state or federal program (Evans 2002). Additionally, conversion of farmland could reduce agricultural production and farm employment. The Nature Conservancy, however, is contracting with local farmers to plant native trees and shrubs, which puts additional money into the local economies.

Agricultural Waiver of Waste Discharge Requirements from Irrigated Lands

California Water Code Section 13260 requires the California Regional Water Quality Control Boards (RWQCBs) to prepare waste discharge requirements (WDRs) that limit discharges to comply with applicable laws and regulations. In 1982, the Regional Board waived WDRs for 23 categories of discharges, including irrigation return waters and stormwater.

In 1999, SB 390 amended California Water Code Section 13269 to require that all waivers in place before January 1, 2000 expire on January 1, 2003, unless the RWQCBs take action to renew them. In addition, the RWQCBs must review any new waivers adopted after January 2000 every five years.

In October 2002, the Central Valley RWQCB proposed a conditional waiver of WDRs for discharges from irrigated lands that waives permitting for agricultural tailwater, operational spills, subsurface drainage, and stormwater runoff, subject to certain conditions. The primary condition of the waiver includes the creation of regional watershed groups[12] that achieve the following objectives:

- Develop plans for the implementation of management practices; and
- Develop monitoring plans to assess the sources and impacts of pollutants in discharges from irrigated lands and track progress toward lowering discharges.

The objective of the waiver is to create programs that manage discharges from irrigated lands, to prevent violations of any water quality standards. The waiver would be in effect for five years beginning January 2003 (Central Valley RWQCB 2002).

The Sacramento Valley Water Quality Coalition, San Joaquin River Group Authority, San Joaquin Drainage Authority and the South San Joaquin Valley Water Quality Coalition recently formed the "Ag Coalition" to provide an initial report to the Central Valley RWQCB that outlined all irrigated land in the watershed and described the activities necessary to meet the conditional waiver requirements. The Ag Coalition intends to provide a detailed report to the Central Valley RWQCB that will identify the watershed groups, and include a watershed monitoring plan, a compilation of

[12] The watershed group includes dischargers who participate in a group to comply with conditions of the waiver. Individual dischargers who do not participate in a group must also comply.

existing management practices, an implementation plan, identification of sub watersheds, and potential funding mechanisms (Northern California Water Association 2003).

In July 2003, the Central Valley RWQCB decided to continue temporarily the conditional waiver program. Under the new proposal, farmers who join a water monitoring coalition must identify themselves and their farm's operational information. Because the decision received mixed responses from both farmers and environmental groups, the Board agreed to reconsider the plan in January 2004 after it has been if effect for a few months. This is a contentious issue facing Tehama County's 95,660 acres of irrigated land.

Sacramento River Conservation Area Forum (SRCAF)

In 1986, the State Legislature passed SB 1086, which called for a management plan for the Sacramento River and its tributaries that would protect, restore, and enhance fisheries and riparian habitat. The law established an Advisory Council, composed of representatives of state and federal agencies, county supervisors, and representatives of landowners, water contractors, commercial and sport fisheries, and general wildlife and conservation interests (SRCAF 2000). In 1989, the Council published the Upper Sacramento River Fisheries and Riparian Habitat Management Plan (1989 Plan). Many of the fisheries action items outlined in the 1989 Plan have been, or are being implemented, such as fish bypass structures at diversions on Sacramento River tributaries and the Shasta Dam temperature control structure.

In 1993, the Advisory Council, reconvened by the Secretary of Resources, developed the SRCAF Handbook to guide riparian habitat management along the river. The overall objectives of the management program include:

- Preserve remaining riparian habitat;
- Reestablish a continuous riparian ecosystem along the Sacramento River between Redding and Chico; and
- Reestablish riparian vegetation along the river from Chico to Verona.

Figure 2-5 illustrates the regions contained in these objectives. The SRCAF Handbook includes a set of basic principles, management guidelines and recommended actions to achieve its primary goals.

The entities involved in management activities along the river signed a Memorandum of Agreement (MOA); signatories included the Boards of Supervisors of seven counties. The MOA signatories agreed to work within the principles and guidelines in the Handbook and to support the formation of a Non-Profit Organization (NPO) to coordinate management activities (SRCAF 2003).

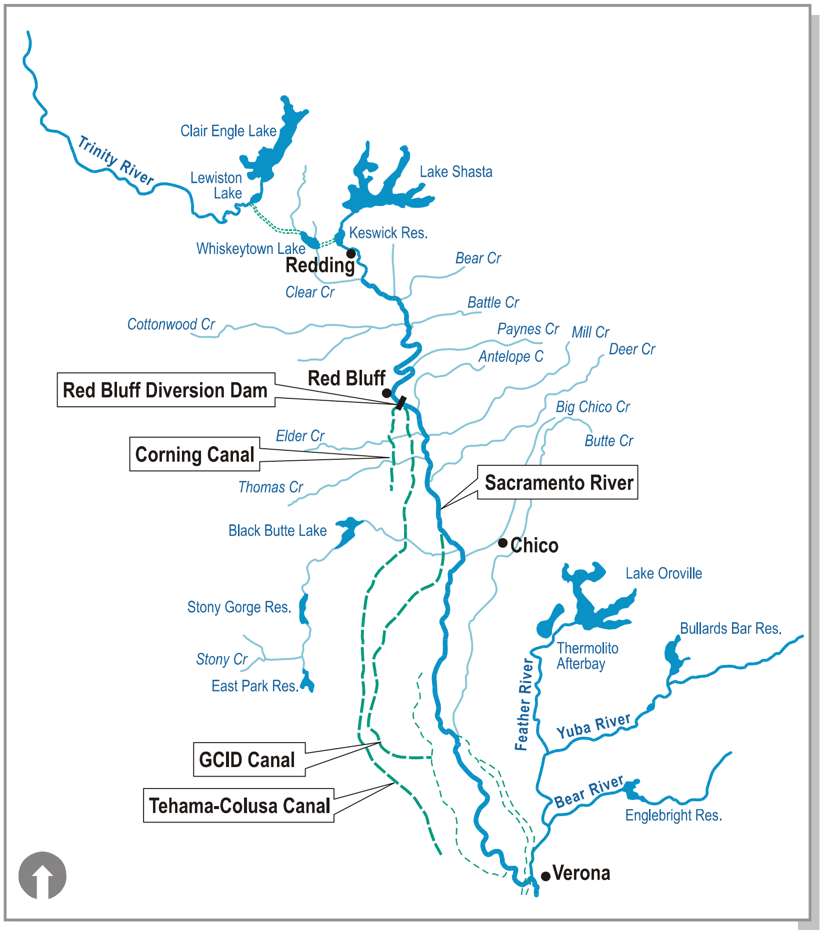


Figure 2-5
Sacramento River Basin

In May 2000, the Board of Directors of the newly formed SRCA NPO met for the first time. The Board of Directors consists of a public interest appointee, a landowner appointee from Tehama, Butte, Colusa, Glenn, Shasta, Yolo and Sutter Counties and an ex-officio appointee from seven state and federal agencies (Bundy 2003). The NPO focuses most of its work on the area within the inner river zone guideline, primarily between Red Bluff and Colusa (Sacramento River Advisory Council 2002).[13] In April 2002, the SRCA Board renamed the organization to the "Sacramento River Conservation Area Forum" to more accurately reflect the organization goals and objectives. FCWCD staff is a member of the SRCAF Technical Advisory Committee, which reviews all relevant proposed projects within the conservation area.

2.3 County Issues

2.3.1 Surface Water and Groundwater Management

Baldwin v. County of Tehama

In 1992, the Tehama County Board of Supervisors (Board) enacted Urgency Ordinances Nos. 1552 and 1553 in response to a threat of wholesale groundwater export from the county (FCWCD 1996). The Ordinances prohibited the extraction of groundwater for export without a permit granted by the Board. These ordinances contained a sunset clause on February 28, 1994.

In *Baldwin v. County of Tehama* (1994), landowners challenged the Tehama County Urgency Ordinances that limited groundwater extractions and conveyance out of the county. The landowners were planning to pump groundwater from wells in Tehama County, introduce the water into the Tehama-Colusa Canal, and then deliver an equivalent amount of water to lands that they owned in Glenn and Colusa Counties. The trail court judges found that Tehama County's ordinances were invalid and

[13] The inner river zone is an area where flooding and channel movement are present.

prevented the county from enforcing them. Tehama County appealed the case, and the Court of Appeal reversed the trial court decision and upheld the Tehama County ordinances.

Baldwin v. County of Tehama (1994) addressed the question of whether or not a county ordinance that regulates groundwater is preempted by state law regulation of groundwater. The Court found that while state law regulates aspects of groundwater, state statutes do not wholly preclude county regulation. Furthermore, the Court stated that the statutes in the Groundwater Management Sections of California Water Code suggest that the problems of groundwater management should be addressed at the local level (31 Cal. App. 4^{th} 166).

Specifically, Water Code 10755.3 was amended in response to the *Baldwin v. County of Tehama* (1994) decision to require cities and counties involved in managing groundwater to meet and coordinate with local agencies that conduct groundwater management programs under AB 3030 (authorizing groundwater management plans) (State Bar of California 1995).

As a result of the Court's decision, a number of counties throughout California, 28 as of 2003, have developed ordinances to regulate the use of groundwater (Draft Bulletin 118-2003).

Tehama County Ordinance No. 1617

In 1994, the Board passed Ordinance No. 1617, which removed the sunset clause in Ordinance Nos. 1552 and 1553 and continued the remaining sections. Ordinance No. 1617 contains the following provisions:

- The Board must issue a permit for the extraction of groundwater from one parcel of land for use on another parcel, specifically when the other parcels are not adjacent to, and under common ownership with, the parcel from which the groundwater is extracted;
- Well operations are restricted if they could adversely affect the operations of wells on adjoining property owned by others; and
- Mining of groundwater for export from the county is prohibited (Tehama County Ordinance No. 1617). [14]

Tehama County Flood Control and Water Conservation District Coordinated AB 3030 Groundwater Management Plan

In 1997, the FCWCD solicited the involvement of private and public water purveyors to develop sound groundwater management practices in accordance with AB 3030 guidelines. The FCWCD Coordinated AB 3030 Groundwater Management Plan was formally adopted on September 22, 1998.

---

[14] Mining is the extraction of groundwater from any aquifer that exceeds the aquifer recharge from local and imported water, less pre-existing groundwater extractions.

The development and implementation of the plan represents a true "coordinated" effort between the FCWCD and participating entities. A MOU was signed by the FCWCD and participating entities recognizing their responsibilities, commitment and participation in the development and implementation of plan. The following Tehama County water agencies have adopted the MOU with the FCWCD to participate in the plan:

- Corning Water District;
- El Camino Irrigation District[15];
- Rancho Saucos Water District;
- Rio Alto Water District;
- City of Corning;
- City of Red Bluff; and
- City of Tehama.

The Groundwater Management Plan identifies the following purposes:

- To prevent long term overdraft of groundwater within the Plan Area;
- To balance long-term average annual replenishment with extraction and other losses to the basin as may be consistent with the public interest of the Plan Area population;
- To develop a comprehensive groundwater basin management program, which protects the groundwater resources of Tehama County in order to provide local users with a reliable long term water supply;
- To implement groundwater management plan through the development of County wide consensus wherever possible; and
- To develop a plan to protect basin groundwater quality.

The Coordinated AB 3030 Groundwater Management Plan includes Phase I, Phase II and Phase III. Phase I is the cornerstone of potential activities described in the plan, activities under this phase will continue for the duration of plan implementation. Phase II or Phase III activities will only be initiated if more directed groundwater management activities are deemed necessary and would be implemented under separate agreement between the FCWCD and participating entities signatory to the MOU.

---

15 El Camino Irrigation District has adopted an individual plan that was designed as a stand alone document to be accepted as an addendum to the County wide plan.

Phase I, "passive management," of the plan consists of non-intervening activities such as performing water level and water quality monitoring, coordinating efforts with other agencies, developing data inventory and evaluation, coordinating with the technical advisory committee, issuing reports, and promoting public outreach. This Water Inventory and Analysis document is an integral part of Phase I.

Phase II addresses the planning for "limited management" actions. Phase II groundwater management activities consist of an extension and expansion of Phase I activities. This phase could include the identification and management of well head protection and recharge areas, development of procedures and process to interface with land use planning agencies to protect against groundwater contamination, drought and overdraft mitigation planning, replenishment assessment, protection of in basin beneficial uses and promotion of conservation programs.

Phase III is the "active management" phase identified in the plan and would focus on long-term, management intensive activities. Phase III could include control of saline water intrusion, regulation of migration of contamination, facilitation of conjunctive use operations, and assessment, construction and operations of various groundwater management projects (i.e., contamination cleanup, recharge, storage, conservation, water recycling, or extraction projects).

In 2001, FCWCD received $190,000 for the Tehama County Water Inventory and Analysis through the AB 303 grant fund process and in accordance with the passive management objectives (Phase I) in Section 320 of the Counties AB 3030 plan (FCWCD 1996).

Redding Area Water Council

In June 1993, thirteen public and private entities in Shasta County formed the Redding Area Water Council (RAWC). The RAWC is composed of those entities that have jurisdictional, proprietary or similar interests in the Redding area groundwater and surface water supplies and management. These entities formed the RAWC to address the local impacts to water supplies during the 1986 through 1992 drought.

In 1996, the RAWC initiated a long-term water resources planning effort for the Redding Basin. The Redding Basin Water Resources Management Plan is separated into three major phases. Phase 1, which was completed in October 1997, developed current and projected land uses and water needs through the year 2030. Phase 2 includes the development and adoption of a Groundwater Management Plan, development of a detailed regional groundwater model of the Basin, evaluation of existing water supply reliability, and screening-level evaluation of short and long-term action for improving regional water supplies. Currently, the RAWC is developing potential alternatives for a regional water supply plan to improve the reliability of water supplies consistent with the following "Core Elements":

- Groundwater pumping increases;

- Water transfers/ exchanges;
- Conjunctive management of groundwater and surface water supplies;
- Water rights protection;
- Conservation and demand management;
- Non-potable supply development; and
- Other institutional actions (CH2M HILL 2001).

The southern boundary of the Redding basin is the Red Bluff arch in Tehama County, as shown on Figure 1-2. ACID is the only RAWC agency that includes a portion of Tehama County within its boundaries. Shasta and northern Tehama Counties overlies the Redding groundwater basin and therefore actions taken through the RAWC Redding Basin Water Resources Management Plan will be of importance to Tehama County.

References

Association of California Water Agencies. 1994. *Elements of a Groundwater Management Plan.* Accessed May 2, 2003. Available at http://wwwdpla.water.ca.gov/cgi-bin/supply/gw/management/hq/ab3030/manual/main.pl

Bundy, Burt. (Sacramento River Conservation Forum, Manager, Red Bluff, California). March 19, 2003. Telephone conversation with Matt Colwell of CDM, Sacramento, California.

Bureau of Reclamation. 2001. *Central Valley Project Improvement Act*. Accessed April 1, 2003. Available at http://www.mp.usbr.gov/cvpia/.

Bureau of Reclamation. 2002. *Draft CVPIA Annual Work Plans (FY 2002).* Accessed April 1, 2003 Available at http://www.mp.usbr.gov/cvpia/awp/2002/3406(b)(10)-AWP-FPP-FY02%20Format.pdf

Bureau of Reclamation. 2002a. *CALFED Ops Group, 2003. Status of EWA acquisitions for 2003,* Acessed May 7, 2003. Available at http://wwwoco.water.ca.gov/calfedops/ops/2003/2003status_ewa.pdf

Bureau of Reclamation. *Anadromous Fish Restoration Program, Fact Sheet*. Accessed February 10, 2003. Available at http://www.mp.usbr.gov/cvpia/wap/docs/AFRP.html.

Bureau of Reclamation. 2003. *CVPIA Contract Renewal Process*. Accessed April 1, 2003 Available at http://www.mp.usbr.gov/cvpia/3404c/index.html

Bureau of Reclamation. 2003a. *Level 4 Water Acquisition Summary from 1994 to present by Water Year.*

Bureau of Reclamation. 2003b. *Finding of No Significant Impact and Environmental Assessment for Reclamation's Consent to Water Sale and Transfers under the Sacramento River Settlement Contractors 2003 Irrigation Season Water Transfer Program.*

Brinkley, Cheryl. 2003. *Lake Red Bluff Appears Saved.* Red Bluff Daily News. Accessed August 6, 2003. Available from: http://www.redbluffdailynews.com.

CALFED Bay-Delta Program. July 2000. *Ecosystem Restoration Program Plan Strategic Plan for Ecosystem Restoration*. Final Programmatic EIS/EIR Technical Appendix.

CALFED Bay-Delta Program. 2001. *CALFED Bay-Delta Program's Environmental Water Account Facts and Background.* Accessed February 3, 2003. Available at http://calfed.ca.gov/Programs/EnvironmentalWaterAccount/FactSheet.htm.

CALFED Bay-Delta Program. 2001a. *About the Environmental Water Program*. Accessed February 10, 2003. Available at http://www.calfedewp.org/about.html.

CALFED Bay-Delta Program website. Accessed December 2, 2002. Available at http://calfed.ca.gov/AboutCalfed/PrimaryObjectives.shtml.

CALFED Bay-Delta Program website. Accessed May 23, 2003. Available at http://calwater.ca.gov/Archives/EcosystemRestoration/EcosystemRestorationArchive.shtml.

CALFED Operations Group. 2003. *Status of EWA Acquisitions for 2003.* Accessed May 7, 2003. Available at http://wwwoco.water.ca.gov/calfedops/ops/2003/2003status_ewa.pdf

California Bay Delta Authority. 2003. *California Bay Delta Update*. Accessed May 7, 2003. Available at http://calfed.ca.gov/Newsletter/MonthlyUpdate_2003/MonthlyUpdate_March03.shtml

California Bay Delta Authority. 2003a. *Annual Report 2002*. Accessed January 31, 2003. Available at http://www.calfed.water.ca.gov/AboutCalfed/AnnualReport2002.shtml.

California Bay Delta Authority. 2003b. Environmental Water Account Draft EIS/EIR. Accessed: August 4, 2003. Available at: http://www.usbr.gov/mp/EWA/Index.htm.

California Data Exchange Center. 1997. *Sacramento River at Tehama Bridge River Stage.* Accessed March 14, 2003. Available at http://cdec.water.ca.gov/cgiprogs/histPlot?station_id=teh&sensor_num=1&dur_code=H&start_date=12%2F30%2F1996+00%3A00&end_date=1%2F3%2F1997&geom=900x400.

Californians for Clean Water and Coastal Protection. 2002. *Funding Categories*. Accessed March 24, 2003, Available at http://www.prop50yes.com/funding.html

Camp Dresser & McKee. 2001. *Butte County Water Inventory and Analysis Report*. Prepared for Butte County Department of Water and Resource Conservation.

Campbell, Kate. 2002. *Sacramento River Conservation Area is Scaled Back*. March. Accessed March 14, 2003. Available at http://www.cfbf.com/agalert/2002/aa-030602b.htm.

CH2M HILL. 2001. *Redding Basin Water Resources Management Plan, Phase 2C Scope of Services.*

Department of Water Resources. 1980. *Bulletin 118-80: California's Groundwater*.

Department of Water Resources. 2003. *AB 303 Local Groundwater Assistance Fund*. Accessed May 12, 2003. Available at http://www.dpla2.water.ca.gov/grants-loans/pdfs/ab303_02-03.pdf.

Environmental Water Account Agencies. April 2003. *EWA Acquisition Strategy for 2003*. Accessed May 19, 2003. Available at http://wwwoco.water.ca.gov/calfedops/ops/2003/2003ewa_acq_strat.pdf

Evans, Tom, Family Water Alliance. 2002. *Local Control Over Habitat Conversion to be Reasserted*. Accessed February 5, 2003. Available at http://www.familywateralliance.com/local_control_over_habitat_conve.htm.

Fulton, Allen; Dudley, Toccoy; Stanton, Kelly and Spangler, Debbie. 2003. *Seeking an Understanding of the Groundwater Aquifer Systems in the Northern Sacramento Valley*.

Gardner, Michael. 2003. *Plan Readied to Share Colorado River Water*. San Diego Union Tribune. February 6, 2003.

Gould, Susan D. 1997. *California Flooding Could Be Worst Ever*. Accessed March 14, 2003. Available at http://www.naco.org/pubs/cnews/97-01-20/cfloods.htm.

Integrated Storage Investigations. 2000. *North of the Delta Offstream Storage Investigation Progress Report.* Accessed February 3, 2003. Available at http://www.isi.water.ca.gov/ssi/nod/docs/prog_index.pdf.

Legislative Analysis Office. 2003. Analysis of the 2002-03 Budget Bill, CALFED Bay-Delta Program. Accessed June 3, 2003. Available at http://www.lao.ca.gov/analysis_2002/resources/res_2_calfed_anl02.htm.

Nature Conservancy. 2003. *Sacramento River.* Accessed August 7, 2003. Available at http://nature.org/wherewework/northamerica/states/california/preserves/art6325.html

Northern California Water Association. 2002. *Testimony before the Senate Agricultural and Water Resources Committee and the Assembly Water, Parks and Wildlife Committee.* Accessed May 12, 2003. Available at http://www.norcalwater.org/pdf/legtestimony.feb02.pdf.

Northern California Water Association. 2003. *The Week In Review, March 14, 2003.*

Northern California Water Association and Ducks Unlimited. 2003. *Agricultural and Waterfowl Organizations Develop Watershed Program for Sacramento Valley.* Accessed May 12, 2003. Available at http://www.norcalwater.org/media_release_03-Mar-03.htm..

Peter Baldwin v. County of Tehama. 1994. 31 Cal. APP 4th 166, *; 36 Cal. Rptr. 2d886.

Sacramento River Conservation Forum. 2000. *About the Program*. Accessed March 14, 2003. Available at http://www.sacramentoriver.ca.gov/about.html.

State Bar of California. 1995. *1995 California Water Law Newsletter*. Accessed on May 2, 2003. Available from: http://ceres.ca.gov/env_law/1995water.html

State of California Department of Finance. 2001. *Interim County Population Projections*. Sacramento, California. June.

State Reclamation Board and U.S. Army Corp of Engineers. 2002. *Sacramento and San Joaquin River Basins Comprehensive Study Interim Report.* December. Accessed February 10, 2003. Available at http://www.compstudy.org/docs/interimreport20021220/interimrpt-part01.pdf.

State Reclamation Board and U.S. Army Corp of Engineers. *Sacramento and San Joaquin River Basins Comprehensive Study, Technical Studies.* 2002. Accessed February 25, 2003. Available at http://www.compstudy.org/docs/techstudies/appendix_d_hydraulics.pdf.

State Water Resources Control Board. 2002. *Groundwater Quality Monitoring Act, AB 599 (LIU).* Accessed February 3, 2003. Available at http://www.swrcb.ca.gov/cwphome/land/gama/webpages/internet/ab599hom.htm.

Tehama Colusa Canal Authority. 2003. *Fish Passage Improvement Project at the Red Bluff Diversion Dam.* Accessed February 10, 2003. Available at http://www.tccafishpassage.org/index.htm?main_intro.htm~TCCAmain.

Tehama County Flood Control and Water Conservation District. 1996. *Coordinated AB 3030 Groundwater Management Plan.*

United States General Accounting Office. 2000. *Federal Land Management, Federal Land Acquisitions in California Since January 1994.* GAO/RCED-00239.

Water Education Foundation. 1995. *Layperson's Guide to Water Rights Law.*

Section 3 Physical Setting

3.1 Topography

Tehama County encompasses roughly 2,950 square miles and 1.9 million acres of varied topography. Tehama County includes three distinct topographical areas:

- The Coastal Range in the west;
- The Sacramento Valley in the center; and
- The Cascade and Sierra Mountain foothills in the east.

The County extends nearly eighty miles from the highest reaches of the Coastal range in the West through the valley to the high alpine zones of the Cascade and Sierra Mountains in the east. The eastern and western mountain areas generally drain to the lowest points in the central Sacramento Valley. The Sacramento River flows approximately forty miles in the North-South direction through Tehama County, bisecting the county.

In the west, the Coastal Range has a rugged topography with elevation reaching 8,092 feet at Mount Linn. The lowest elevation is found in the south-central portion of the Sacramento valley at 210 feet. Brokoff Mountain, elevation 9235 feet above mean sea level (msl), is the highest point in Tehama County and is on the northeastern County boundary in the Cascade Mountains. Figure 3-1 at the end of this section illustrates the Tehama County topography.

Figure 3-2 identifies the area and elevation characteristics of Tehama County. The figure shows that 50 percent of the County lies below the 1600-foot elevation and ten percent lies above the 5,500-foot elevation.

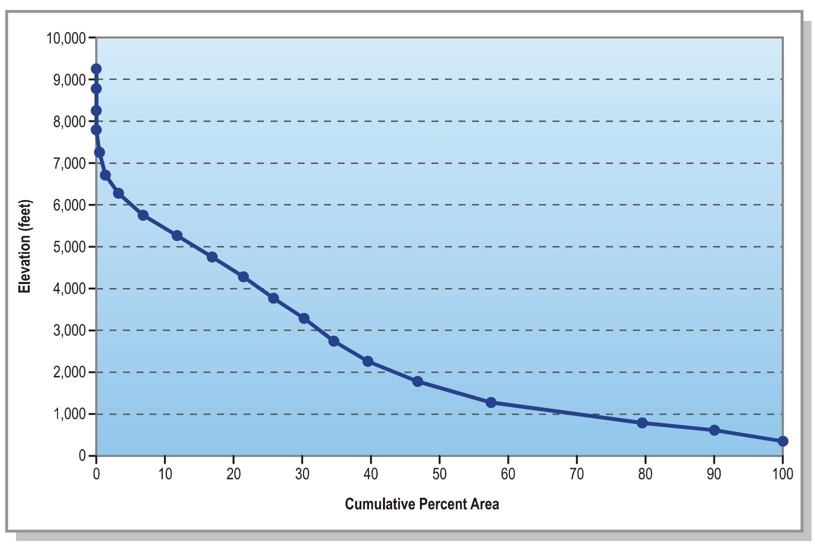


Figure 3-2
Tehama County Area Elevation Curve

3.2 Climate

Tehama County's temperature and precipitation variability correlate to the topographic extremes in the county. Three selected weather stations provide detail on both the seasonal variation in temperature, rainfall, and snowfall over different elevations and geographic regions. The stations are:

> **Harrison Gulch Ranger Station:** in the Coastal Range, elevation 2,750 feet above msl, adjacent to the Mountain Region West Inventory Unit, records extending up to 55 years through 2003.
>
> **Red Bluff:** with records extending 123 years through 2000, in the Red Bluff East Inventory Unit, elevation 341 feet above msl, representing the Valley region of the County.
>
> **Mineral:** in the Cascade Mountains, elevation 4,880 feet above msl, in Mountain Region East Inventory Unit, records extending 73 years through 2000.

Harrison Gulch Ranger Station, a few miles north of the Tehama County line, provides a long history of climatic observation data representative of the Coastal Mountains in the western region of the County.

Red Bluff station was chosen to represent the typical central valley climate, with summers being very warm and dry with mild, somewhat wet winters.

Mineral Ranger Station provides a long history of climatic observations that capture the significant orographic effects of the Cascade Mountains in eastern Tehama County.

Figure 3-3 (at the end of this section) shows key Tehama County climatic and hydrologic information stations. This figure will be included on the District's website that is currently under development. Website visitors will be able to access real-time precipitation and stream flow data directly from the web page by "clicking" on any of the locations indicated on the map.

3.2.1 Temperature

Table 3-1 includes the average, maximum and minimum monthly mean air temperatures at the three stations described above. Temperature measurements collected at the same time vary widely from station to station, higher temperatures are reported on the valley floor and lower temperatures are observed at higher elevations. In addition, a wide seasonal variability in temperatures is reported at each site.

The eastern portion of the County, represented by Mineral, exhibits average temperatures in December, January and February near or below freezing and average daily minimum temperatures below freezing for seven months of the year. In contrast, Red Bluff's average maximum temperature is above 90 degrees for four months of the year.

Table 3-1 Monthly Air Temperatures at Three Stations (Degrees F)									
Station Mo.\Statistic	***Harrison Gulch R.S.***			***Red Bluff***			***Mineral***		
	Avg	***Max***	***Min***	***Avg***	***Max***	***Min***	***Avg***	***Max***	***Min***
January	N/A	N/A	N/A	45.8	54.7	36.9	31.2	40.9	21.5
February	36.9	49.8	24.1	50.2	60.0	40.3	33.3	43.6	23.0
March	44.1	57.0	31.2	53.9	64.8	43.0	35.8	46.5	25.1
April	48.7	64.3	33.0	59.5	72.1	46.9	40.9	53.7	28.2
May	54.5	70.4	38.9	67.8	81.8	53.8	48.0	62.5	33.6
June	63.8	81.4	46.3	75.8	90.4	61.2	55.5	71.5	39.4
July	69.8	89.7	49.9	81.6	97.8	65.4	61.8	80.8	42.8
August	68.4	88.7	48.0	79.5	95.9	63.1	60.8	80.3	41.4
September	62.6	82.7	42.4	74.9	90.7	59.0	56.1	74.2	38.0
October	52.8	71.1	34.4	64.9	78.9	51.0	47.6	62.9	32.4
November	44.4	59.9	28.9	53.1	63.8	42.4	37.9	48.6	27.3
December	N/A	N/A	N/A	46.6	55.4	37.9	32.5	42.0	23.1

Source: Climate data Western Regional Climate Center, Reno Nevada, Western U.S. Climate Historical Summaries Available at http://www.wrcc.dri.edu/summary/climsmsca.html

3.2.2 Precipitation

Precipitation resulting from orographic cooling is evidenced by the annual rainfall total contours (isohyetal contours) for Tehama County shown on Figure 3-4 (at the end of this section). Air temperatures cool as an air mass rises over the mountains, resulting in condensation of moisture that falls as rain or snow. Table 3-2 presents minimums, averages and maximums of annual precipitation and snowfall for the above same three stations, illustrating the significant year-to-year variability in rainfall and snowfall in Tehama County.

Table 3-2 Annual Precipitation and Snowfall at Three Stations (Inches)			
	Harrison Gulch R.S.	***Red Bluff***	***Mineral***
Precipitation *			
Average	36.7	23.7	53.4
Maximum	81.4	53.6	99.7
Minimum	17.6	9.0	22.1
Snowfall**			
Average	38.7	2.1	152.4
Maximum	170.7	15.5	308.6
Minimum	0	0	71.1

Source:
* Data compiled by Jim Goodridge in cooperation from California Department of Water Resources
** Climate data Western Regional Climate Center, Reno Nevada, Western U.S. Climate Historical Summaries Available at http://www.wrcc.dri.edu/summary/climsmsca.html

Precipitation is strongly seasonal, occurring generally in the period October through March or April. Approximately half of the total annual precipitation occurs from November through mid-February.

Table 3-3 depicts the monthly precipitation variability over the period of record for the three stations. In summer months, areas of high pressure commonly are established over northern California, effectively blocking the inland movement of moist marine air. Thus, most of the precipitation falls in late fall and winter (October through March). Figure 3-5 illustrates the average precipitation during both winter (October – March) and summer (April – September), and the influence of elevation.

Table 3-3
Monthly Precipitation at Three Stations (Inches)

Station Mo.\Statistic	Harrison Gulch R.S.			Red Bluff			Mineral		
	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min
January	7.0	24.7	0.6	4.6	21.5	.2	9.3	28.8	.6
February	5.8	17.6	0.0	3.9	17.1	.0	7.9	28.3	.4
March	5.0	26.8	0.3	3.1	12.8	.0	7.2	24.2	1.5
April	2.3	7.5	0.0	1.6	7.1	.0	4.1	14.2	.4
May	1.4	6.8	0.0	1.1	6.9	.0	2.6	9.7	.0
June	0.7	3.9	0.0	.5	2.6	.0	1.4	5.0	.0
July	0.1	1.3	0.0	.1	1.5	.0	.2	2.6	.0
August	0.3	3.4	0.0	.1	3.3	.0	.4	4.1	.0
September	0.6	4.2	0.0	.6	7.5	.0	1.1	7.5	.0
October	2.3	12.4	0.0	1.3	8.4	.0	3.9	23.4	.0
November	4.9	17.3	0.1	2.8	17.1	.0	6.6	25.9	.0
December	6.2	16.7	0.0	4.0	12.9	.0	8.7	31.5	.0

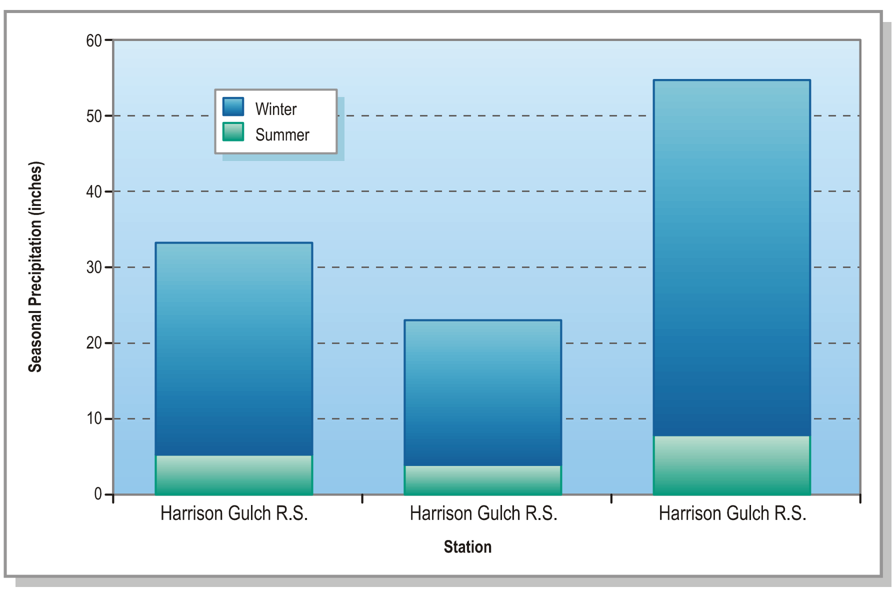


Figure 3-5
Average Precipitation at Three Stations

Table 3-2 includes the depth of snowfall observed at the three representative stations. Measured snowfall in the Coastal Range in western Tehama County (Harrison Gulch station) is only about 25 percent of the snowfall that is measured in the Cascade Range in eastern Tehama County (Mineral station). Practically all of the precipitation in the valley (Red Bluff station) occurs as rain.

Snow is important because of the winter feast-summer famine situation that occurs with the annual distribution of precipitation. Precipitation that accumulates as snow during the winter months melts and runs off, providing water for irrigation, energy generation, recreation, municipal, and industrial uses throughout the county. Snowmelt largely overlaps the irrigation season enabling a much more effective use of water than would be possible if the precipitation fell as rain and ran off immediately. Surface water users who rely on local surface water diversions originating in the Cascade Range (such as Mill Creek and Deer Creek) benefit from this runoff pattern.

Early in the 20th century water agencies gained an appreciation of the relationship between timing of snow accumulation and subsequent runoff. The State of California recognizes the inherent value of snowpack information and the need for centralized coordination of efforts in collecting snow data.

The California Cooperative Snow Surveys program administered by DWR coordinates with more than 50 state, national, and private agencies in collecting snow data throughout the State. Over 300 snow courses are sampled each winter, with some of the original courses having a continuous period of record of more than 60 years (California Cooperative Snow Surveys 1999).

The standard snowpack measurements of importance to water managers and hydrologists are the depth and water content of the snowpack. Snowfall differs from snow depth because snowfall settles and compacts. Snowpack depth is a better measurement of accumulation. Snow water content equates to the water equivalent of the snowpack. As an example, a full bucket of snow, when melted, would result the water content measurement.

Anthony Peak in the Coastal Mountains is on the western boundary of the Mountain Region West Inventory Unit. The Covelo Ranger station measures the Anthony Peak snow course established in 1944. Figure 3-6 depicts the average snow depth and water content of the snow pack at monthly measuring dates.

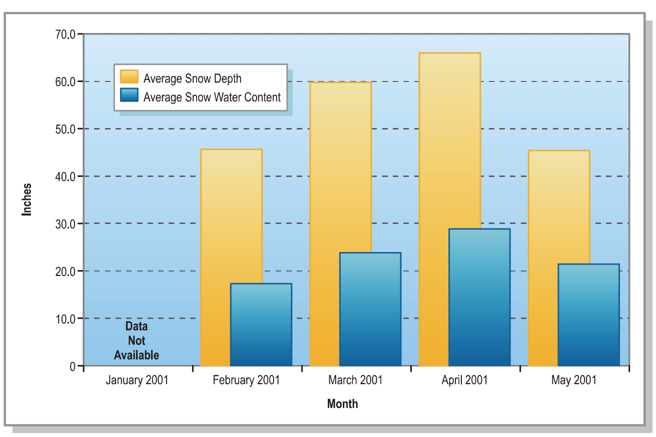


Figure 3-6
Anthony Peak Snow Course
No. 62 (Elev = 6200 ft)

As previously noted, significantly more accumulation of snow occurs in the eastern mountains of Tehama County. Lassen National Park rangers measure the Lower Lassen Peak snow course, established in 1930, situated south of the summit at the 8,250-foot elevation. Figure 3-7 presents the average snow depth and the water content of the snow pack at monthly measuring dates. Lower Lassen Peak snow course averages 17 feet of snow depth and 7 feet of water content at the annual maximum accumulation in April.

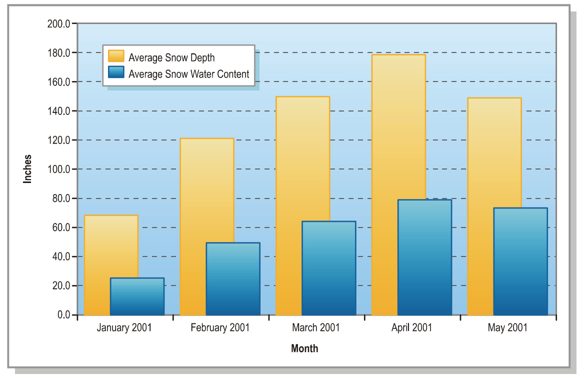


Figure 3-7
Mt. Lassen Snow Course No. 47 (Elev = 8,250 ft)

Based on the geographic location and long data history, Mt. Lassen snow course can be used to provide characteristic snow pack information that contributes to the many snow fed streams of eastern Tehama County.

Current data of the snow pack information is available at http://cdec.water.ca.gov/

3.3 Surface Water Hydrology

Hydrologic and hydraulic response characteristics of rivers and streams vary dependent upon the watershed headwater origins, area-elevation relationships, soil types and precipitation accumulation patterns.

Figure 3-8 (at the end of this section) shows the major surface water bodies within Tehama County. The Sacramento River is the largest river in the county, into which drain many important tributary streams. At Red Bluff, a portion of the river's flow is diverted into the Tehama-Colusa Canal, a Reclamation irrigation facility stretching 100 miles south to serve agricultural land. The Corning Canal is used to supply surface water diverted from the Sacramento River to districts in Tehama County, such as the Corning Water District.

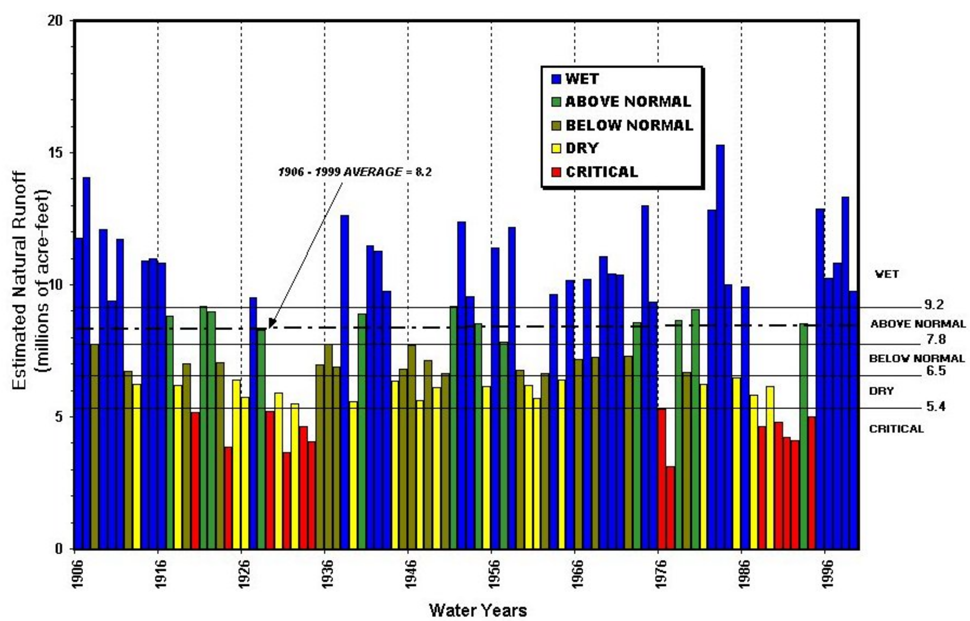
Tributaries of the Sacramento River that flow from the mountains and across the valley floor before reaching the Sacramento River provide much of the surface water supply within Tehama County. A dependable supply of water from these tributary streams is vital to the economic and environmental health of Tehama County. Large tributary streams in Tehama County that originate west of the Sacramento River include Cottonwood Creek, Elder Creek, and Thomes Creek. Large tributary streams in Tehama County that originate east of the Sacramento River include Battle Creek, Paynes Creek, Antelope Creek, Mill Creek, Deer Creek and Pine Creek.

These tributary streams also significantly contribute to the groundwater recharge in the basin. Recalling that most of the precipitation occurs at higher elevations, the streams that transport the water to lower elevations play an important role by conveying water to lower elevations where it is intercepted at locations where streams flow over permeable geologic formations. Although detailed investigations have not been completed to quantify the volume of groundwater recharged from streams in Tehama County, the understanding that streams account for a significant percentage of groundwater recharge is accepted.

3.3.1 Surface Water Flows and Variability

An indicator of annual surface water flow variability in the region is the Sacramento River Water Supply Index. The index is a regional indicator of surface flow and water supply availability for the northern Sacramento Valley. It incorporates the sum of the unimpaired monthly runoff measured at the Sacramento River at Bend Bridge, the Feather River inflow to Lake Oroville, the Yuba River at Smartville, and the American River inflow to Folsom Lake. Unimpaired runoff represents the natural water production of a river basin unaltered by upstream diversions, storage, and export of water to or import of water from other basins. The Index is the sum of 40 percent of the current April through July flow, 30 percent of the current October through March flow, and 30 percent of the index for the previous water year. Based on the calculated value, each year of the index is then classified as wet, above normal, below normal, dry or critical. Figure 3-9 shows the Sacramento River Index annually since 1906 and the classification range for each type-year.

From Figure 3-9, it can be seen that the period from 1995 to 2000 water years comprise the longest continuous period of above average flows in the period of record but were preceded by an eight-year period of mostly dry and critical years.



Source: Department of Water Resources

Figure 3-9
Sacramento River 40-40-30 Water Supply Index

The following section describes the surface water flow, variability, and infrastructure that influences hydrologic stream response. Flow response time (lag time), base flow, and flood flow characteristics were used to identify the variability in three streams and rivers in Tehama County. Mill Creek, Cottonwood Creek, and the Sacramento River flow at Bend Bridge were chosen to represent three typical topographical regions and hydrologic responses of the larger rivers and streams of the county.

- Mill Creek represents the typical snow fed rivers and streams of the eastern portion of the county.
- Cottonwood Creek represents the typical flood flow runoff response of rivers and streams eastern portion of the county
- The Sacramento River dominates the central region of the county and characterizes a controlled (Shasta Dam) runoff in a large watershed.

Mill Creek

Of the major rivers and streams of Tehama County, Mill Creek watershed headwaters reach the highest elevation. The average flows shown in Figure 3-10 indicate a significant contribution from snowmelt during the April through July period. The "average" runoff in May differs slightly from the average February runoff. This runoff flow regime is indicative of snow fed streams. May flows are enhanced by snowmelt and February precipitation accumulates as snow instead of contributing to immediate runoff. The "minimum" flows in Figure 3-10 represent higher flows in May when compared to any other month of the year. The base flow and snowmelt component continues to add flow to Mill Creek despite very low average May precipitation.

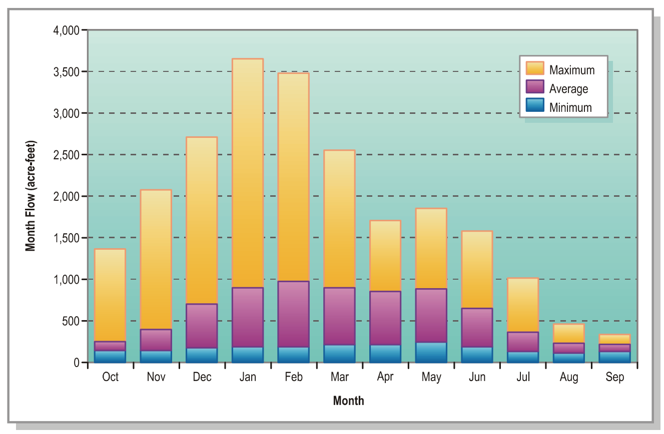


Figure 3-10
Mill Creek Near Los Molinos Monthly Flow
USGS stream gauge 11381500

Anticipating the snowmelt response has significant importance to irrigated agriculture, energy generation, recreation, municipal, and industrial uses. Lower Lassen snow course is immediately adjacent to the headwaters of Mill Creek.

Figure 3-11 shows the relationship of snowpack accumulation on April 1 and the resulting total volume of runoff during the following April through July period. Water managers and hydrologists throughout the State use this type of hydrologic relationships to effectively manage water supplies.

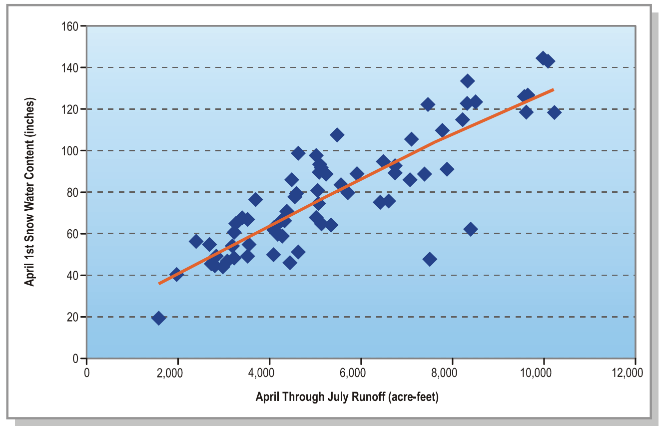


Figure 3-11
Mt. Lassen Snow Accumulation vs. Mill Creek Summer Runoff

Cottonwood Creek

The watershed characteristics of the western area of the county generate a flood flow runoff regime with very small snowmelt and base flow components. Cottonwood Creek is one of the larger streams draining the eastern slope of the Coastal range. Figure 3-12 presents the monthly flow of Cottonwood Creek. Comparing the minimum flow patterns of Cottonwood Creek and Mill Creek illustrates the difference in snowmelt and base flow contribution in each stream. Cottonwood Creek includes very little snowmelt in May and practically no base flow or carryover runoff in June through January. The flows show a significant and immediate response to precipitation (mostly rain) falling on the watershed. The short time between rainfall and runoff in the basin is exemplified by the maximum flow occurring in February at a magnitude of eight times greater than the average flow.

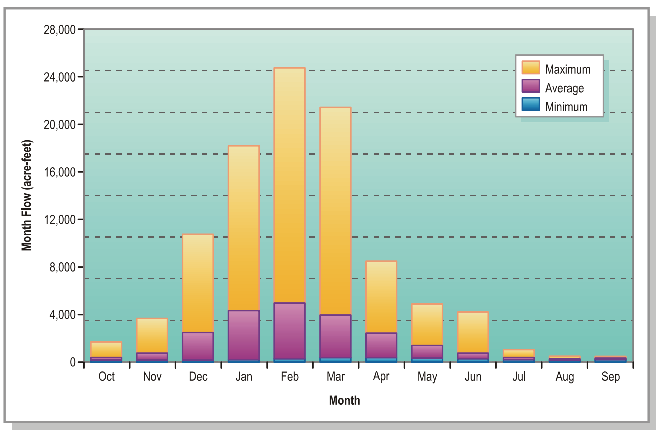


Figure 3-12
Cottonwood Creek Near Cottonwood Monthly Flow USGS Stream gauge 11376000

Sacramento River at Bend Bridge

In its natural condition, the Sacramento Valley was a flood-ravaged region during the winter and spring months where an inland sea a hundred miles long regularly formed during the rainy season, to drain slowly away during the late spring months. Today the Valley is marvelously productive (Kelly 1989).

The natural flow of the Sacramento River exists only on paper as a computed number that accounts for the development and impairment of water resource facilities. Unimpaired flow is the method that natural hydrologic conditions can be related to river flow. The ever-changing presence of man has modified the flow regime of many rivers in the State. The unimpaired flow of the Sacramento River gauged at Bend

Bridge is the keystone to many indices that classify the hydrologic conditions of the Sacramento Valley and the availability of water supply statewide.

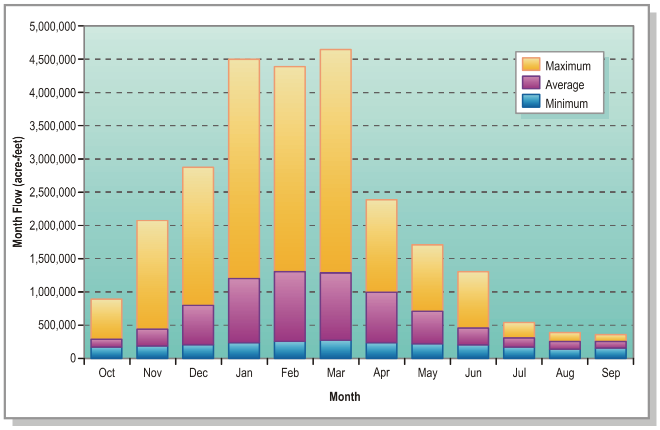


Figure 3-13
Sacramento River at Bend Bridge Unimpaired Runoff

The unimpaired flow of the Sacramento River at Bend Bridge near Red Bluff is shown in Figure 3-13. It is apparent that the magnitude of the flows in the river would contribute to the development of an inland sea. The hydrograph presents watershed characteristics that combine the effects discussed for Mill and Cottonwood Creek.

The Sacramento River at Bend Bridge hydrograph is broader at the winter peak and does not rise and recede as sharply as the watershed of Cottonwood Creek. The April through July period flows recede from the maximum flows in February and March compared to Mill Creek flows that increase slightly in May.

Of particular interest is the consistent minimum base flows that occurs throughout the year. This is indicative of the large watershed with extended lag times and permeable soils.

Water Resource Infrastructure Development

River flow regimes are constantly modified by the development and operation of water resource control facilities. Hydrologic conditions in Tehama County have been significantly modified since the development of diversion structures for mining and irrigated agriculture in the 1800's.

The development of the CVP has significantly modified the flow regime of the Sacramento River at Bend Bridge. The completion of the multipurpose Shasta dam in 1945 has significantly modified the flows of the Sacramento River. The Corning Canal near Red Bluff was completed in 1957 for local agricultural water needs. The Trinity River Project was completed in 1963 designed to store and divert water to the Sacramento River. The Red Bluff diversion Dam was completed in 1979 to aid in the diversion of Sacramento River water to the Corning and Tehama Colusa Canals. The Tehama Colusa Canal completed in 1979 stretches 100 miles to the south.

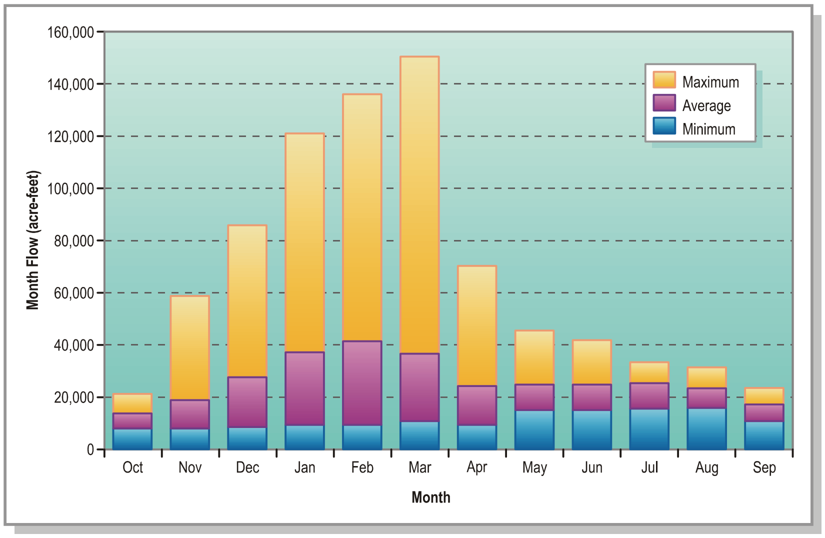


Figure 3-14
Sacramento River Above Bend Bridge Near Red Bluff (1964-2001) Monthly Flow USGS Stream Gauge 11377100

Figure 3-14 indicates the controlled monthly flow of the Sacramento River at Red Bluff. The data represents the period of 1964 through 2001. The comparison of Figure 3-14 to Figure 3-13 reveals the monthly distribution of flow is not related to hydrologic conditions of the watershed, but is more closely related to demand for water from users. A significant reduction in flows in the peak winter months occurs. A significant increase in flows occurs to meet summer demands below the gauging location.

Dams Within Jurisdiction of the State of California (Tehama County)

Tehama County has numerous water storage reservoirs within the county boundaries. DWR Bulletin 17 provides information on 9 dams in Tehama County, which fall under the jurisdiction of DWR's Division of Dam Safety (DWR 1993). Table 3-4 lists dams within Tehama County within jurisdiction of the Division of Dam Safety, including information on the dam name, owner, year completed, stream dammed and storage capacity.

Table 3-4
Tehama County Dams Under Division of Dam Safety Jurisdiction

Name	***Owner***	***Year Completed***	***Stream***	***Storage Capacity (Acre-Ft.)***
Black Butte	Corps of Engineers	1963	Stony Creek	143,700
Red Bluff Div	U.S. Bureau of Reclamation	1964	Sacramento River	3,920
Top Cat	Top Cat Inc	1976	TR Brannin CR	516
Sunflower	Newell T & Anne W Partch	1976	Sunflower Gulch	420
South Log Pond	Diamond Lands Corporation	1957	TR Sacramento R	146
Rye	T.M. Cattle Company	1959	Kendrick Creek	83
Finley	Forest Service		Oak Creek	70
Black Butte Rereg	City of Santa Clara	1989	Stony Creek	52
Corral	T.M. Cattle Company	1959	Kendrick Creek	51

3.4 Soils

There are 14 basic soil categories represented in Tehama County, as illustrated on Figure 3-15 at the end of this section. The soils associated with the valley portions of Tehama County are deep, generally level, very fertile, and support agricultural practices. The soils associated with the mountain portions of Tehama County are shallow and generally on a slope.

3.5 Hydrogeology

Understanding the geology of any area is critical when evaluating water resources because some subsurface geologic units can act as an aquifer to store groundwater, while other units prevent or restrict the flow of groundwater. An aquifer is defined as an underground layer of rock, sand or other material that contains water. Certain surface soils and rock units are permeable, allowing for percolation of water to recharge groundwater. Others have low permeability, restricting groundwater recharge. Understanding how geologic units were deposited and their relationship to surrounding geologic units is the first step to understanding the interaction of surface water and groundwater resources. Recent work by DWR Northern District has increased understanding of geologic units in Tehama County, and is included in this report.

The following discussion regarding Tehama County hydrogeology is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

Tehama County covers several geologic regions and a wide range of diverse groundwater-bearing units. Discussions of the regional hydrogeology are grouped into areas encompassing the inventory units within the Sacramento and Redding Groundwater Basin Region, Mountain Region East, and Mountain Region West. These regions are shown in Figure 1-2, at the end of Section 1.

The Sacramento Valley is a structural basin filled with up to five miles of sediment. These marine and continentally derived sediments have been deposited almost continuously from the Late Jurassic period to the present. Of these deposits, older sediments in the basin were emplaced in a marine environment and usually contain saline or brackish groundwater. Younger sediments were deposited under continental conditions and generally contain fresh groundwater. Sediments thin near the margins of the basin, exposing older metamorphic, granitic and marine sedimentary rocks underlying and bounding the Sacramento Valley sediments.

Principal hydrogeologic units of the Sacramento Valley and Redding groundwater basins consist of Pliocene sedimentary deposits, such as the Tuscan, Laguna, and Tehama formations, and Quaternary terrace deposits, such as the Riverbank and Modesto formations. The Tuscan, Laguna, and Tehama formations are the source of water for deep irrigation and municipal wells, while the Riverbank and Modesto formations yield water to the shallower domestic wells. The main hydrogeologic units and source of groundwater in Tehama County are the Tuscan and Tehama Formations. Other units that supply lesser amounts of groundwater to the county are the Riverbank and Modesto formations. Groundwater in these formations exists largely within the primary porosity associated with the spaces between the individual sand and gravel deposits and within the secondary porosity associated with fractures and jointing of the more competent volcanic rocks.

Groundwater occurs under both unconfined and confined conditions in Tehama County. Unconfined conditions are present in the Riverbank and Modesto formations. Although the Tuscan Formation is unconfined where it is exposed near the valley margin, at depth the Tuscan Formation is confined and forms one of the major aquifer systems in Tehama County. The Tehama Formation is also confined at depth, with coarse-grain, near-surface deposits contributing to the unconfined aquifer system. Confined conditions usually exist at a depth of 200 feet or more, where a confining layer, such as a clay bed, rests above the underlying aquifer deposits.

The following is a discussion of the geologic units and their hydrogeologic properties found within the Sacramento Valley and Redding Groundwater Basin Region, Mountain Region East and Mountain Region West of Tehama County.

3.5.1 Sacramento Valley and Redding Groundwater Basin Regions

The following discussion regarding Sacramento Valley and Redding Groundwater Basin Regions is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

The Sacramento Valley and Redding groundwater basins of Tehama County lie within the northern Sacramento Valley, as shown in Figure 3-16, at the end of this section. Upland portions of the region average around 820 feet above msl on both the east and west sides of the valley. This upland topography consists of hills gradually increasing in elevation to the west, dissected uplands, and alluvial fans of moderate relief. The land surface slopes downward toward the axis of the valley, where the elevation ranges from around 330 feet msl at the north end of the county to about 150 feet msl at the Tehama-Glenn county line. The majority of Tehama County’s groundwater resources come from the Sacramento Valley Region.

A notable feature within this region is the Red Bluff Arch, which separates the Sacramento Valley groundwater basin from the Redding groundwater basin. The Red Bluff Arch is an east-northeast trending combination of folds and a fault, which forms the northernmost barrier to groundwater flow in the Sacramento Valley groundwater basin. Because of this, the groundwater issues in the Redding Groundwater Basin are different to the issues in the Sacramento Groundwater Basin.

In an effort to better understand the groundwater resources of the northern Sacramento Valley groundwater basin, DWR developed a series of maps illustrating the surface and subsurface geology. The surface geology of the Tehama County portion of these maps is shown on Figure 3-16, and in three geologic cross-sections presented on Figures 3-17 through 3-19, at the end of this section. The geologic legend for the maps is shown on Figure 3-20, at the end of this section. The cross-sectional maps also illustrate the subsurface geology, base of fresh water, geologic structure, and stratigraphic sequence beneath the Sacramento Valley portion of Tehama County.

On a regional scale, the base of post-Eocene continental deposits is commonly considered the approximate base of fresh groundwater in the Sacramento Valley (Page 1974). Locally, the base of fresh groundwater fluctuates depending on local changes in the subsurface geology and geologic formational structure.

The approximate base of fresh groundwater is shown on the geologic cross-sections on Figures 3-17 through 3-19. The base of fresh groundwater was determined through examination of electric resistivity logs. Fresh groundwater is water with a specific conductance of less than 3,000 micromhos per centimeter; water with a specific conductance that exceeds 3,000 micromhos per centimeter is considered to be saline (Berkstresser, Jr. 1973).

A detailed discussion of the major groundwater-bearing formations within the Tehama County portion of the Sacramento Valley is presented below. Geologic surface exposures of the water-bearing formations described below are shown on the geologic plan-view map in Figure 3-16, and on the subsurface maps in Figure 3-17 through 3-19.

3.5.1.1 Tuscan Formation

Extent and Thickness

The Tuscan Formation extends from east of Redding to Oroville, including Dairyville and Los Molinos, and from the base of the Cascade Range and Sierra Nevada into the subsurface about five miles west of the Sacramento River (Page 1986). The maximum thickness of the formation ranges from about 1,700 feet in the east, thinning to approximately 300 feet at the westward extent (Lydon 1969). Mapped thickness of the individual units of the Tuscan Formation on the cross-sections suggests that the thickness of the Tuscan Formation may be higher when all units are present: Unit A has an average mapped thickness of 250 feet, the thickness of Unit B can range up to 1,200 feet in places, Unit C has a mapped thickness of up to 600 feet and Unit D has a thickness ranging from 30 to 160 feet, for a total approximate thickness of up to 2,200 feet.

Age and Composition

The Pliocene Tuscan Formation is composed of a series of volcanic mudflows, tuff breccia, tuffaceous sandstone, and volcanic ash layers. The formation is described as four separate but lithologically similar units, Units A through D, which in some areas are separated by layers of thin tuff or ash units (Helley and Harwood 1985). Stratigraphic position and general lithologic character distinguish each unit. Unit A consists of the oldest deposits of the Tuscan Formation. Units B and C overlie Unit A in most locations in Tehama County. Unit D is the youngest unit and is exposed in the northeast portion of the Sacramento and Redding groundwater basins. Groundwater in the Sacramento Valley portion of Tehama County is contained primarily within the two middle units of the Tuscan Formation, Units B and C, and within the Tehama Formation.

Unit A is the oldest water-bearing unit of the Tuscan Formation. This unit is characterized by the presence of metamorphic clasts within the interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone. Unit A contains the Nomlaki Tuff, a dacitic pumice tuff, at its base or within the basal portion of the unit. The presence of the Nomlaki Tuff within the basal sections of the Tuscan and Tehama formations indicates simultaneous deposition of these units. Groundwater encountered within Unit A is associated with primary porosity of the conglomerate and sandstone layers and with secondary porosity associated with the fractured tuff breccia.

Unit B is composed of a fairly equal distribution of lahars, tuffaceous sandstone, and conglomerate. These evenly layered, moderately thin beds form the characteristic look of the Tuscan Formation seen in the eastern foothills of Tehama County. Extending westward into the subsurface, the sediments of Unit B form a very productive water-bearing system. Within Unit B, the interbedded, permeable layers of reworked sand and gravel become a conduit for groundwater movement, transmitting water into the aquifer from recharge areas in the Cascade foothills. The permeable layers of the Unit B sediments comprise the main aquifer material for groundwater storage in the valley. In most locations, Unit C overlies Unit B, and can be seen on the geologic map in Figure 3-16, and in the cross-sections of the Sacramento Valley, Figures 3-17 through 3-19.

Unit C consists of massive mudflow, or lahar deposits with some interbedded volcanic conglomeratic sandstone. In the foothills, these lahars are well cemented and form the cap rock for the ridges in Tehama County. Evidence of wood fragments found in Unit C suggests fast-moving, massive mudflows at the time of deposition. In the subsurface, these low-permeability lahars form thick, confining layers for groundwater contained in the more permeable sediments of Unit B. Unit C is overlain in some locations by Unit D and can be seen on the geologic map in Figure 3-16, and cross-sections of the Sacramento Valley, Figures 3-17 through 3-19.

Unit D is the youngest depositional unit and is characterized by large masses of grey hornblende andesite. Exposures of Unit D extend from the eastern boundary of the Sacramento Valley Region into the Mountain East Region, as seen on the geologic map (Figure 3-16). Unit D is separated from Unit C in places by the tuff of Hogsback Ridge. Unit D has very low permeability; any water associated with the unit is most likely due to secondary permeability from fractures and jointing.

Water-bearing Properties
Groundwater in the Sacramento Valley and Redding Groundwater Basin Region is contained primarily within the pore spaces of the reworked sand and gravel layers of the Tuscan Formation. Much of the groundwater is confined under pressure by layers of impermeable clays, lahars, or tuff breccia. Volcanic sands of the Tuscan Formation can yield high amounts of water to wells in many areas of the eastern Sacramento Valley.

Table 3-5 shows the results of aquifer studies performed on the Tuscan Formation. Of the studies presented, the Dye Creek and Deer Creek studies are most in agreement.

3.5.1.2 Tehama Formation

Extent and Thickness
The extent of the Tehama Formation ranges from north of Redding to Vacaville; and from the western portion of the Sacramento Valley east to Sacramento River. The majority of exposures of the Tehama can be seen in the west-central portion of Tehama County, as seen in Figure 3-16. The Tehama Formation exists next to and on top of the Tuscan Formation. Thicknesses range from about 2,000 feet in Tehama County to about 3,000 feet in the south-central part of the Sacramento Valley (Olmsted and Davis 1962).

Table 3-5
Tuscan Formation Aquifer Properties

Location	Aquifer	Transmissivity (gpd/ft)	Specific Capacity (gpm/foot of drawdown)	Hydraulic Conductivity (gpm/ft^2)
Dye Creek	lower confined	126,000	18	319
Dye Creek	fully penetrated	58,600	18	319
Vina	"Shallow zone"	103,894 - 418,746	41	NA
Vina	"deep zone"	60,495 - 373,893	41	NA
Deer Creek	"deep zone"	40,505	16	NA

Source: California Department of Water Resources Northern District

Transmissivity: The capacity of an aquifer to transmit water measured in gallons per day per foot. Higher transmissivities indicate more water can be extracted from the aquifer less drawdown occurring.

Specific Capacity: The discharge of a well divided by the drawdown in it, measured in gallons per minute per foot of drawdown. Higher specific capacities indicate more water can be extracted from the aquifer less drawdown occurring.

Hydraulic Conductivity: How fast groundwater moves through the aquifer's material, measured in gallons per minute per square foot.

Age and Composition

The Tehama Formation of Plio-Pleistocene age consists of massive, pale green, grey and tan sandstone and siltstone with lenses of pebble and cobble conglomerate (Helley and Harwood 1985). Interstratified beds and lenses of fine gravel are cross-bedded with fore-set beds on the east, indicating deposition of streams from the west (Russell 1931). Beneath the floor of the Sacramento Valley, the Tehama formation interfingers with the Tuscan Formation just west of the Sacramento River. It is unconformably overlain by the Riverbank and Modesto Formations and unconformably underlain by Cretaceous rocks, the Nomlaki Tuff, the Upper Princeton Valley fill or Tuscan Formation Unit C.

Water-bearing Properties

Because the Tehama Formation consists of massive amounts of sandy-silt, silty-clay and lenses of poorly-consolidated sand and gravel, permeabilities are low to moderate, with localized areas of high permeability. Bulletin 118-6 states that in the upland area west of Red Bluff and Corning, wells drilled to depths of 430 feet yield 475 to 950 gpm, while wells near the western basin boundary yield a maximum of 475 gpm (DWR 1976). Specific capacities on most wells are less than 34 gpm per foot of drawdown. Evidence of the lithologic variability within the Tehama Formation is illustrated in two areas of Tehama County, the El Camino Irrigation District and the Rancho Tehama Reserve area, shown in Table 3-6.

Table 3-6 Tehama Formation Aquifer Properties				
Location	**Average Discharge (gpm)**	**Transmissivity (gpd/ft)**	**Average Specific Capacity (gpm/foot of drawdown)**	**Hydraulic Conductivity (gpm/ft^2)**
El Camino Irrigation District	1080	NA	76	NA
Rancho Tehama Reserve	41	32,747	NA	900

Source: California Department of Water Resources, Northern District

Average Discharge: The amount of water the well was pumping, measured in gallons per minute.

Transmissivity: The capacity of an aquifer to transmit water, measured in gallons per day per foot. Higher transmissivities indicate more water can be extracted from the aquifer less drawdown occurring.

Specific Capacity: The discharge of a well divided by the drawdown in it, measured in gallons per minute per foot of drawdown. Higher specific capacities indicate more water can be extracted from the aquifer less drawdown occurring.

Hydraulic Conductivity: How fast groundwater moves through the aquifer's material, measured in gallons per minute per square foot.

3.5.1.3 Riverbank Formation

Extent and Thickness

Exposures of the Riverbank Formation are observed from the Redding Basin to south of the Sutter Buttes. In Tehama County the Riverbank Formation is exposed primarily west of the Sacramento River, at Corning (Figure 3-16). The Riverbank Formation is deposited on the Tehama Formation and the Tuscan Formation. The thickness of the formation ranges from less than one foot to over 200 feet, depending on location. More recent depositions of the Modesto Formation and basin deposits have produced the limited surface exposure of this formation.

Age and Composition

The Riverbank Formation was deposited between 450,000 and 130,000 years ago, forming wide alluvial fans and terrace deposits. Stream terrace deposits of the formation appear topographically above the younger Modesto Formation terrace deposits. The Riverbank Formation consists of weathered reddish gravel, sand and silt, with the color attributed to post-depositional weathering of the formation. The topographic location and weathered red color distinguish the Riverbank from more recent alluvial fan and terrace deposits (Helley and Harwood 1985).

Water-bearing Properties

The thickness of the Riverbank Formation can be a limiting factor to the water-bearing capabilities of the formation. The Riverbank Formation is moderately to highly permeable and yields moderate quantities of water to domestic and shallow irrigation wells. It also provides water to deeper irrigation wells that have multiple zones of perforation. Well yields are higher in areas where concentrations of gravel and sand are present. Groundwater occurs generally under unconfined conditions.

3.5.1.4 Modesto Formation

Extent and Thickness

The Modesto Formation is widespread throughout the Sacramento Valley, occurring from Redding southward into the San Joaquin Valley. The most notable occurrences in Tehama County are found east of the Sacramento River (Figure 3-16). The Modesto Formation was deposited on the Riverbank Formation, the Tehama Formation, and the Tuscan Formation. Similar to the Riverbank, the Modesto Formation ranges in thickness from less than 10 feet in many of the terraces and along the margins of the valley to nearly 200 feet across the valley floor (Helley and Harwood 1985).

Age and Composition

Radiocarbon dating indicates that the Modesto Formation is Pleistocene in age with the upper and lower members dated at 14,000 and 42,000 years old, respectively (Marchandt and Allwardt 1981). The formation consists of tan and light grey, gravelly sand, silt, and clay. Where it overlies the Tuscan Formation, the clasts within the Modesto are distinctly red, brown or black. The upper member shows no indication of weathering, while the lower member shows slight weathering (Helley and Harwood 1985).

Water-bearing Properties

Like the Riverbank Formation, the thickness of the Modesto Formation limits the water-bearing capabilities of the formation. These deposits provide water to domestic and shallow irrigation wells, as well as to deeper wells with multiple zones of perforations. In locations where gravel and sand predominate, groundwater yields are moderate. Lesser yields are found in areas with high silt and clay content. Groundwater occurs generally under unconfined conditions.

3.5.2 Mountain Region East

The following discussion regarding Mountain Region East hydrogeology is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

The Mountain Region East extends from the Sacramento Valley Region to the eastern boundary of Tehama County, including Mineral. The region ranges in elevation from 7,867 feet msl at Butt Mountain near the eastern border of the county to about 650 feet msl near Pine Creek at the southern boundary with the Sacramento Valley Region.

Groundwater yields occur through a combination of primary and/or secondary porosity.

Portions of the Mountain Region East act as recharge areas for the Tehama County portion of the Sacramento Valley groundwater basin aquifer. Groundwater recharge occurs in the form of precipitation and deep percolation of runoff from nearby creeks, streams, and reservoirs.

Following is a summary of the geology in the Mountain Region East of Tehama County that focuses on the fresh groundwater-bearing units of the region. The description of the surface geology is based on the geologic map of Tehama County developed by DWR that is shown on Figure 3-19 at the end of this section.

The Tuscan Formation is the major source of groundwater in the Mountain Region East, including the town of Mineral. Groundwater occurs in the fractures and joints of the volcanic mudflows, as well as in the weathered horizons between buried mudflows (DWR 2003). Lesser amounts of groundwater are found in the alluvium, which is a localized source of groundwater and supplies moderate amounts of water to shallow wells.

3.5.2.1 Tuscan Formation

The Tuscan Formation within the Mountain Region East is the same as the description of the Tuscan Formation in the Sacramento Valley and Redding Groundwater Basin Regions, with the exception of Water-Bearing Properties.

Water-bearing Properties
Exposures of the Tuscan Formation in the Mountain Region East act as a recharge area for the aquifer system in the Sacramento Valley. Groundwater intercepted in wells in this region is generally of an unconfined nature, with groundwater levels reflecting rainfall patterns. Most groundwater in the formation is confined under pressure by layers of impermeable clays and tuff breccia (CDWR 1978). Specific yields are much lower in the Mountain Region East than in the valley area.

Although aquifer performance test data is not available for the Mountain Region East, work has been done on the Tuscan Formation in the upland Foothill Region of Butte County by Slade and Associates, LLC in June of 2000. The foothill area is geologically and topographically similar to the western portion of the Mountain Region East. Results from this study indicate that transmissivity values in the Tuscan Formation are approximately 10,000 gpd/ft in areas adjacent to Clark Road in Paradise. However, in the Lime Saddle area, Slade determined that transmissivity values in the confined portion of the Tuscan Formation are an extremely low 1,100 gpd/ft (DWR 2003). Another study, also conducted by Slade and Associates, LLC (DWR 2003), estimated transmissivity based on Pacific Gas & Electric (PG&E) pump test data for the Magalia area. Estimates from the PG&E pump test data indicate a transmissivity range of 10,000 to 20,000 gpd/ft for the Tuscan Formation. (DWR 2003)

3.5.3 Mountain Region West

The following discussion regarding Mountain Region West hydrogeology is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

The Mountain Region West is the westernmost region in Tehama County, including the towns of Paskenta and Lowrey. There are no appreciable geologic units supplying groundwater to the region. Where groundwater is encountered, it is mainly derived from secondary porosity associated with fracturing and jointing of pre-Tertiary rock, or from Pliocene or Quaternary alluvial deposits along stream channels. Elevations range from 8,090 feet at Mt. Linn in the South Yolla Bolly Mountains to around 650 feet at the southwestern-most boundary of the Mountain Region West near the confluence of Kendrick and Stony Creeks.

Following is an overview of the surface and subsurface geology and a discussion of the groundwater-bearing units of the Mountain Region West.

Groundwater-bearing units in the Mountain Region West are negligible. Where groundwater does occur, it is limited to isolated areas of Tertiary and Quaternary deposits along streams, or to the fractures and joints within the Pre-Tertiary rocks. Following is a description of the Tertiary and Quaternary deposits found in the Mountain Region West.

3.5.3.1 Tehama Formation

The Tehama Formation within the Mountain Region West is the same as the description of the Tehama Formation in the Sacramento Valley and Redding Groundwater Basin Regions. The Tehama Formation is found on the eastern edge of the Mountain Region West (Figure 3-16).

3.5.3.2 Riverbank Formation

The Riverbank Formation within the Mountain Region West is the same as the description of the Riverbank Formation in the Sacramento Valley and Redding Groundwater Basin Regions. In the Mountain Region West, the Riverbank formation is found in the southwestern portion of the region, near Paskenta (Figure 3-16).

3.5.3.3 Modesto Formation

The Modesto Formation within the Mountain Region West is the same as the description of the Modesto Formation in the Sacramento Valley and Redding Groundwater Basin Regions. Exposures of the Modesto Formation are present in the southwestern portion of the Mountain Region West, near Newville (Figure 3-16).

3.5.4 Groundwater Recharge Areas

The movement of water into and out of an aquifer is a dynamic process. Processes such as extraction from wells and groundwater discharge to surface water bodies remove water from storage in an aquifer. Both artificial and natural processes result in the recharge of aquifers.

Artificial recharge occurs as irrigation water percolates downward from unlined canals and irrigated farm fields, eventually reaching the water table. Figure 5-2 depicts areas within Tehama County where irrigation water is applied and would be expected to receive groundwater recharge from deep percolation of irrigation water. Artificial recharge is also accomplished in areas where groundwater banking projects are constructed, such as within the Kern County Water Agency near Bakersfield, California. Groundwater banking includes artificial recharge of groundwater by direct injection into wells or operation of constructed recharge basins. Tehama County water managers have not completed studies targeted to assess the rate and volume of water that could be stored in water-bearing formations for future use.

Natural recharge of aquifers occurs along the intersection of mountains with a groundwater basin (mountain front recharge), where surface water bodies flow over permeable geologic formations in the basin, and through infiltration of precipitation that falls within the basin. The downward percolation of water from surface water bodies (streams and rivers) at locations where they flow across underlying permeable formations is believed to represent a significant portion of natural recharge to the groundwater aquifers in Tehama County. Figure 3-21 includes the surface exposure (outcrop) location of permeable, water-bearing formations and the associated streams that flow across these formations. No Tehama County studies were located documenting the rate or volume of water that naturally recharges groundwater in locations where surface water bodies flow over water-bearing formations.

Freshwater-bearing units identified on Figure 3-21 include:

- Quaternary Alluvium
- Quaternary Modesto formation
- Quaternary Riverbank formation
- Tertiary Tehama formation
- Tertiary Tuscan formation, Unit B

Each of these freshwater-bearing units is described in detail in Section 3.5.1. and is discussed below with consideration to both natural groundwater recharge and the potential for artificial recharge.

Quaternary Alluvium

Quaternary alluvium occurs within Tehama County primarily peripheral to the Sacramento River and in streambeds in tributary streams flowing into the Sacramento River from the west, including approximately 15 miles of outcrop on Thomes Creek and 15 miles of outcrop on Cottonwood Creek. The overall thickness of the alluvium is typically limited to 50 feet or less and the lateral extent is limited to areas adjacent to rivers and streams. Groundwater within the permeable alluvium is assumed to be in direct communication with the associated surface water body.

Natural recharge and discharge of water between the alluvium and surface water body is directly related to stream flow conditions. During high flow periods, the surface water body would be expected to recharge alluvial groundwater. Conversely, during low flow periods groundwater would discharge to the stream until the water table elevation decreased to an elevation equal to the streambed elevation.

Artificial recharge opportunities are unlikely due to the limited vertical and lateral extent of the alluvium and the short period of time that groundwater could be maintained in storage in the alluvium.

Quaternary Modesto Formation

The Modesto Formation is older than the alluvial deposits and younger than the Riverbank Formation. Extensive outcrops are located immediately east of the Sacramento River, adjacent to the river and the associated alluvial deposits. The Modesto Formation underlies much of the developed agricultural ground within the Los Molinos Mutual Water Company area. The formation thickness ranges from approximately 100 feet near the Sacramento River to 1 foot in stream drainages at highest elevations where outcrops are observed.

Natural recharge to the formation likely occurs where surface water bodies flow across the formation. As shown on Figure 3-21, the formation extends up many tributary streams both east and west of the Sacramento River, including approximately 8 miles on Deer Creek, 4 miles on Mill Creek, 8 miles on Antelope Creek, 8 miles on Thomes Creek, and 9 miles on both Elder and Cottonwood Creek.

Artificial recharge to supplement existing supplies may be possible in combination with the underlying Riverbank Formation. The Stoney Creek Fan Project in Glenn County is evaluating groundwater recharge opportunities associated with these formations. Within Tehama County, shallow domestic wells are completed in these formations and approximately 25 to 40 percent of agricultural wells on the east side of the Sacramento River are completed in the Modesto and Riverbank Formations.

Limited thickness and extent of the Modesto and underlying Riverbank Formations may limit opportunities for storage of recharged water. Groundwater banking projects associated with these formations would likely focus on recharge during winter and spring months followed by extraction of the stored water during summer months.

Quaternary Riverbank Formation

The Riverbank Formation is present principally on the west side of the Sacramento River and generally is confined to drainage bottoms at higher elevations, as shown on Figure 3-21. At lower elevations (from the Sacramento River to approximately 10 miles west) the formation is found over a broader area, as shown on Figure 3-21. Fingers of the Riverbank Formation extend up many of the west side drainages, including approximately 9 miles on both Thomes and Elder Creek, 14 miles on Oat Creek, 16 miles on Reed Creek, and 18 miles on Cottonwood Creek. The younger Modesto Formation in some locations overlies the Riverbank Formation.

Natural recharge is assumed to occur along the stream reaches that flow over the formation. The potential for artificial recharge is discussed above in conjunction with the Modesto Formation.

Tertiary Tehama Formation

The Tehama Formation outcrops from directly west of the Sacramento River to the west edge of the groundwater basin in both the Sacramento and Redding groundwater basins. In southern Tehama County, the edge of the basin is located near Paskenta. The Tehama Formation underlies the alluvial formations; including Quaternary alluvium, the Modesto Formation and the Riverbank Formation. Thickness of the formation ranges from approximately 2000 feet near the center of the basin near the Sacramento River to less than 100 feet near the basin edge.

Natural recharge of the Tehama Formation likely occurs as groundwater in the overlying Riverbank and Modesto Formations migrates downward. Additional recharge would be expected to occur where the Tehama Formation is exposed in stream channels. Although the Tehama Formation includes beds of sand and gravel associated with water production, much of the formation has relatively high clay content. As a result, the opportunities for artificial recharge should focus on the identification of location where the more permeable sands and gravels are exposed at the surface.

Tertiary Tuscan Formation, Unit B

The Tuscan B, or lower Tuscan, is an extensive aquifer extending from Red Bluff in the north to Maxwell in the south, where a recent 1000-foot well intersected the lower Tuscan. In an east-west direction, the aquifer extends from the foothills of the Sierra Nevada on the east to approximately Interstate 5 on the west. The lower Tuscan is approximately 500 feet thick near the center of the basin. Approximately 35 to 55 percent of the irrigation wells are completed in the lower Tuscan in the Los Molinos and Vina areas, respectively. The majority of production from the lower Tuscan is near the eastern edge of the basin where the formation is found at shallower depths.

Natural recharge areas for the lower Tuscan Formation in Tehama County extend from Mill Creek south to Pine Creek. Approximately 16 miles of Mill Creek, 13 miles of Deer Creek, and 8 miles of Pine Creek flow across the recharge area for the lower Tuscan. The majority of exposed recharge areas are located south in Butte County. Studies are in progress in Butte County to better understand the source and quantity of recharge. No studies are currently planned in Tehama County, but momentum is gaining to better understand this regional aquifer.

Artificial recharge of the lower Tuscan is possible by development of recharge basins, direct injection, or through substitution of groundwater extracted with surface water supplies. Studies are proposed in Butte County to assess the potential for artificial recharge of this aquifer. Groundwater banked in the lower Tuscan could potentially be used for a wide range of activities, from expanding local supplies to development of a drought water bank.

3.5.5 Total Groundwater in Storage

Information on the total groundwater in storage in Tehama County was not finalized at the completion of this report. Information will be included in the forthcoming report from DWR, entitled *Tehama County Groundwater Inventory*.

3.5.6 Change in Groundwater in Storage

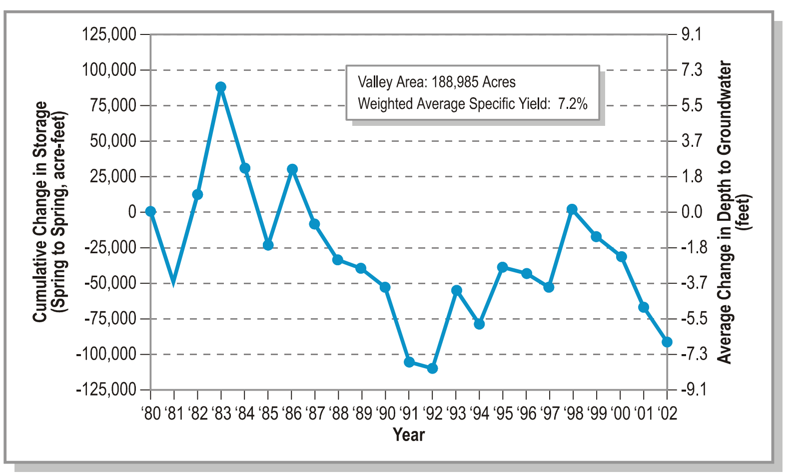
The following discussion regarding changes in groundwater in storage is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

Change in groundwater in storage is dependent on many factors, including climatic conditions, the annual rate of groundwater extraction, and the annual rate of groundwater recharge. Groundwater storage commonly fluctuates within a given year and from year to year. Groundwater in storage will typically decline during periods of drought and rebound during periods of above-normal precipitation. Within the same year, groundwater in storage will decline through the summer months as it is extracted for municipal and agricultural uses, then recover as extraction slows and seasonal precipitation increases recharge. In basins where the amount of annual groundwater extraction is at or below the amount of normal-year recharge, the long-term change in groundwater in storage will remain the same. In basins where the annual amount of groundwater extraction exceeds the amount of normal-year recharge, the long-term change in groundwater in storage will decline. Depletion of groundwater in storage is typically exhibited by a decline in groundwater levels during periods of normal precipitation.

The annual spring-to-spring changes in groundwater in storage for the Sacramento Valley portion of Tehama County were calculated over a 20-year period from 1980 to 2000. The spring-to-spring changes in groundwater storage were calculated using groundwater contour maps developed from spring groundwater level measurements in the upper portion of the aquifer. Digital three-dimensional groundwater elevation surfaces were constructed using the spring groundwater level data, and the volume differences between consecutive spring-to-spring groundwater elevation surfaces were calculated. Changes in groundwater in storage calculated from groundwater elevation contour maps are a good approximation of the actual changes in the volumes of groundwater in storage over time. However, the accuracy of groundwater elevation contours varies with respect to the groundwater gradient, the data density, and proximity to the basin boundary. Overall, the calculated volumes of groundwater in storage are considered accurate within plus or minus 10%.

The spring-to-spring changes in groundwater in storage are graphically illustrated in the cumulative spring-to-spring changes in groundwater in storage graphs found under each inventory unit in Section 3. The spring-to-spring graphs start with a baseline of zero for the spring of 1980. Similar to the 1997 water year, basin-wide groundwater levels during the spring of 1980 closely characterize groundwater conditions associated with a normal water year. Changes in spring-to-spring storage in subsequent years are shown as cumulative changes and are calculated based on the difference between groundwater levels during the 1980 base year and the spring of any given year. Changes in groundwater in storage data are summarized in Table A-1, Appendix A.

The cumulative spring-to-spring changes in storage for the Sacramento Valley area are illustrated in Figure 3-22. Figure 3-22 shows that the groundwater in storage increases during the wet years of 1983 and 1996, decreases during the drought of the early 1990s, gradually recovers over the next five years, and then declines gradually until the present. Overall, the amount of groundwater in storage during spring 2000 was about 25,000 acre-feet less than that of 1980. The fluctuation in the amount of groundwater in storage between the peak in 1983 and the low in 1992 is estimated at 127,000 acre-feet.



Source: California Department of Water Resources, Northern District

Figure 3-22
Estimated Cumulative Change in Spring to Spring Storage

3.5.7 Groundwater Monitoring

The Department of Water Resources performs groundwater level monitoring in the Sacramento Valley portion of Tehama County. Until 1989, the majority of these wells were measured twice per year, during the spring and fall. Beginning in 1990 the groundwater level monitoring was increased to monthly, before returning to a semi-annual measurement in 1995. The current monitoring grid has 100 observation wells. The current Tehama County groundwater level-monitoring grid is shown in figure 3-23 at the end of this section. Presented in Appendix B are additional maps with monitoring well locations, hydrographs, water source data, and irrigation district outlines.

3.5.8 Groundwater Movement

The following discussion regarding groundwater movement is taken from the pre-publication draft report Tehama County Groundwater Inventory, DWR Northern District, May 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

3.5.8.1 Valley Movement of Groundwater

Groundwater movement in the Sacramento Valley Region was evaluated utilizing groundwater elevation contours developed for Tehama County. The contours shown in Figure 3-24, at the end of this section were developed using Spring 2000 groundwater level data collected by DWR and local cooperators. The direction of groundwater movement is illustrated in Figure 3-24 by a series of small arrows perpendicular to the groundwater elevation contours. The overall pattern of groundwater movement during spring in the Sacramento Valley Groundwater Basin is south toward the Sacramento River. The Sacramento River is a gaining river throughout Tehama County, acting as a drain being recharged by groundwater from the valley aquifer system. In the Redding Groundwater Basin, groundwater moves north and east towards the Sacramento River, moving away from the Red Bluff Arch as indicated in Figure 3-24.

3.5.8.2 Mountain East Movement of Groundwater

There are limited data to accurately determine the direction and rate of groundwater movement in the Mountain Region East. In general, groundwater generally moves down-gradient, following the contour of the topographic surface. In the Mountain Region East, this can be interpreted as groundwater flowing from high to low elevations, following drainages toward the center of the valley, where it tends to follow the course and direction of the Sacramento River.

3.5.8.3 Mountain West Movement of Groundwater

There are limited data to accurately determine the direction and rate of groundwater movement in the Mountain Region. In general, groundwater generally moves down gradient following the contour of the topographic surface. In the Mountain Region West, this can be interpreted as groundwater flowing from high to low elevations following drainages toward the center of the valley, where it tends to track the course and direction of the Sacramento River.

References

Berkstresser CF Jr. 1973. *Base of Fresh Ground Water, Approximately 3,000 Micromhos, in the Sacramento Valley and Sacramento-San Joaquin Delta, California*. Menlo Park, CA: U.S. Department of the Interior, U.S. Geological Survey, pp. 40-73. Map: scale [ca. 1:500,000]; 1 map; 76 x 54 cm.; folded in envelope 28 x 23 cm. (Series title: U.S. Geological Survey, Water resources investigations.)

California Cooperative Snow Surveys, 1999. *History of Snow Surveys*. Accessed July 15, 2003 available at http://cdec.water.ca.gov/snow/info/HistSnowSurvey.html

Department of Water Resources, 1993. *Dams Within the Jurisdiction of the State of California*. Accessed June 9, 2003 available at http://elib.cs.berkeley.edu/kopec/b17/html/home.html

California Department of Water Resources. 1978. *Evaluation of Ground Water Resources, Sacramento Valley*. Prepared in cooperation with the U.S. Dept. of the Interior, U.S. Geological Survey. Sacramento CA: the Department. ix, 136 p.: [1] leaf of plates; ills.; maps (4-fold. in pocket); 28 cm. (Series title: Department of Water Resources. Bulletin 118-6.)

California Department of Water Resources, Northern District. 2003 draft. *Tehama County Groundwater Inventory Analysis*

_____ 2001. *Geology and Hydrogeology of the Freshwater Bearing Aquifer Systems of the Northern Sacramento Valley, California*. Sacramento CA: the Department. (Series title: Department of Water Resources. Bulletin 118-7, draft report.)

Kelley, Robert Lloyd. 1989. *Battling the Inland Sea: American Political Culture, Public Policy, and the Sacramento Valley, 1850-1986*. Accessed July 21, 2003. Available at http://www.ucpress.edu/books/pages/2940.html

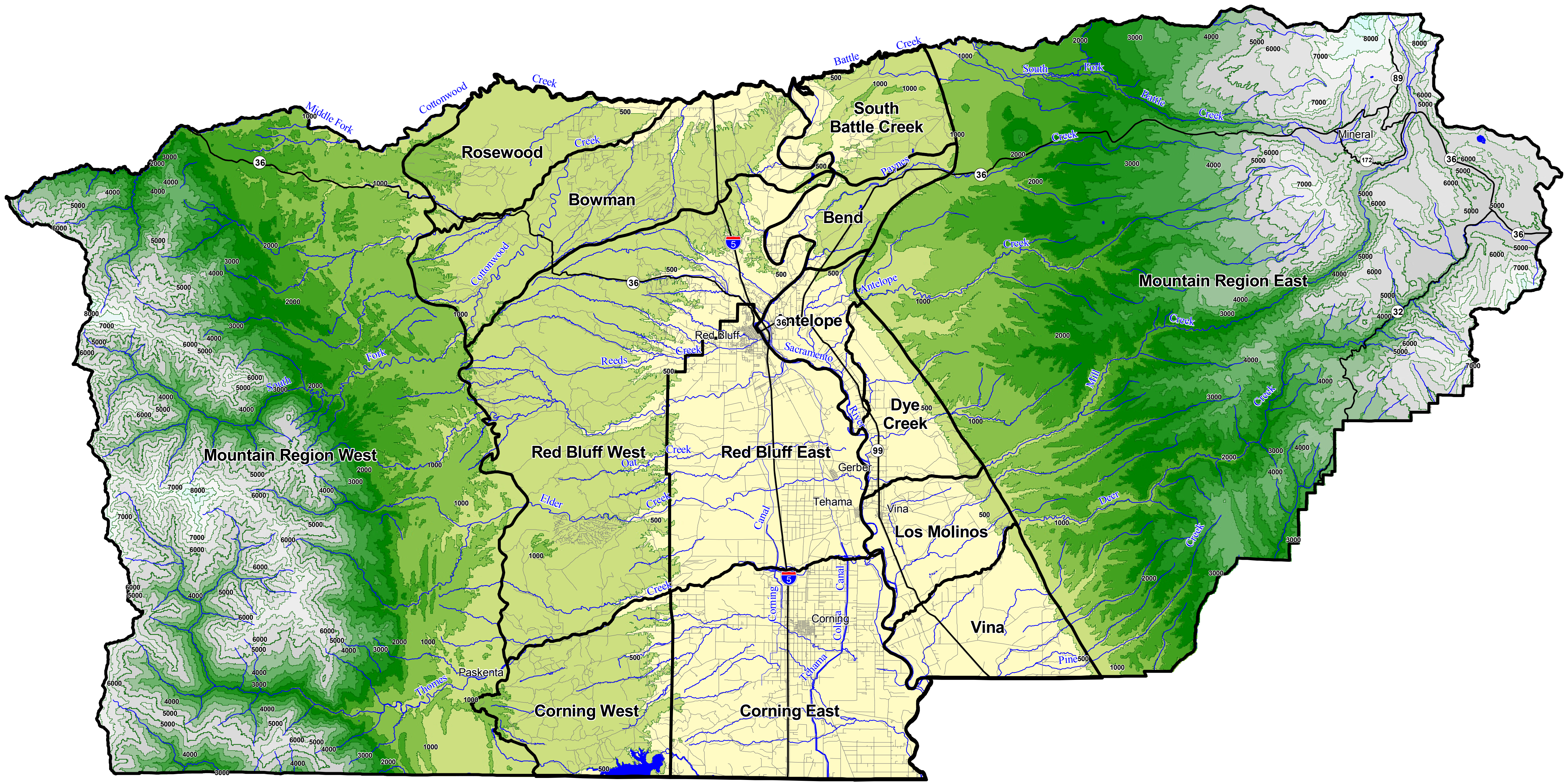
Lydon, Philip A. 1969. *Geology and Lahars of the Tuscan Formation in Northern California*. Coats RR, Hay RL, and Anderson CA, eds. Boulder, Co: Geological Society of America, v, 678, pp. 441-475; xiii, 198 leaves: ill.; maps; ports; 26 cm. (Series title: Studies in Volcanology: a memoir in honor of Howel Williams. U.S. Geological Society of America. Memoir 116.)

Marchand, Denis E; Allwardt, Alan. 1981. *Late Cenozoic Stratigraphic Units, Northeastern San Joaquin Valley, California*. Washington DC: U.S. Government Printing Office: for sale by the Supt. of Docs, GPO, 1981. iv, 70 p.: ill. (2 fold. in pocket); 24 cm. (Series title: Geological Survey bulletin; 1470.)

Olmsted FH, Davis GH. 1961. *Geologic Features and Ground-water Storage Capacity of the Sacramento Valley, California*. Washington DC: U. S. Government Printing Office. vi, 241 p.: maps (1 col.); diagrs.; tables.; 24 cm. (Series title: U.S. Geological Survey. Water-supply paper 1497.)

Page RW. 1974. *Base and Thickness of the Post-Eocene Continental Deposits in the Sacramento Valley, California*. Menlo Park CA: U.S. Geological Survey. 16 p.: maps; 27 cm. (Series title: U. S. Geological Survey. Water-resources investigations; 45-73 20001174374003321026.)

Russell, R. D. 1931. *The Tehama Formation of Northern California*. University of California. 133 p. (PhD thesis).

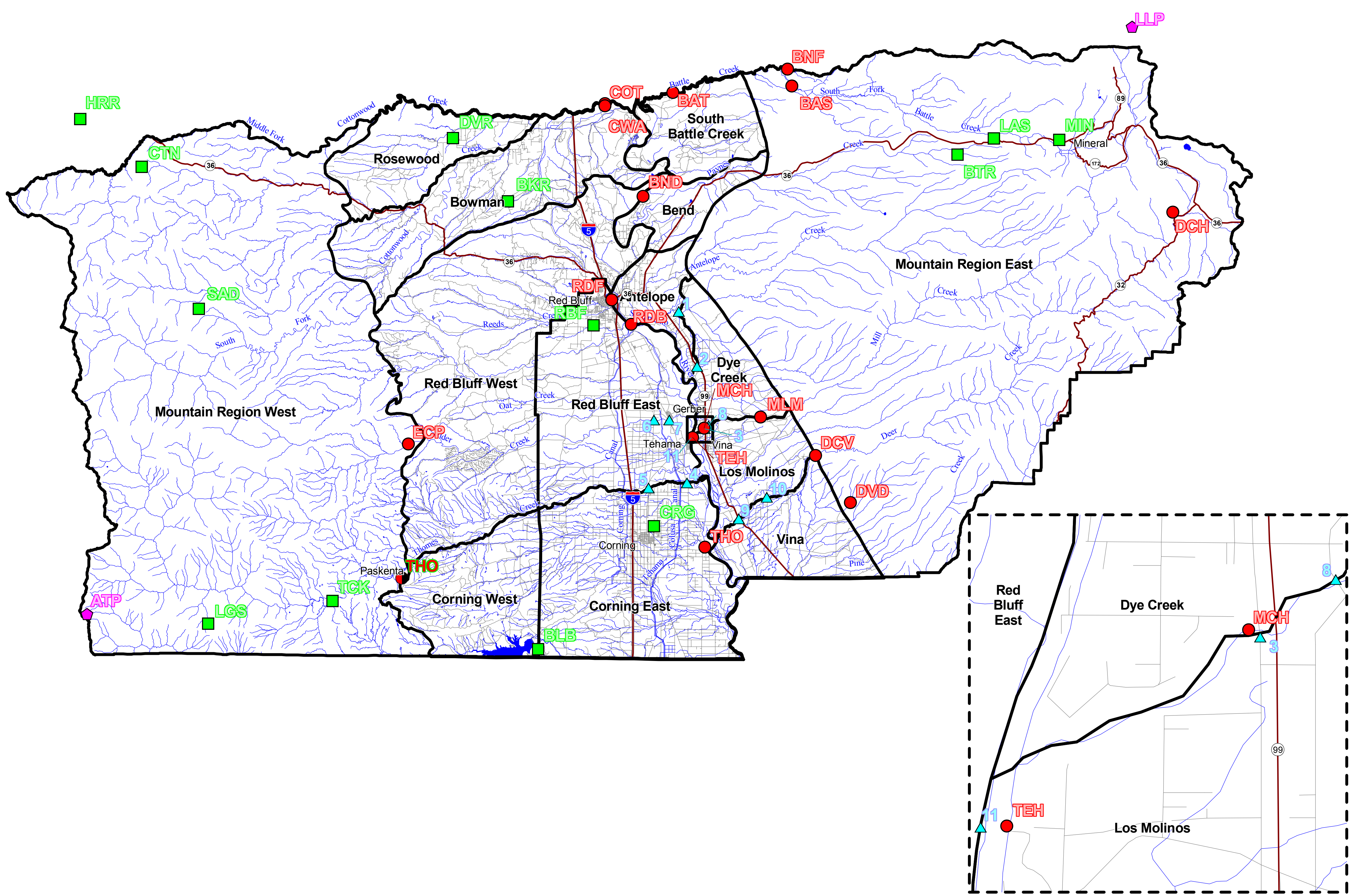


CDM

August 2003

Figure 3-1
Topography

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-1 Topography
DATE: Aug 18, 2003 4:31 PM



STREAM GAGING STATIONS

- BAS South fork Battle Creek near Manton
- BAT Battle Creek
- BND Sacramento River at Bend Bridge
- BNF North Fork Battle Creek
- COT Cottonwood Creek (DWR)
- CWA Cottonwood Creek Auxilary Gage
- DCH Deer Creek at Hwy 32
- DCV Deer Creek near Vina
- DVD Deer Creek below Sanford Vina Dam
- ECP Elder Creek near Paskenta
- MCH Mill Creek below Hwy 99
- MLM Mill Creek near Los Molinos
- RDB Sacramento River at Red Bluff Diversion
- RDF Red Bluff (Alert)
- TEH Sacramento River at Tehama Bridge
- THO Thomes Creek (DWR)
- VIN Sacramento River at Vina Woodson Bridge

CLIMATOLOGICAL STATIONS

- BKR Baker
- BLB Black Butte
- BTR Battle Ridge
- CRG Corning Airport
- CTN Cottonwood Creek near Beegum
- DVR Davis Ranch
- HRR Harrison Gulch RS
- LAS Lassen Lodge
- LGS Log Spring
- MIN Mineral
- RBF Red Bluff
- SAD Saddle Camp
- TCK Thomes Creek (CDF)

SNOW STATIONS

- ATP Anthony Peak
- LLP Lower Lasen Peak

WATER TEMPERATURE MONITORING STATIONS

1 Antelope Creek at Cone Grove Road
2 Antelope Creek at Hwy 99E
3 Mill Creek at Hwy 99E
4 Thomes Creek at Hwy 99W
5 Thomes Creek at Hall Road
6 Mill Creek at Bueno Vista Road
7 Elder Creek at Hwy 99W
8 Elder Creek at San Benito Ave
9 Deer Creek at Hwy 99E
10 Deer Creek at Leninger Road
11 Sacramento River at Mill Creek Park

CDM

August 2003

- Stream Gaging Station
- Stream Gaging & Climatological Station
- Climatological Station
- Water Temperature Monitoring Station
- Snow Station

NOTE: Points are linked to an external database.

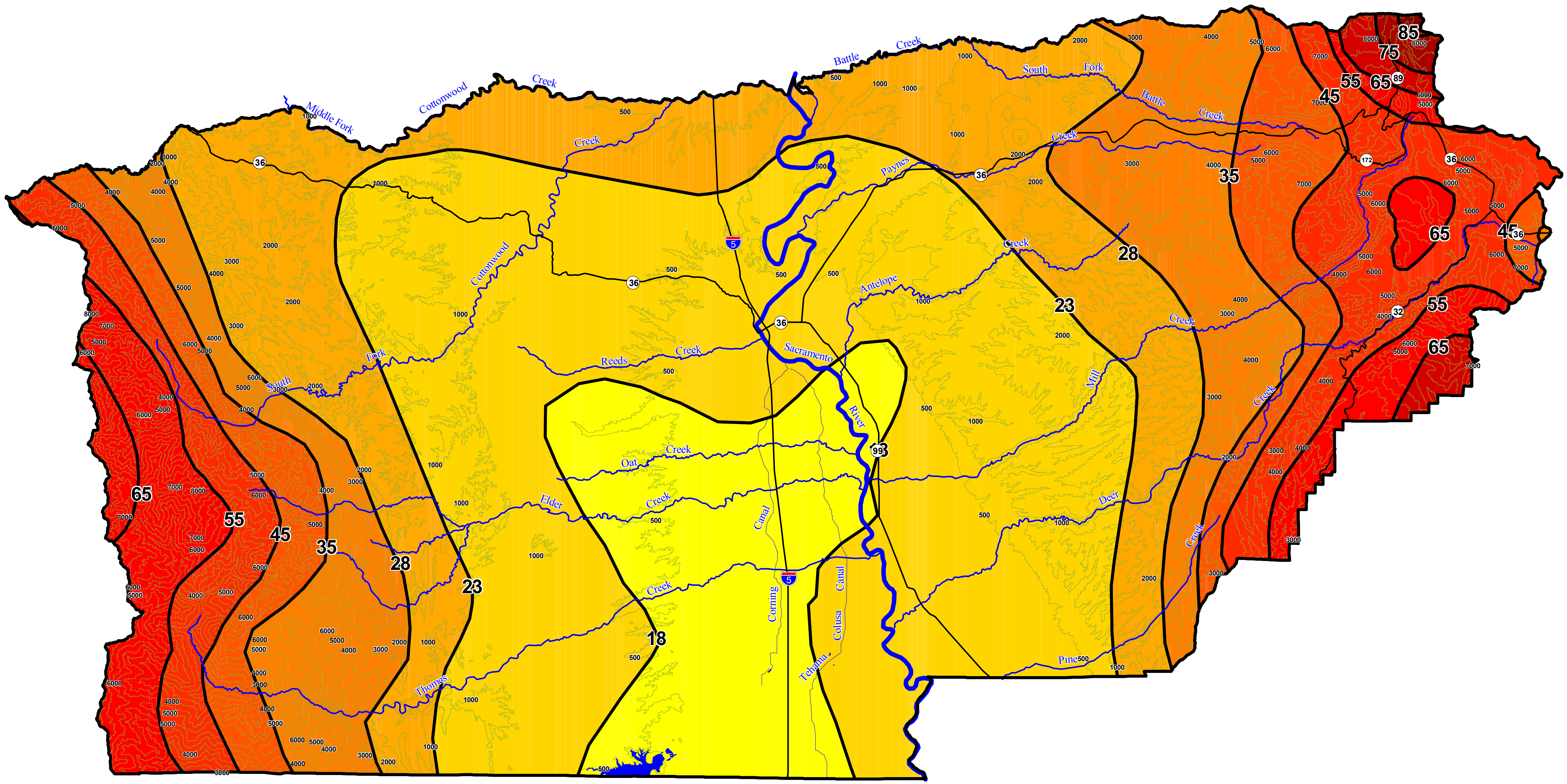
N

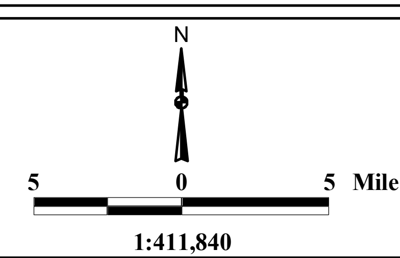
5 0 5 Miles

1:500,000

Figure 3-3 Climatological, Stream Gaging, and Water Temperature Stations

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-3 Climatological, Stream Gaging, and Water Temperature Stations
DATE: Aug 19, 2003 1:48 PM





CDM

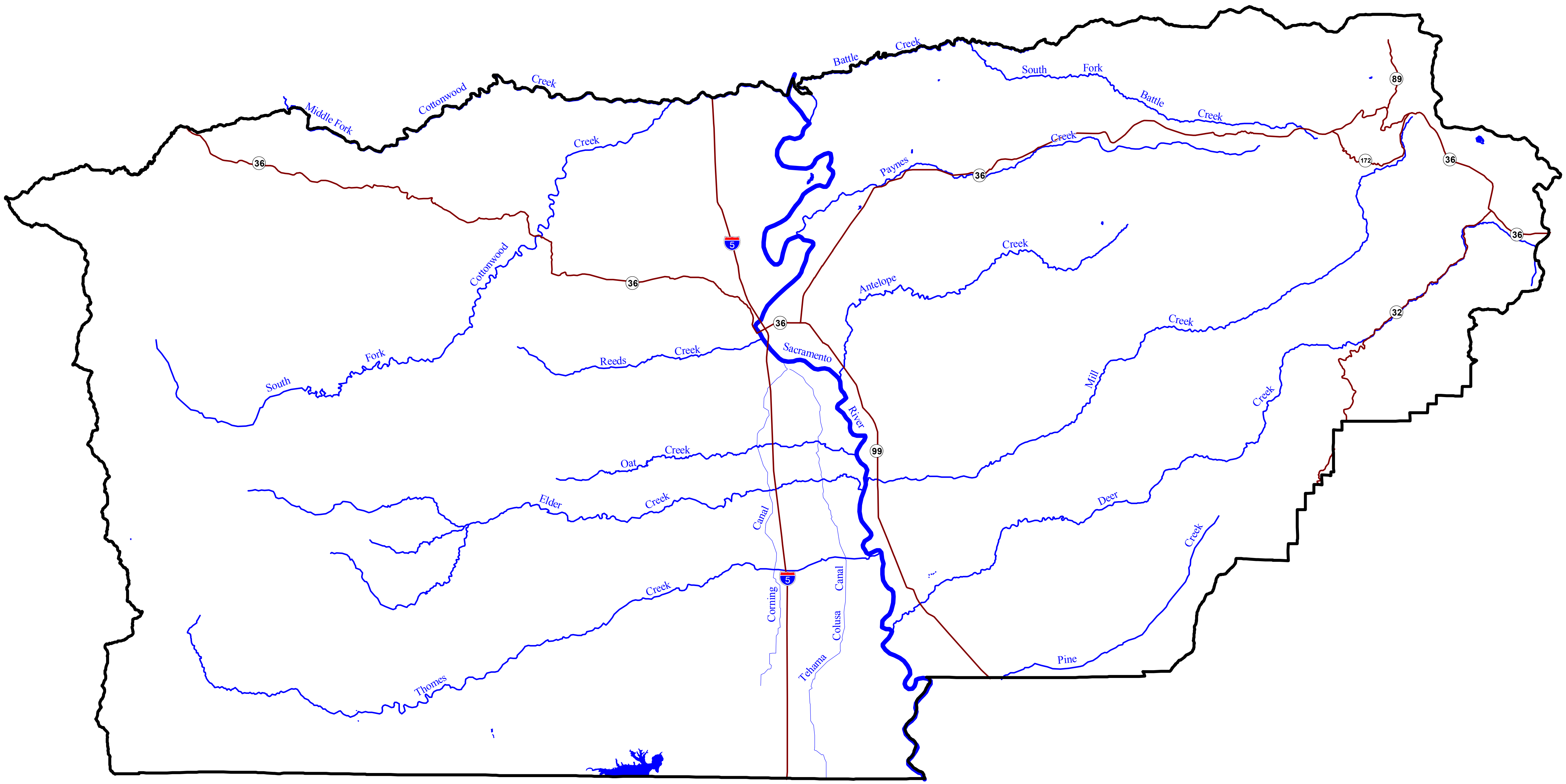
August 2003

Precipitation (Inches)

<18	23-28	35-45	55-65	75-85
18-23	28-35	45-55	65-75	85-95

Figure 3-4
Precipitation

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-4 Precipitation
DATE: Aug 19, 2003 1:47 PM



N

5 0 5 Miles

1:411,840

CDM

August 2003

Figure 3-8
Surface Water Bodies

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-8 Surface Water Bodies
DATE: Aug 19, 2003 1:46 PM

1 COLUMBIA-VINA ASSOCIATION: Very deep, nearly level moderately fine textured to moderately coarse textured soils on flood plains of the Sacramento River

2 MAYWOOD-TEHAMA ASSOCIATION: Very deep to moderately deep, nearly level to very gently sloping soils on flood plains and terraces along tributaries of the Sacramento River

3 CORNING-REDDING ASSOCIATION: Nearly level to sloping, gravelly, medium-textured soils that are moderately deep to shallow to claypan or hardpan; on terraces west of the Sacramento River and along its tributaries

4 TUSCAN-INKS ASSOCIATION: Nearly level to steep, cobbly soils that are shallow to moderately deep to hardpan; on terraces east of the Sacramento River

5 NEWVILLE-DIBBLE ASSOCIATION: Shallow to deep, moderately steep or steep, medium to fine textured soils underlain by soft sedimentary rock

6 MILLSHOLM-LODO ASSOCIATION: Shallow to moderately deep, moderately steep to very steep soils underlain by sandstone and shale

7 TOOMES-GUENOC ASSOCIATION: Shallow or moderately deep, rocky, gently sloping to steep soils underlain by volcanic rock

8 MAYMEN-LOS GATOS-PARRISH ASSOCIATION: Shallow or moderately deep, steep or very steep, rocky soils underlain by sandstone and shale

9 HENNEKE-STONEYFORD ASSOCIATION: Shallow to moderately shallow, steep or very steep, rocky soils underlain by volcanic rock

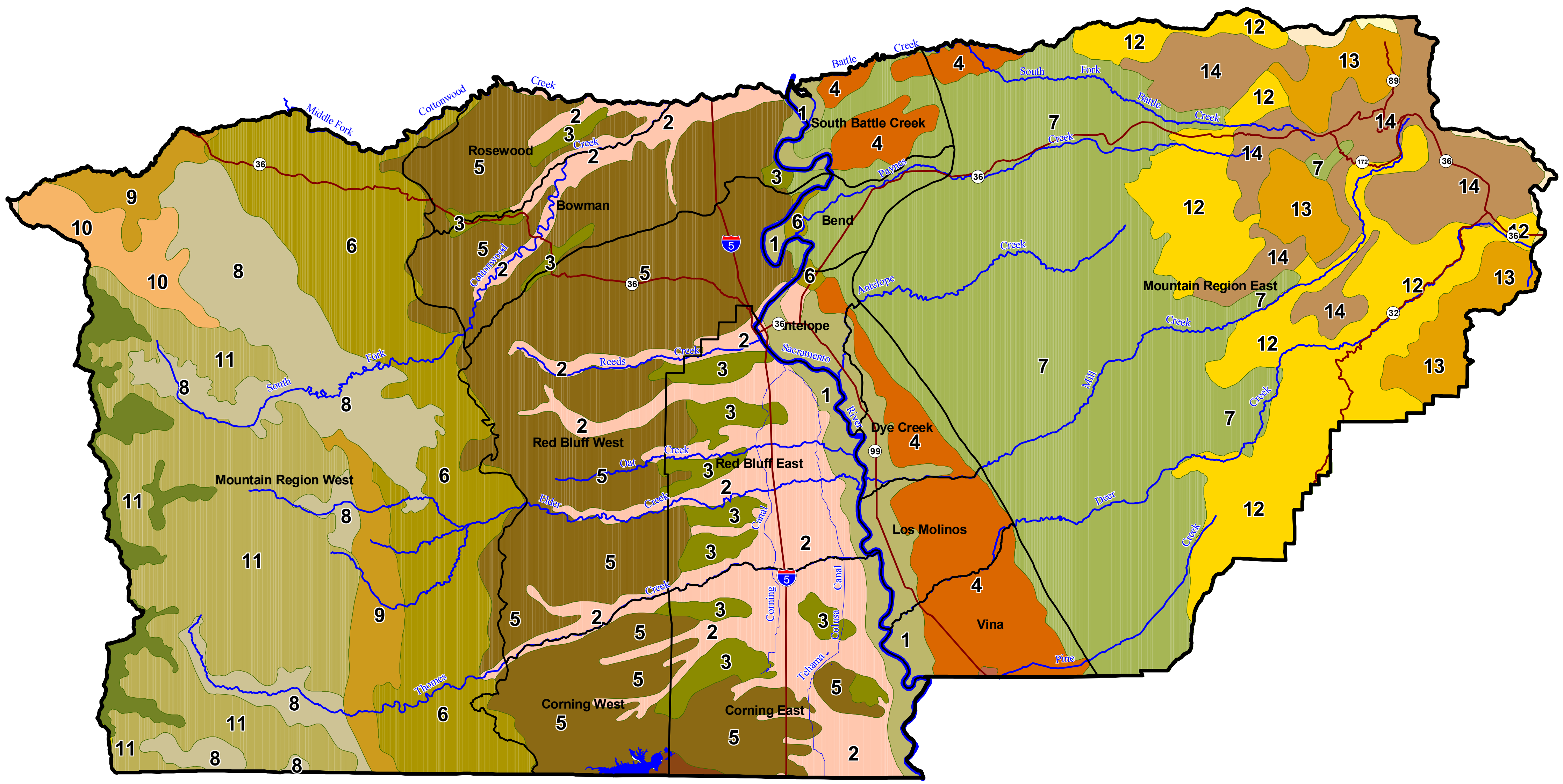
10 DUBAKELLA-NEUNS ASSOCIATION: Moderately deep or deep, steep or very steep, snoty soils underlain by volcanic rock

11 SHEETIRON-JOSEPHINE ASSOCIATION: Moderately deep or deep, steep or very steep soils underlain by hard sedimentary rock

12 COHASSET-MCCARTHY ASSOCIATION: Moderately deep or deep, moderately steep or steep, stoney soils underlain by volcanic rock

13 WINDY-IRON MOUNTAIN ASSOCIATION: Very shallow or moderately deep, moderately steep or steep, stony soils underlain by volcanic rock

14 JIGGS-LYONSVILLE-FORWARD ASSOCIATION: Moderately deep, moderately steep or steep, stony, light-gray soils underlain by volcanic rock



Data Source: Natural Resources Conservation Service (NRCS)

CDM

August 2003

N

5 0 5 Miles

1:500,000

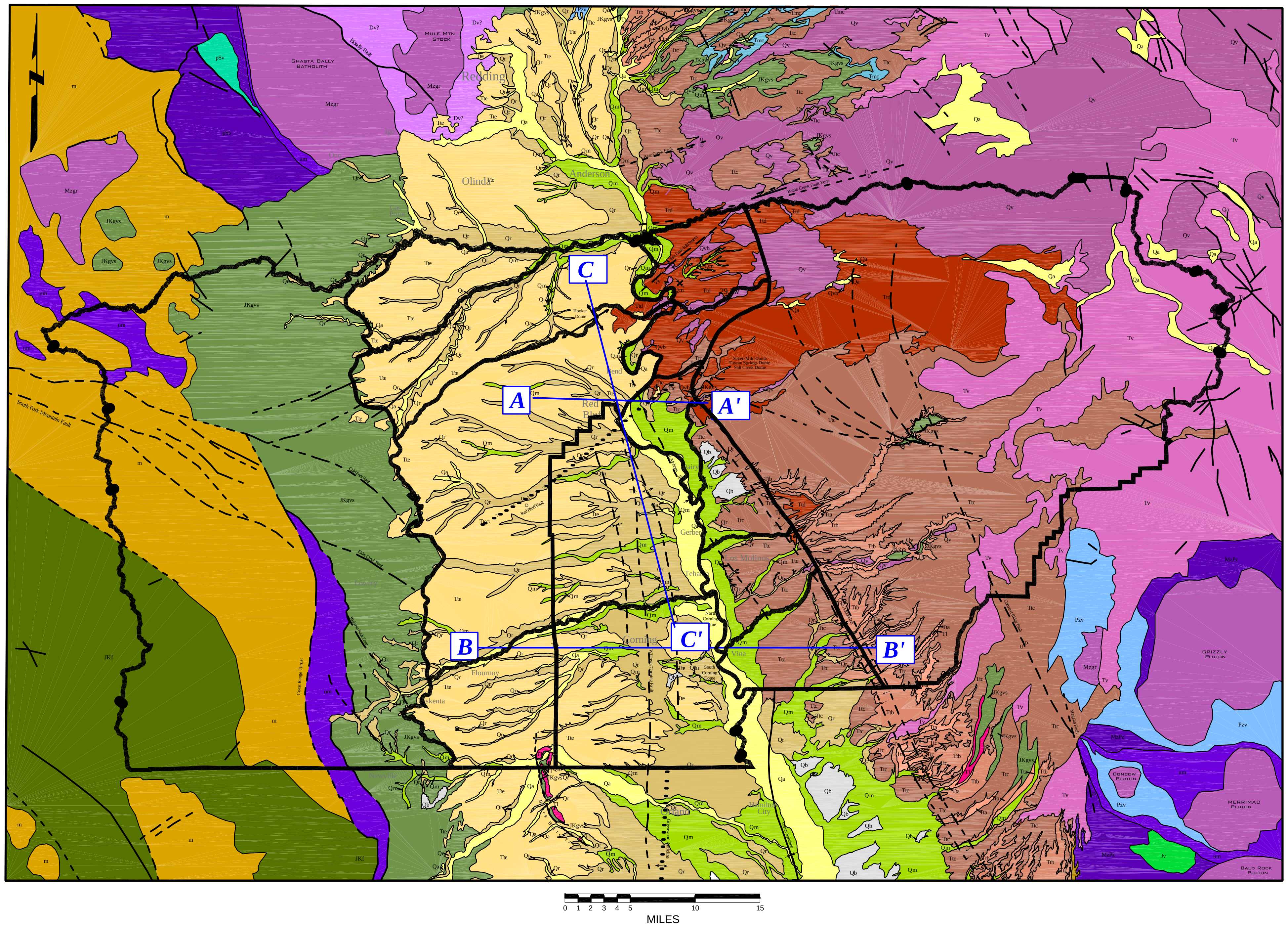
Figure 3-15
Soils

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-15 Soils
DATE: Aug 19, 2003 1:48 PM

DRAFT

TEHAMA COUNTY GROUNDWATER INVENTORY STUDY AREAS

← MOUNTAIN REGION WEST → ← SACRAMENTO & REDDING GW BASIN REGIONS → ← MOUNTAIN REGION EAST →



GEOLOGIC MAP OF TEHAMA COUNTY

Modified from - *Geology and Hydrogeology of the Freshwater Bearing Aquifer Systems of the Northern Sacramento Valley, California, California Department of Water Resources, Bulletin 118-7, 2001, Pre-Publication Draft*

Map Legend

Geologic Contact - dashed where inferred, queried where uncertain.

U D **Fault** - dashed where location is approximate; dotted where location is concealed. U indicates upthrown side and D indicates downthrown side.

Anticline - Arrows indicate direction of dip.

Syncline - Arrows indicate direction of dip.

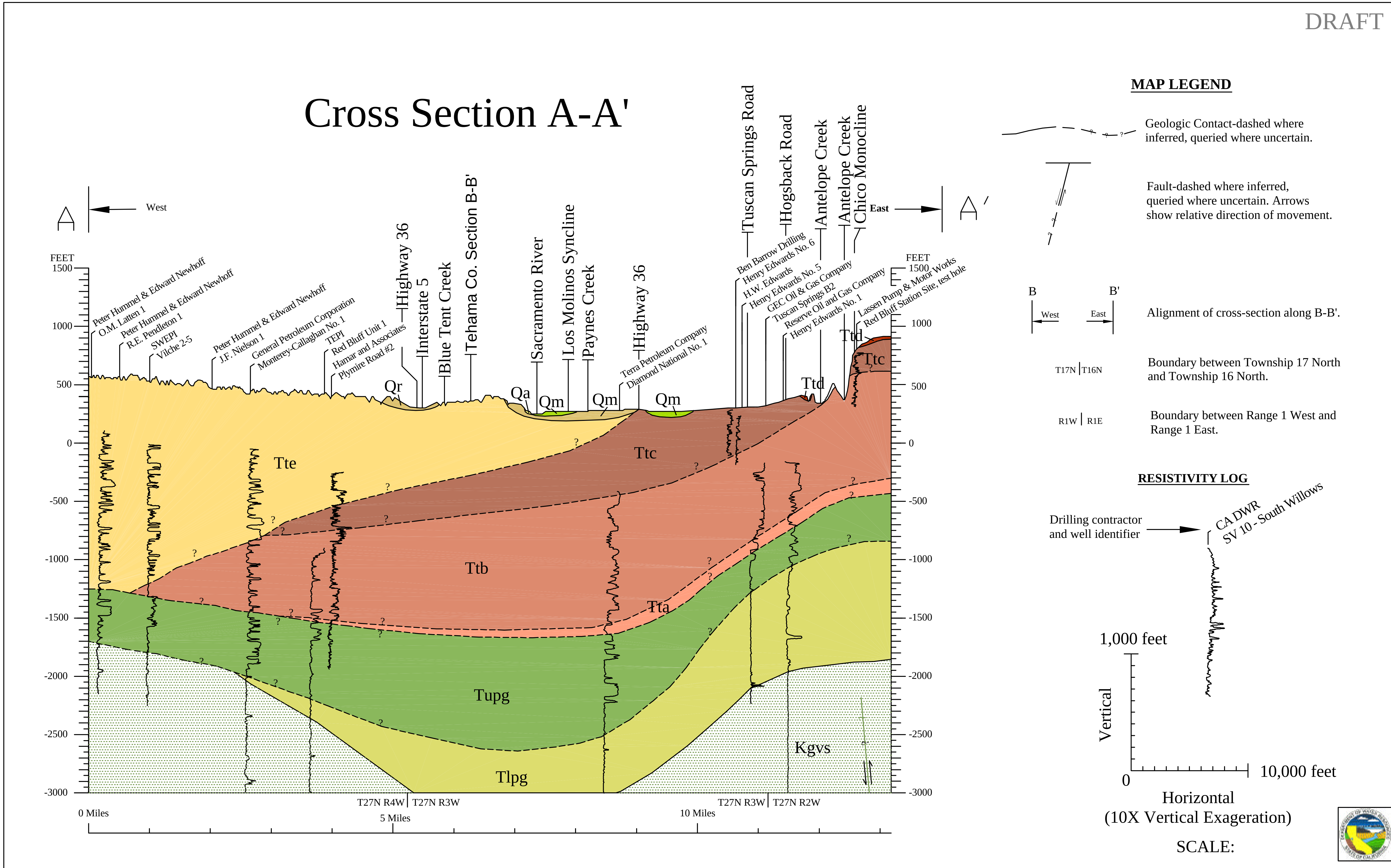
25 **Monocline** - Arrows indicate direction of dip, number indicates steepness of dip in degrees.

A A' **Location of Geologic Cross-Sections** - Letters correspond to geologic sections shown in Plates X and X.

County and Inventory Unit Boundaries

August 2003

Figure 3-16
Geologic Map of Tehama County

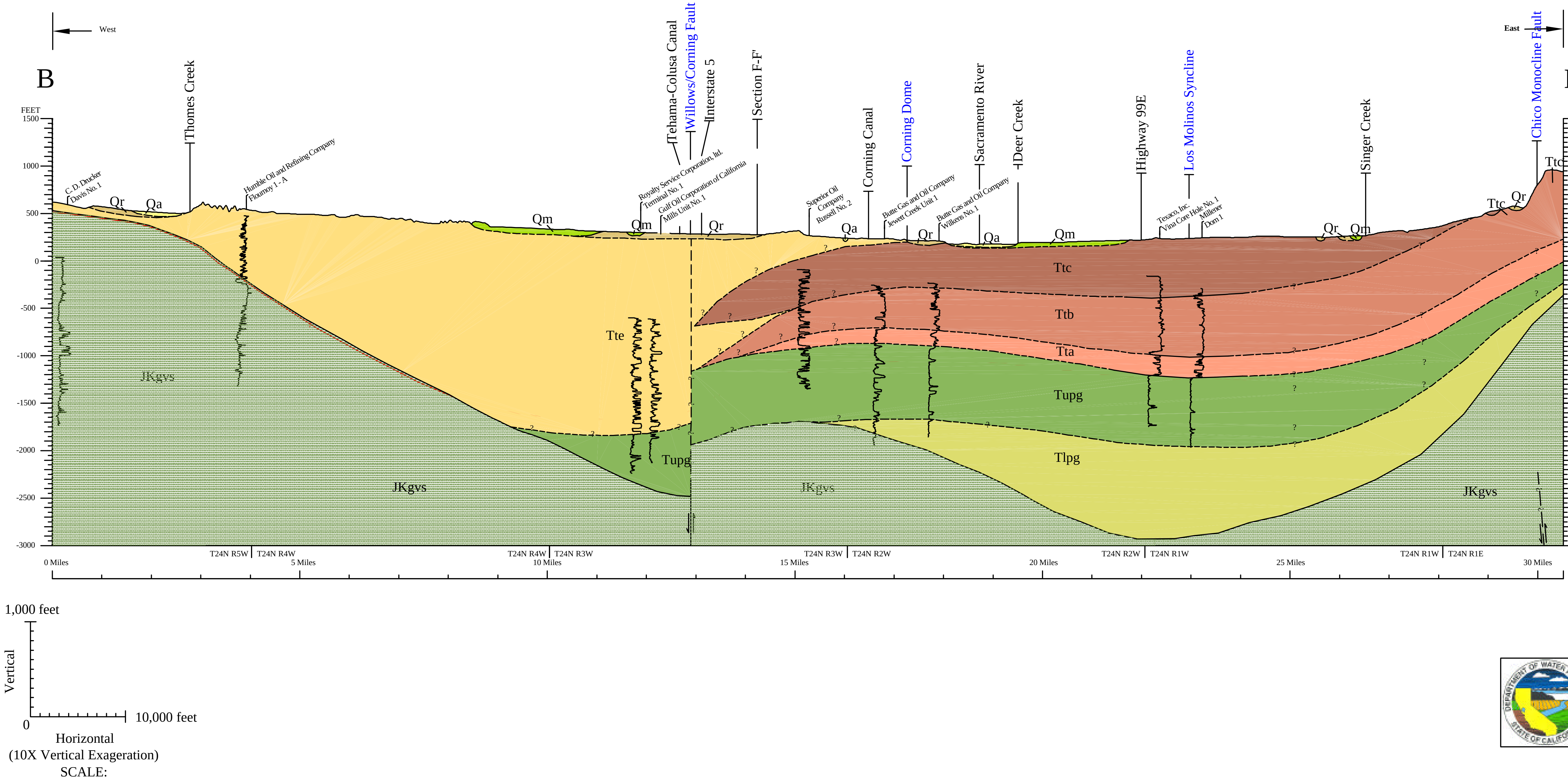


August 2003

Figure 3-17
Cross Section A-A'

DRAFT

Cross Section B-B'

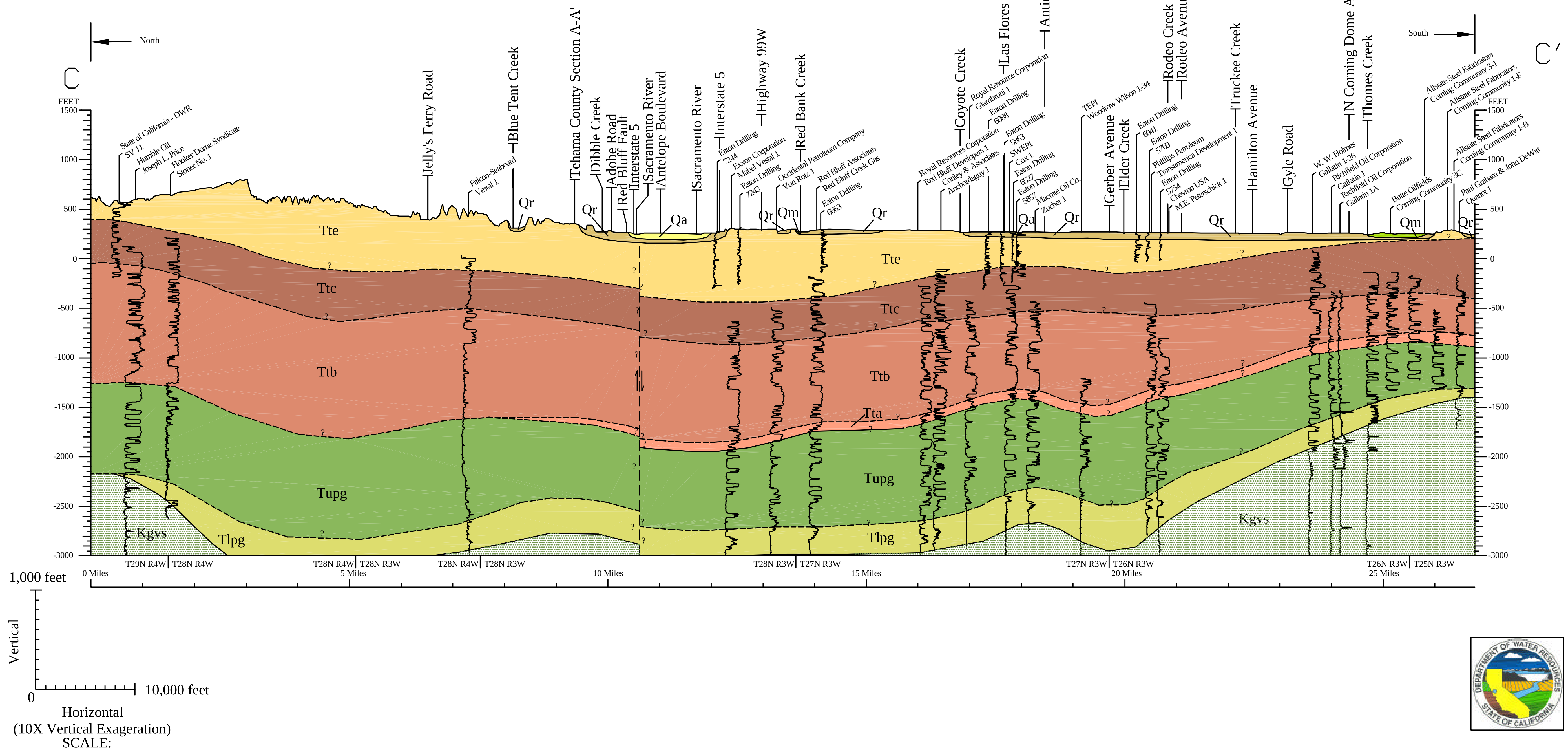


August 2003

Figure 3-18
Cross Section B-B'

DRAFT

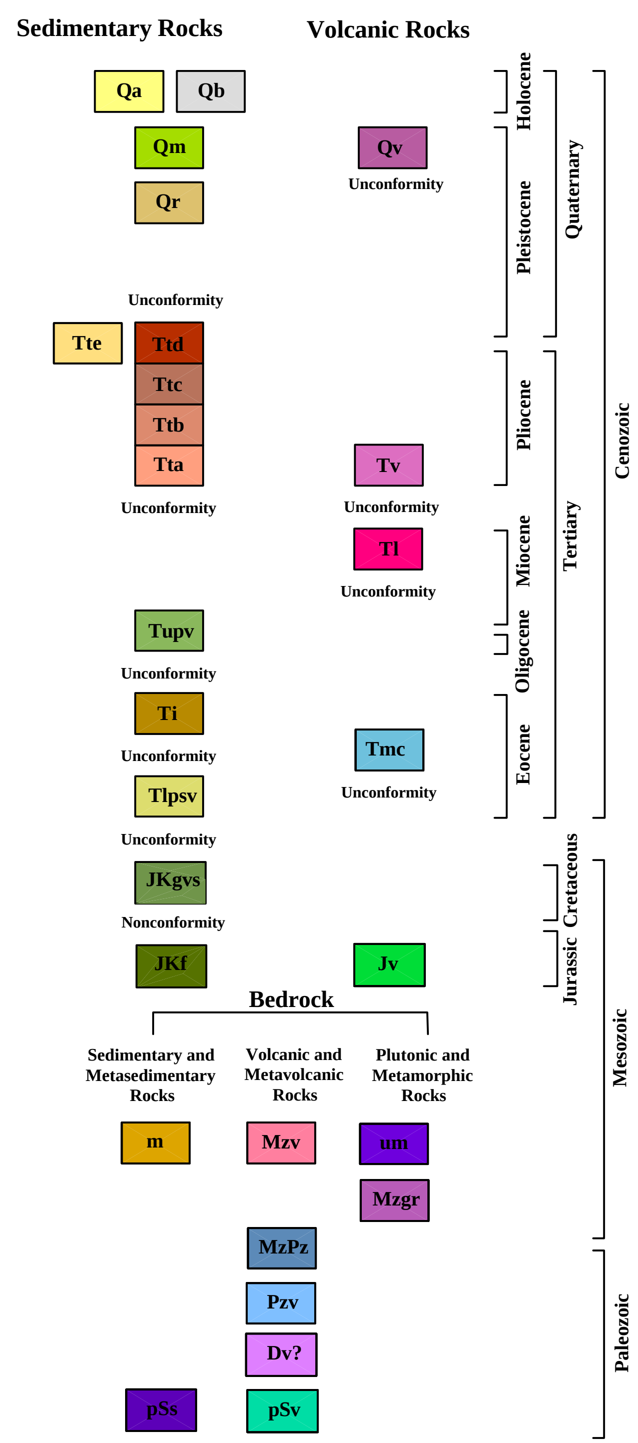
Cross Section C-C'



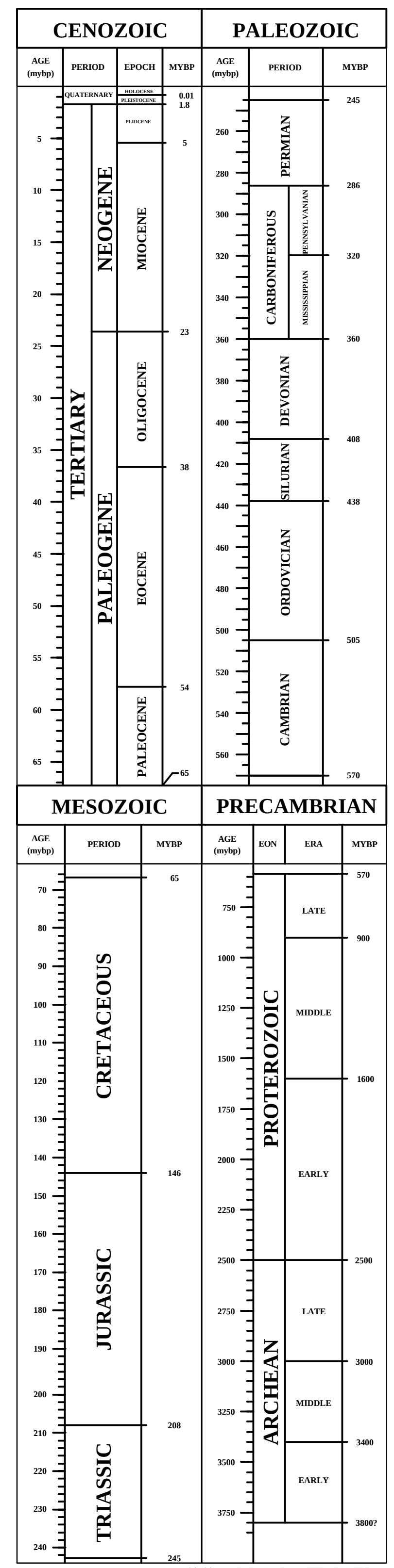
August 2003

Figure 3-19
Cross Section C-C'

CORRELATION OF MAP UNITS



NORTH AMERICAN GEOLOGIC TIME SCALE

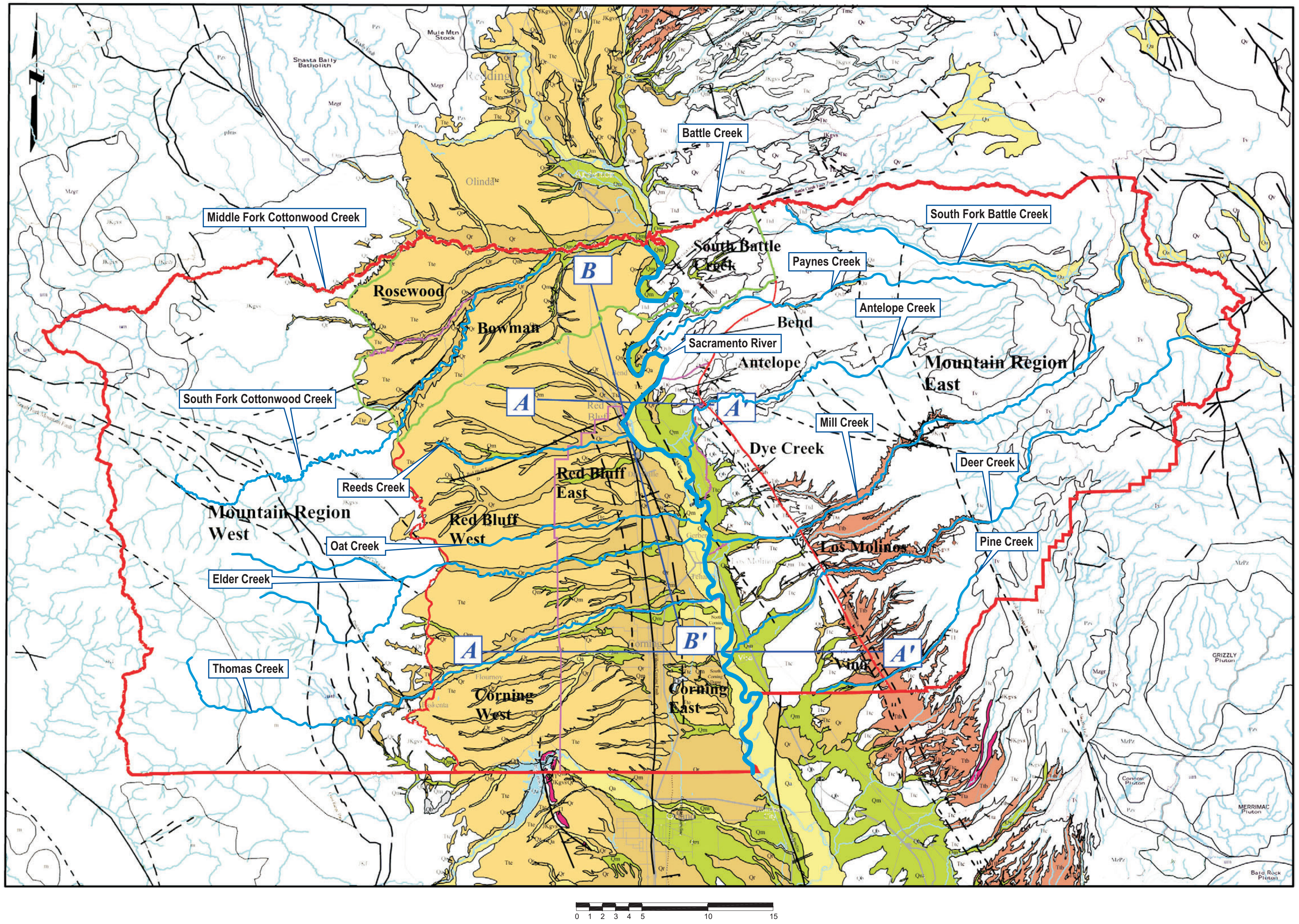


DESCRIPTION OF MAP UNITS

- **Qa** — **Alluvium** (Holocene)-Includes surficial alluvium and stream channel deposits of unweathered gravel, sand and silt, maximum thickness 80 ft. *(adapted from Helley & Harwood, 1985)*.
- **Qb** — **Basin Deposits** (Holocene)-Fine-grained silt and clay derived from adjacent mountain ranges, maximum thickness up to 200 ft. *(adapted from Helley & Harwood, 1985)*.
- **Qm** — **Modesto Formation**, undifferentiated (Pleistocene)-Alluvial fan and terrace deposits consisting of unconsolidated weathered and unweathered gravel, sand, silt and clay; maximum thickness approximately 200 ft. *(adapted from Helley & Harwood , 1985)*.
- **Qr** — **Riverbank Formation**, undifferentiated (Pleistocene)-Alluvial fan and terrace deposits consisting of unconsolidated to semi-consolidated gravel, sand and silt; maximum thickness approximately 200 ft. *(adapted from Helley & Harwood, 1985)*.
- **Qv** — **Volcanic Andesite, Basalt and Rhyolite**, undifferentiated (Pleistocene)-Younger basalt flows, rhyolite and andesite found primarily on the east side of the Sacramento Valley; max. thickness 100 ft. *(adapted from Helley & Harwood, 1985 and Strand, 1962)*.
- **Tte** — **Tehama Formation** (Plio-Pleistocene)-Includes Red Bluff Formation on west side. Pale green, gray and tan sandstone and siltstone with lenses of pebble and cobble conglomerate; maximum thickness 2,000 ft. *(adapted from Helley & Harwood, 1985)*.
- **Ttd** — **Tuscan Unit D** (Plio-Pleistocene)-Fragmental flow deposits characterized by monolithic masses containing gray hornblende and basaltic andesites and black pumice, maximum thickness 160 ft. *(adapted from Helley & Harwood, 1985)*.
- **Ttc** — **Tuscan Unit C** (Plio-Pleistocene)-Includes Red Bluff Formation on east side. Volcanic lahars with some interbedded volcanic conglomerate and sandstone, and reworked sediments; maximum thickness 600 ft. *(adapted from Helley & Harwood, 1985, DWR Bulletin 118-7, 2001, draft report)*.
- **Ttb** — **Tuscan Unit B** (Pliocene)-Layered, interbedded lahars, volcanic conglomerate, volcanic sandstone and siltstone; maximum thickness 600 ft. *(adapted from Helley and Harwood, 1985; DWR Bulletin 118-7, 2001, draft report)*.
- **Tta** — **Tuscan Unit A** (Pliocene)-Interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone containing metamorphic rock fragments; maximum thickness 400 ft. *(adapted from Helley & Harwood, 1985; DWR Bulletin 118-7 (in progress), 2001)*.
- **Tv** — **Basalts and Andesites**, undifferentiated (Pliocene)-Older basalts and andesites found on the northeastern portion of the Sacramento Valley and southwest of Winters; maximum thickness up to 230 ft. *(adapted from Helley & Harwood, 1985)*.
- **Tl** — **Lovejoy Basalt** (Miocene)-Black, dense, hard microcrystalline basalt; maximum thickness 65 ft. *(adapted from Helley & Harwood, 1985)*.
- **Tupv** — **Upper Princeton Valley fill** (Late Oligocene to Early Miocene)-Non-marine sediments composed of sandstone with interbeds of mudstone and occasional conglomerate and conglomerate sandstone; maximum thickness 1,400 ft. *(adapted from Redwine, 1972)*.
- **Tmc** — **Montgomery Creek Formation** (Eocene)-Massive to thick-bedded nonmarine sandstone with lenses of pebble conglomerate and shale, maximum thickness up to 650 ft. *(adapted from Helley & Harwood, 1985)*.
- **Ti** — **Ione Formation** (Eocene)-Marine to non-marine deltaic sediments, light colored, commonly white conglomerate, sandstone and siltstone, which is soft and easily eroded; max. thickness 650 ft. *(adapted from DWR Bulletin 118-6, 1978; Creely, 1965)*.
- **Tlpsv** — **Lower Princeton Submarine Valley fill** (Eocene)-includes Capay Formation. Marine sandstone, conglomerate and interbedded silty shale, maximum thickness 2,400 ft. *(adapted from Redwine, 1972)*
- **JKgvs** — **Great Valley Sequence** (Late Jurassic to Upper Cretaceous)-Marine clastic sedimentary rock consisting of siltstone, shale, sandstone and conglomerate; maximum thickness 15,000 ft.
- **JKf** — **Franciscan Formation** (Jurassic to Cretaceous)-Dominated by greenish-grey greywackes with lesser amounts of dark shale, limestone and radiolarian chert, maximum thickness up to 25,000 ft. *(adapted from strand, 1962 and Norris & Webb, 1990)*.
- **Jv** — **Volcanic and Metavolcanic Rocks** (Jurassic)-Pyroclastic rocks and flows *(adapted from Saucedo and Wagner, 1992)*.
- **m** — **Mixed Rocks** (pre-Cenozoic)-Undivided metasedimentary and metavolcanic rocks of greatly varying types *(adapted from Jennings, 1977)*.
- **um** — **Ultramafic Rocks** (Mesozoic)-Primarily composed of serpentine, with peridotite, gabbro and diabase *(adapted from Jennings, 1977)*.
- **Mzgr** — **Undifferentiated Granitic Plutons** (Mesozoic-Paleozoic)-Undivided granitic plutons and related rocks *(adapted from Jennings, 1977)*.
- **MzPz** — **Mesozoic and Paleozoic Metasedimentary Rocks** (Mesozoic and Paleozoic)-Undivided metasedimentary rocks including slate, shale, sandstone, chert, conglomerate, limestone, dolomite, marble, phyllite,schist, hornfels and quartzite *(adapted from Jennings, 1977)*.
- **Pzv** — **Paleozoic Metavolcanic Rocks** (Paleozoic)-Undivided metavolcanic rocks, primarily flows, breccia, and tuff, including greenstone, diabase and pillow lavas *(adapted from Jennings, 1977)*.
- **Dv?** — **Devonian and Pre-Devonian Metavolcanic Rocks** (Devonian and Pre-Devonian)-Undivided metavolcanic rocks *(adapted from Strand, 1962)*.
- **pSs** — **Pre-Silurian Metasedimentary Rocks** (Pre-Silurian)-Undivided metasedimentary rocks *(adapted from Strand, 1962)*.
- **pSv** — **Pre-Silurian Metavolcanic Rocks** (Pre-Silurian)-Undivided metavolcanic rocks *(adapted from Strand, 1962)*.

Figure 3-20
Description of Map Units

← MOUNTAIN REGION WEST → ← SACRAMENTO & REDDING GW BASIN REGIONS → ← MOUNTAIN REGION EAST →



GEOLOGIC MAP OF TEHAMA COUNTY

Modified from - *Geology and Hydrogeology of the Freshwater Bearing Aquifer Systems of the Northern Sacramento Valley, California, California Department of Water Resources, Bulletin 118-7, 2001, Pre-Publication Draft*

Map Legend

Fault - dashed where location is approximate; U indicates upthrown side and D indicates downthrown side.

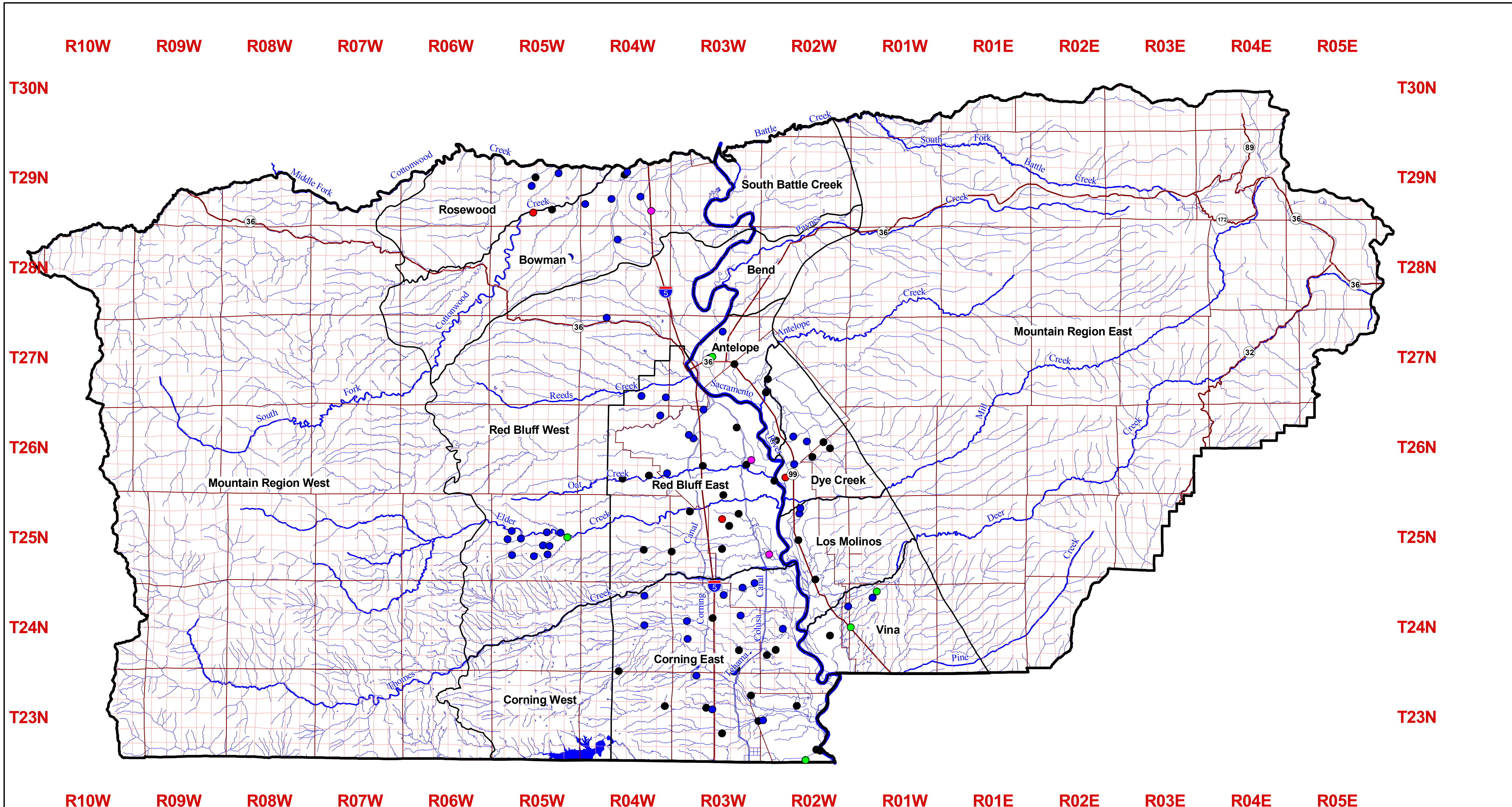
Anticline - Arrows indicate direction of dip.

Syncline - Arrows indicate direction of dip.

Monocline - Arrows indicate direction of dip, number indicates steepness of dip in degrees.

A A' **Location of Geologic Cross-Sections -** Letters correspond to geologic sections shown in Plates X and X.

Figure 3-21
Areas of Recharge in Tehama County

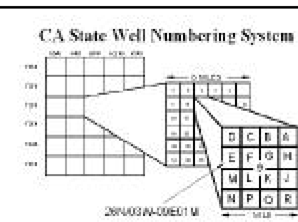


Data Source: Department of Water Resources, Northern District

CDM

August 2003

- Dedicated Monitoring Wells
- Domestic Wells
- Irrigation Wells
- Municipal/Industrial/Public Wells
- Other Wells



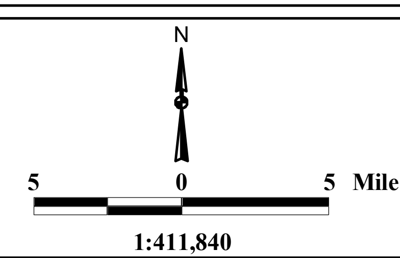
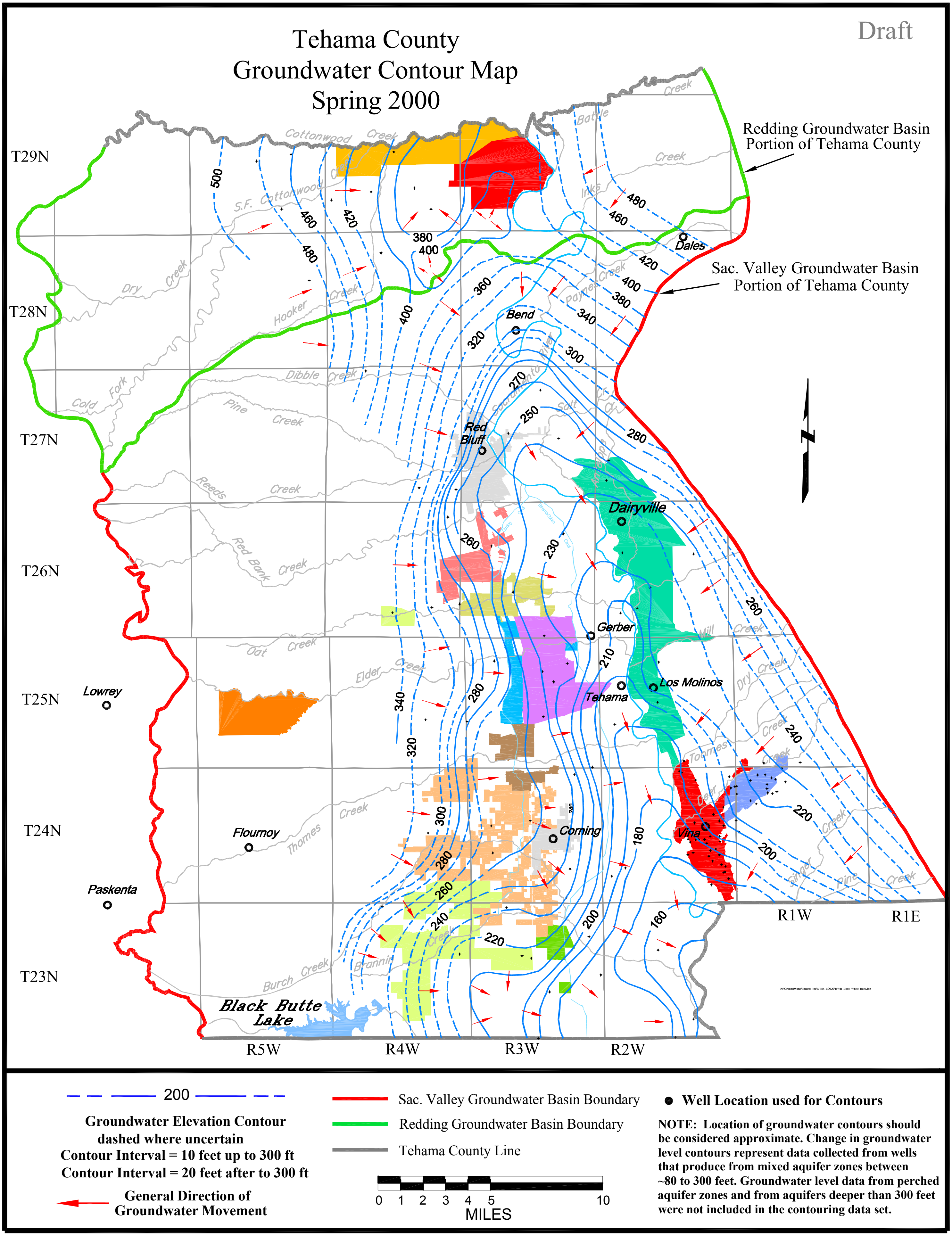


Figure 3-23 Groundwater Well Monitoring Grid

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 3-23 Groundwater Well
DATE: Aug 19, 2003 1:48 PM



Source: California Department of Water Resources, Northern District

Figure 3-24
Tehama County Groundwater Contour Map, Spring 2000

Section 4 Water Management

4.1 Water Sources

Groundwater and surface water are the main sources of water for domestic, environmental and agricultural uses within Tehama County. Seasonal and geographic variability of water availability presents substantial challenges to the management of Tehama County's water resources. Water sources and the availability of supply occur from the complex surface water systems that range from gravity diversions of full natural flow of a snow fed stream to the highly controlled Keswick reservoir and Red Bluff Diversion Dam operations. Groundwater sources and the availability of supply are considerably less variable. Figure 5-2, in Section 5, depicts the source water (groundwater, surface water, or a combination of both) available to water users within the county.

The beginning of this chapter describes water rights and sources at the broader county level. Section 4.2 describes water management activities within each Inventory and Inventory Sub-unit.

4.1.1 Surface Water

Surface Water Rights

Water has always been an important commodity in California; therefore, a complex system of water rights has developed. Water resources were first significantly used during the Gold Rush of 1848, and competition for water resources intensified with the growth of agriculture and industry.

The highest priority water right is "riparian rights," which are attached to properties that border natural waterways. Water from riparian rights can be used only on the property adjacent to the waterway, and riparian right-holders cannot transfer their water. Originally, riparian water rights secured water with no limits placed on its use. However, a later court case changed this position and established that water users with riparian rights must be held to a standard of "reasonable use"[1].

The second type of water right is an "appropriative right", which can be secured by properties not immediately adjacent to waterways. Miners, who would post a notice to divert water and secure the water right, initiated this water rights system. Appropriative water rights were recognized legally in 1855, and are prioritized according to a "first in time, first in right" hierarchy. Appropriative water rights are dependent on the water being put to beneficial use. If the water is not used for a period of 5 years, the water rights can expire.

---

1 The doctrine of reasonable use, which limits all rights to the use of water to, that quantity reasonably required for beneficial use and prohibits waste or unreasonable use or unreasonable methods of use or diversion. (Sec. 3, Art. XIV, Const. of Cal.; Peabody v. City of Vallejo, 2 Cal. 2d 351, 40 Pac. 2d 486; Tulare Irr. Dist. et al v. Lindsay Strathmore Irr. Dist., 3 Cal. 2d 489, 45 Pac. 2d 972; Rancho Santa Marqarita v. Vail, 11 Cal. 2d 501, 81 P. 2d 533)

Distinctions between riparian and appropriative water rights caused conflicts between water users. The Water Commission Act of 1913 addressed these conflicts by declaring water a property of the state. The Water Commission Act also established a permit process to control water rights. The SWRCB was established to govern the permit process. The Water Commission Act became the basis for appropriating water. The Water Commission Act does not apply to groundwater, riparian rights, or appropriative rights established prior to 1914 ("Pre-1914" rights).

Water use must be "reasonable and beneficial." Beneficial uses include irrigation, domestic, municipal and industrial, hydroelectric power, recreational uses, protection and enhancement of fish, wildlife habitat, fire protection, frost protection, stock watering, and aesthetic enjoyment.

In years of water shortage, appropriative right-holders must reduce their water use according to inverse priority. Priority is established by the year that the rights were secured, so the most recent right-holders are the most junior and will be subject to cutbacks first during shortages. Appropriative right-holders will continue to be cutback in inverse priority until the shortage is corrected. If the shortage is so severe that a shortfall remains after all appropriative right-holders have stopped using water, then the riparian right-holders must share the remaining reduction (Camp Dresser & McKee 2001).

Table 4-1 lists the post-1914 appropriative water rights holders in Tehama County for irrigation and domestic uses. Minor uses such as fire protection, mining and power, are not listed in the table. The major water right holders are defined as those holders having right(s) that provide quantities of water equal to or greater than 1,000 acre-feet. The table is a subset of the extended list of water rights holders with a diversion location in Tehama County obtained from the SWRCB's HydroGraphic Report as of January 2003.

No central depository exists of records for pre-1914 or riparian water rights. The SWRCB does not have jurisdiction over pre-1914 water rights; therefore no mandatory requirement exists for the holders of pre-1914 or riparian water rights to report their annual diversions to the SWRCB. Some pre-1914 or riparian water rights holders, however, have filed a Statement of Diversion with the SWRCB. Table 4-2 lists these pre-1914 or riparian water rights filings.

The only certain way to determine pre-1914 water right holders would be to investigate the individual land holdings and water districts along major water courses within the county, excluding those which have already been adjudicated to determine which landholders or water users have pre-1914 rights.

Water rights include only the right to divert water and in most cases they do not address the availability of water supply for diversions. Water rights are generally stated in maximum diversion rate (cubic feet per second (cfs)) for a specified period of time. The stated maximum diversion rate, however, is not usually available through the entire period of diversion. Therefore, the listed filings in Tables 4-1 and 4-2 are derived from the maximum entitlement under the right and should not be interpreted as an annual supply. The listed water rights do not include those holders that are part of the Mill, Deer and Pine Creek adjudications. These adjudications are discussed in the following sections.

Table 4-1
Tehama County Appropriative Water Rights Holders

Owner[1]	Filings (af)[2]	Date Filed	Use(s)[3]	Source
State Water Resources Control Board	7,237,950	9/30/1977	Domestic, Fish & Wildlife Protection, Industrial, Irrigation, Municipal, Other, Recreational	Thomes Creek; North Fork Stony Creek; Stony Creek; Sacramento River
Bureau of Reclamation	4,806,792	7/30/1927	Domestic, Irrigation, Recreational, Stockwatering	Sacramento River
State Water Resources Control Board	3,039,939	9/30/1977	Domestic, Fish & Wildlife Protection, Incidental Power, Industrial, Irrigation, Municipal, Other, Recreational	Funks Creek; Willow Creek; Stone Corral Creek; Sacramento River
U.S. Fish & Wildlife Service	7,962	10/25/1957	Fish Culture	Battle Creek
Stanford Vina Ranch Irrigation Company	4,581	8/5/1918	Irrigation	Deer Creek
Willis, Ken	2,171	9/19/1947	Domestic, Power	Unnamed Spring
B. Fishman Corning Orchard	1,829	12/27/1954	Irrigation	Thomes Creek
Sewald, Clifford & Elsie	1,520	8/12/1958	Irrigation, Stockwatering	Moore Creek
Foley, Bill & Mike	1,344	5/21/1991	Fish & Wildlife Protection	Thomes Creek
Williams, D.	1,273	12/16/1953	Irrigation, Stockwatering	Thomes Creek
Leviathian, Inc.	1,126	3/31/1950	Irrigation, Stockwatering	Sacramento River

* Data from State Water Resources Control Board, Water Rights Division. Data requested for Tehama County water rights holders greater than 1000 acre-feet. Based on county point of diversion.
1. Name of the Owner of the right.
2. Filings are computed to acre-feet based on Maximum Diversion Rate and Season of Diversion.
3. Only consumptive uses were provided (Irrigation, Domestic, Stockwatering, etc.) Non-Consumptive uses (Power, Mining, Fire Protection) were not provided.

Table 4-2
Tehama County Pre-1914 or Riparian Water Rights Holders

Owner[1]	Right[2]	Filings (af)[3]	Date Filed	Use(s)[4]	Source
Battle Creek Meadows Ranch, Inc.	Pre-1914 or Riparian	376,199	1/23/1986	Irrigation, Stockwatering	Unnamed Stream
Los Molinos Mutual Water Company	Pre-1914 or Riparian	72,380	7/17/1967	Irrigation	Mill Creek
Edwards, H. & W.	Pre-1914 or Riparian	65,142	1/1/1967	Irrigation, Stockwatering	Antelope Creek
Los Molinos Mutual Water Company	Pre-1914 or Riparian	65,142	7/17/1967	Irrigation	Antelope Creek
Stanford Vina Ranch Irrigation Company	Pre-1914 or Riparian	57,289	5/25/1967	Irrigation	Deer Creek
Los Molinos Mutual Water Company	Pre-1914 or Riparian	50,666	7/17/1967	Irrigation	Mill Creek
McIntosh, Wade & Linda	Pre-1914 or Riparian	4,424	5/16/1967	Domestic, Irrigation, Stockwatering	Unnamed Spring
Stanford Vina Ranch Irrigation Company	Pre-1914 or Riparian	4,244	5/25/1967	Irrigation	Deer Creek
Battle Creek Meadows Ranch, Inc.	Pre-1914 or Riparian	2,915	1/23/1986	Irrigation, Stockwatering	South Battle Creek
Leininger, Tod	Pre-1914 or Riparian	1,737	4/5/1982	Domestic, Irrigation, Stockwatering	Deer Creek
McIntosh, Bruce	Pre-1914 or Riparian	1,614	5/16/1967	Domestic, Irrigation, Stockwatering	Spring Creek
Battle Creek Meadows Ranch, Inc.	Pre-1914 or Riparian	972	1/23/1986	Irrigation, Stockwatering	Martin Creek
Battle Creek Meadows Ranch, Inc.	Pre-1914 or Riparian	486	1/23/1986	Irrigation, Stockwatering	Martin Creek
Pacific Gas and Electric Company	Pre-1914 or Riparian	323	6/17/1967	Domestic, Irrigation	Unnamed Spring

*Data from State Water Resources Control Board, Water Rights Division. Data requested for Tehama County water rights holders greater than 1000 acre-feet. Based on county point of diversion.

1. Name of the Owner of the right.
2. Based on Record Type which indicates multiple types of rights. Statement of Diversion was assumed to be a Pre-1914 or Riparian Right which the Board does not have jurisdiction over.
3. Filings are computed to acre-feet based on Maximum Diversion Rate and Season of Diversion.
4. Only consumptive uses were provided (Irrigation, Domestic, Stockwatering, etc.) Non-Consumptive uses (Power, Mining, Fire Protection) were not provided.

Adjudicated Water Bodies

Adjudicated rights are those assigned by a court judgment that divides the water of a natural waterway between parties within the drainage area. A general adjudication of water rights determines the validity and extent of existing water rights in a given area. Adjudication is a legal process, conducted through the Superior Court in the county in which the water is located. Adjudication does not create new rights, it only confirms existing rights.

The adjudication process can be applied to surface water or groundwater. Tehama County does not have any adjudicated groundwater basins. There are three adjudications of surface water rights in Tehama County, including the Pine Creek adjudication (No. 7814), the Mill Creek adjudication (No. 3811), and Deer Creek adjudication.

Pine Creek Adjudication

The Pine Creek Adjudication involves lands located in the southeastern portion of Tehama County and extends into Butte County. The Superior Court of Tehama County, by its Decree of March 13, 1957 adjudicated entitlements to 5.4 cfs in Pine Creek to serve 392.1 acres of agricultural lands based upon their riparian water rights at that time.

The California Division of Water Rights, acting as referee, investigated and reported on the water rights and uses of Pine Creek. On July 28, 1955 the Court adopted the report as the basis for the adjudicated rights (Bennett vs. Reed, 1957).

Mill Creek Adjudication

The Superior Court of Tehama County, by its Decree of August 16, 1920 adjudicated entitlements to all flows below 203 cfs in Mill Creek to serve 8,500 acres of agricultural lands based upon their riparian and appropriated water rights at that time (Reclamation 2002).

Coneland Water Company and eight individuals who appropriated and beneficially used water from the Los Molinos River (Mill Creek) were subject to the decree. The diversion of water took place in the lower reaches of the creek; however, the decree adjudicated the entire stream. The flow in the creek is referred to as the naturally flowing water immediately above the highest point of diversion by any of the 9 parties of the adjudication (Reclamation and USFWS 2002).

At the time of the adjudication, three small diversion structures on lower Mill Creek diverted agricultural water. The Upper Dam diverted water to the north in the Main Canal to serve the Land Company. The Clough and Ward Dams divert water to the South to serve the other irrigated lands as part of the adjudication.

Los Molinos Land Company was the court appointed Watermaster[2] to administer the Mill Creek water rights. Appendix C lists the water rights for the original and current

---

2 The Watermaster is appointed by the court to ensure that water is distributed according to established water rights as determined by court adjudications.

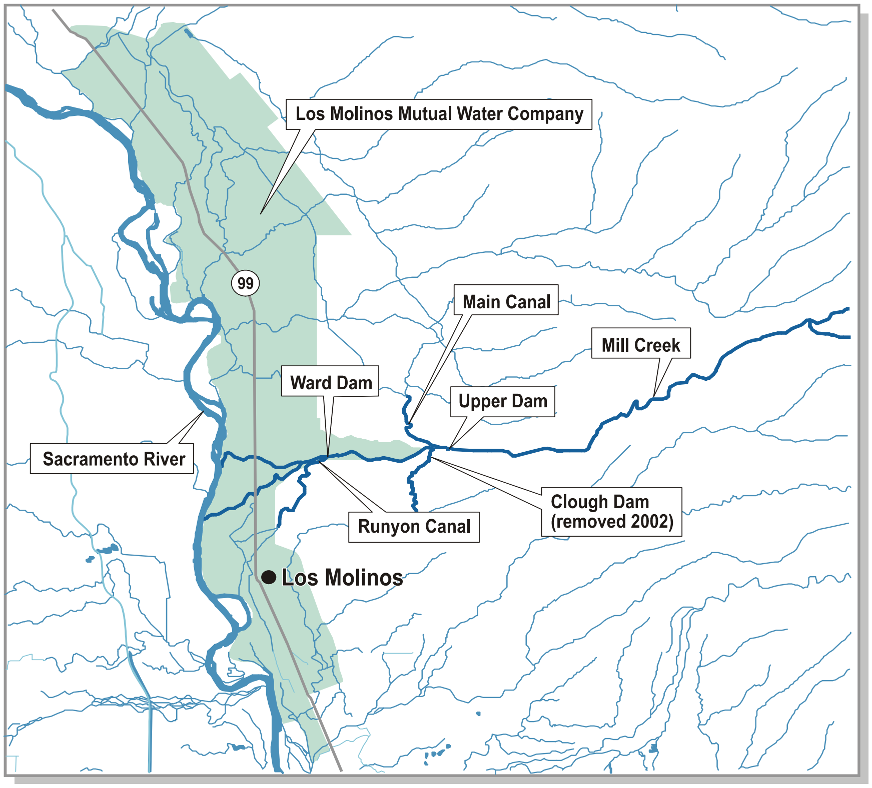


Figure 4-1
Lower Section of Mill Creek and Diversion Structures

owners up to the adjudicated amount of 203 cfs. Figure 4-1 shows the lower section of Mill Creek and the related measurement and diversion structures.

In 1948, the Los Molinos Mutual Water Company (LMMWC) was formed and assumed the diversion responsibilities of the Land Company and the parties to the adjudication. The LMMWC has the current watermaster responsibilities.

Deer Creek Adjudication

In 1921, The Stanford Vina Ranch Irrigation Company (SVRIC) filed suit against upstream riparian water users claiming excessive upstream diversions were leaving SVRIC with little water. In 1923, the courts adjudicated the entire flow of Deer Creek with 65 percent of the flow granted to SVRIC and 35 percent to Deer Creek Irrigation District (DCID). In 1926, changes were made to the adjudication granting 66 percent of the flow to SVRIC, 33 percent to DCID, and 1 percent to Sheep Camp Ditch. Similar to the Mill Creek adjudication, the flow is referred to as the naturally flowing water immediately above the highest point of diversion (DCID 2003).

Central Valley Project

Sacramento River Settlement Contracts

The construction and subsequent operations of Shasta Dam altered the flow regime of the Sacramento River and led individual water right holders, water districts, mutual water companies, and other water users that held Sacramento River water rights to negotiate contracts designed to address the new flow regime. The Sacramento River Settlement Contractors hold valid vested water rights that predate the priority of right held by Reclamation for CVP uses. Settlement Contracts provide for the recognition of the contractors' underlying water rights to divert the natural flow of the Sacramento River (base supply), while also providing for a supplemental supply of CVP project water (project supply) during the summer months. Project water is needed during the summer months when the natural flow of the river is not adequate to meet peak irrigation demands.

In 1964, all of the Settlement Contractors executed water rights settlement contracts with Reclamation after 20 years of discussions to settle water rights disputes. Between Redding and Sacramento, 145 settlement contracts representing approximately 2.2 million acre-feet provide water to 440,000 acres of land bordering the Sacramento River and its tributaries (Reclamation 2002). Anderson-Cottonwood Irrigation District, which straddles the Tehama County - Shasta County border, is a settlement contractor with an annual 165,000 acre-feet base supply and a 10,000 acre-feet project water supply. There are no other settlement contractors within Tehama County with a settlement contract exceeding 10,000 acre-feet annually.

Sacramento River Water Service Contractors

Construction of Shasta Dam impounded the Sacramento River to form Lake Shasta, allowing for storage of spring runoff water that was previously lost to the Pacific Ocean. With the Lake Shasta storage capacity exceeding 4,500,000 acre-feet, water is stored during the winter and spring months for delivery during the summer high water demand period. The stored water is made available to downstream water users through CVP water service contracts.

During dry years, CVP water service contracts are subject to greater and more frequent deficiencies than settlement contracts. Water diverted at the Red Bluff Diversion Dam is mostly diverted for water service contractors on the Tehama Colusa and Corning canals under the Reclamation appropriative right.

In accordance with Section 3404c of the CVPIA, Reclamation is negotiating long-term water service contracts. As many as 113 CVP water service contracts, within the Central Valley of California, may be renewed during this negotiation process (Reclamation 2003).

The majority of the Sacramento River water service contract supplies are diverted at the Red Bluff Diversion Dam for contractors on the Tehama-Colusa and Corning Canals. Table 4-3 lists Sacramento River Water Service Contractors and their project supply quantities in Tehama County.

Table 4-3
Tehama County CVP Water Service Contractors

Contractor	***Project Supplies (af)***
Corning Water District	23,000
Thomes Creek Water District	6,400
Proberta Water District	3,500
Kirkwood Water District	2,100

4.1.2 Groundwater

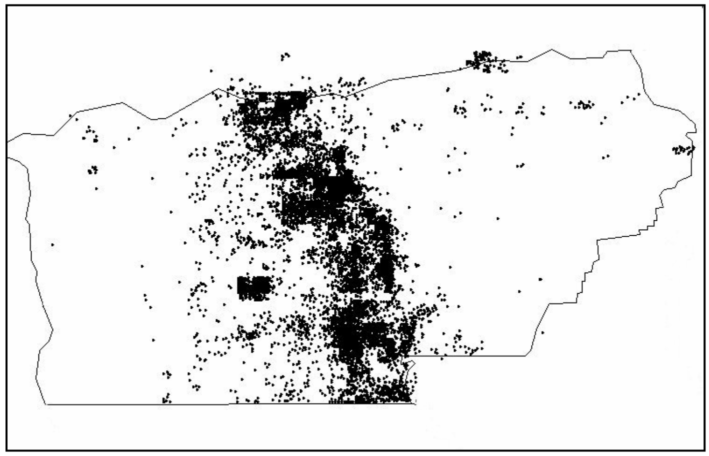
Groundwater Rights

Groundwater use is not governed by the SWRCB. There is no system of groundwater rights except in adjudicated basins, therefore users do not need to apply for groundwater rights before use.

Adjudicated basins occur when the local landowners turn to the courts to decide how to fairly distribute limited groundwater resources. A watermaster is appointed to monitor the basin to ensure that all parties are using the appropriate amounts of groundwater. Several examples of adjudicated basins include the West Coast Basin and Chino Basin, both of which are in Southern California.

Well Distribution

There are over 10,000 wells in Tehama County. The wells are classified by purpose as domestic, irrigation, municipal, monitoring, and other. Figure 4-2 indicates the densities of wells, regardless of type of use, throughout the County. Table 4-4 presents the numbers of wells by type, inventory unit, and inventory sub-unit throughout the county.



Source: Department of Water Resources

Figure 4-2
Distribution of Wells in Tehama County

Table 4-4 and Figure 4-2 were prepared by the DWR on the basis of analysis of information in the Well Completion Report database on file at the DWR. The accuracy of the well-location information varies according to the source of the particular data. Although most locations are correct to within 1 mile (300 feet for monitoring wells) some Well Completion Report data may be in error by up to several miles. Table 4-4 shows that out of 10,354 wells in Tehama County, 7,802 wells are domestic, 1,308 wells are irrigation, 131 are municipal wells, 396 wells are monitoring wells, and 717 are wells listed as other.

Table 4-4
Number of Wells by Use and Area

INVENTORY UNIT	INVENTORY SUB-UNIT	Domestic Wells	Irrigation Wells	Municipal Wells	Monitoring Wells	Other Wells	Totals
Antelope	Antelope Ind.	506	49	6	8	34	603
	City of Red Bluff (49%)	92	8	3	83	19	205
	Los Molinos MWC (27%)	172	55	2	21	10	260
	Totals:	770	112	11	112	63	1,068
Bend	Bend	144	19	0	0	12	175
Bowman	ACID (81%)	191	8	1	0	3	203
	Bowman Ind.	858	25	11	11	14	919
	Rio Alto WD	3	4	2	0	2	11
	Totals:	1,052	37	14	11	19	1,133
Corning East	Action Tree Farm	8	25	0	0	1	34
	City of Corning	61	32	9	36	34	172
	Corning East Ind.	964	408	12	3	136	1,523
	Corning WD	260	139	5	56	65	525
	Kirkwood WD	46	9	0	0	0	55
	Thomes Creek WD (70%)	38	17	0	0	13	68
	Totals:	1,377	630	26	95	249	2,377
Corning West	Corning West	60	14	1	0	14	89
Dye Creek	Dye Creek ID	6	2	0	0	4	12
	Los Molinos MWC (39%)	308	48	2	0	19	377
	Totals:	314	50	2	0	23	389
Los Molinos	Los Molinos Ind.	21	9	2	3	3	38
	Los Molinos MWC (34%)	274	23	4	3	32	336
	SVIC (18%)	8	6	0	2	12	28
	Totals:	303	38	6	8	47	402
Red Bluff East	City of Red Bluff (51%)	76	6	13	106	16	217
	El Camino WD	224	58	0	0	24	306
	Elder Creek WD	52	27	0	0	6	85
	Proberta WD	31	15	0	0	4	50
	Rawson WD	79	9	1	0	1	90
	Red Bluff East Ind.	662	127	20	19	69	897
	Thomes Creek WD (30%)	13	12	2	0	2	29
	Totals:	1,137	254	36	125	122	1,674
Red Bluff West	Rancho Tehama	608	6	1	0	19	634
	Red Bluff West Ind.	1,511	57	6	23	42	1,639
	Totals:	2,119	63	7	23	61	2,273
Rosewood	ACID (19%)	31	8	1	5	3	48
	Rosewood Ind.	165	5	0	0	31	201
	Totals:	196	13	1	5	34	249
South Battle Creeek	S. Battle Creek	12	5	0	0	0	17
Vina	Deer Creek ID	23	8	0	5	7	43
	SVIC (82%)	64	31	3	0	27	125
	Vina Ind.	28	27	1	4	6	66
	Totals:	115	66	4	9	40	234
West Mtn.	West Mountain Ind.	85	2	7	0	18	112
East Mtn.	Mineral	1	0	6	8	2	17
	East Mountain Ind.	117	5	10	0	13	145
	Totals:	118	5	16	8	15	162
	TOTAL FOR REDDING GW BASIN REGION	1,260	55	15	16	53	1,399
	TOTAL SAC. VALLEY GW BASIN REGION	6,339	1,246	93	372	631	8,681
	TOTAL FOR ENTIRE VALLEY	7,599	1,301	108	388	684	10,080
	TOTAL FOR TEHAMA COUNTY	7,802	1,308	131	396	717	10,354
Split Areas	ACID SIU (100%)	222	16	2	5	6	251
	City of Red Bluff SIU (100%)	168	14	16	189	35	422
	Los Molinos MWC SIU (100%)	754	126	8	24	61	973
	SVIC SIU (100%)	72	37	3	2	39	153
	Thomes Creek SIU (100%)	51	29	2	0	15	97

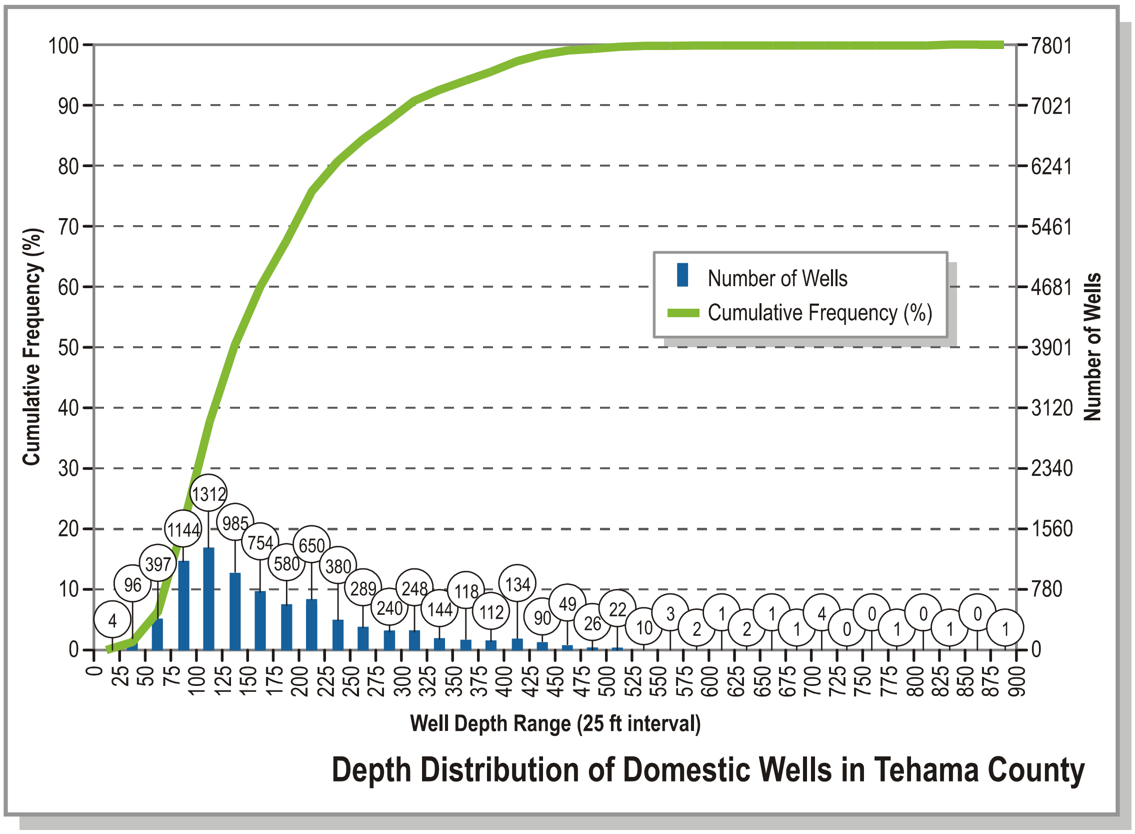
NOTE: "Municipal Wells" include wells listed as industrial, municipal, and/or public. "Other Wells" include wells listed as abandoned, exploratory, other, stock, test unknown, unused, or no info.

Source: Department of Water Resources

Well Depths

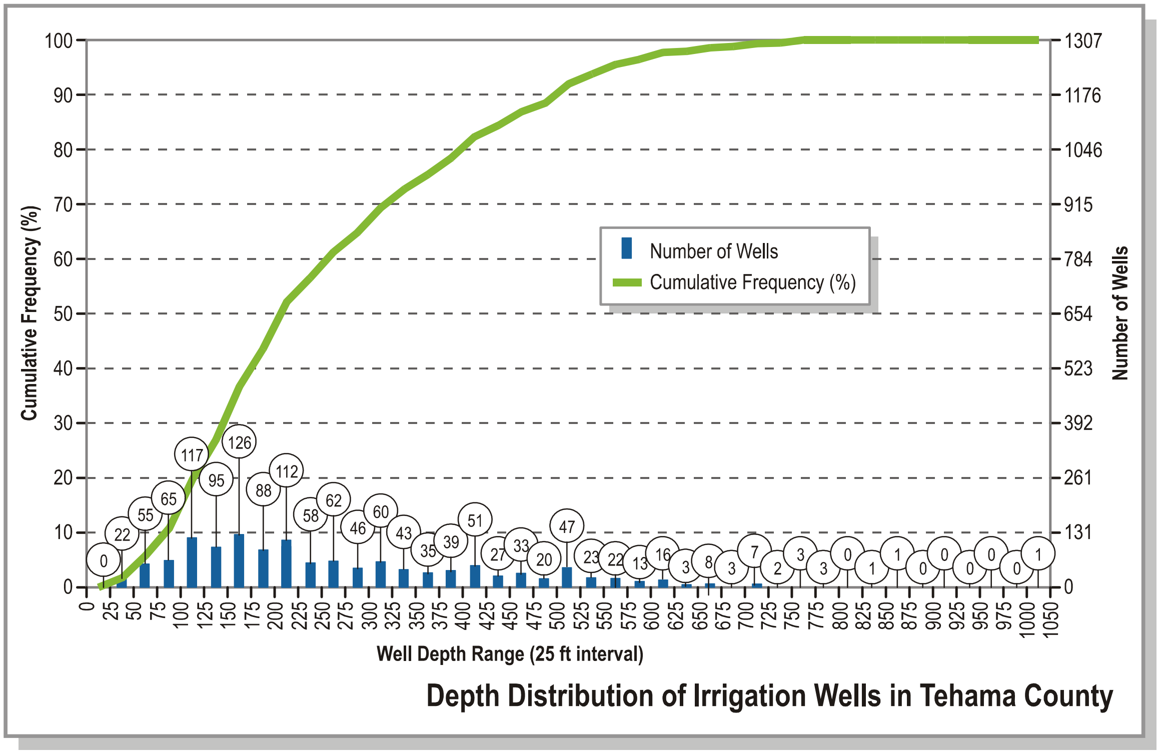
Well depth and well use data were developed by DWR Northern District from Well Completion Reports filed with the DWR. A total of approximately 10,400 well records having depth data were evaluated and classified into four well-type categories: domestic, irrigation, municipal/industrial, and monitoring. The statistical distribution of the well-depth data was evaluated though a series of cumulative frequency distribution curves for each well-type category. Figures 4-3 through 4-5 present the well depth range and cumulative frequency depth distribution for domestic, irrigation, and municipal/industrial wells in Tehama County.

The cumulative frequency distribution of well depth data for Tehama County domestic wells indicates that 50 percent or less of domestic wells are completed to a depth of between 125 – 149 feet or less, indicating water sources with an adequate supply and adequate water quality for domestic use is generally available from the shallow aquifer system.



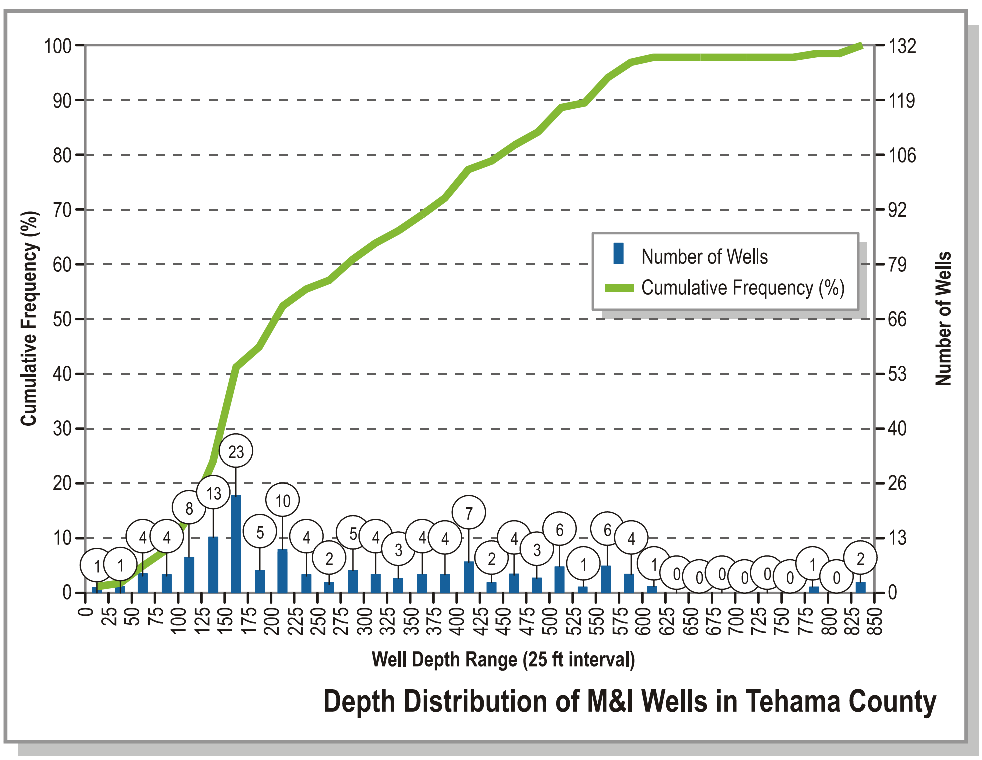
Source: Department of Water Resources

Figure 4-3
Depth Distribution of Domestic Wells in Tehama County



Source: Department of Water Resources

Figure 4-4
Depth Distribution of Irrigation Wells in Tehama County



Source: Department of Water Resources

Figure 4-5
Depth Distribution of Municipal / Industrial Wells in Tehama County

Groundwater Response to Extraction

Figure 4-6 (at the end of the chapter) is a groundwater contour map showing the seasonal change in groundwater levels between the spring and summer 2000. The contour lines in Figure 4-6 represents lines of equal groundwater change, between the spring and summer measurement periods. Figure 4-6 shows that the seasonal groundwater level fluctuation for a normal year in the Sacramento Valley region of Tehama County ranges from 0 to -45 feet. The areas of greatest groundwater decline are those where extraction of groundwater for agricultural and or municipal uses occurs during the summer months. These areas include portions of the El Camino Irrigation District, the Elder Creek Water District, and the Aaction Tree Farm, the area southeast of Corning, and the area west of Proberta Water District.

4.2 Description of Water Management within Inventory Units and Sub-units

The following sections briefly describe each Inventory Unit, which provides a setting for a more detailed discussion of the Inventory Sub-units. Figure 4-7 shows the Inventory units within the County. Mountain Region West and Mountain Region East account for approximately two-thirds of the county acreage. The middle third of the county represents lands overlying groundwater basins and is divided into regions along groundwater basin boundaries.

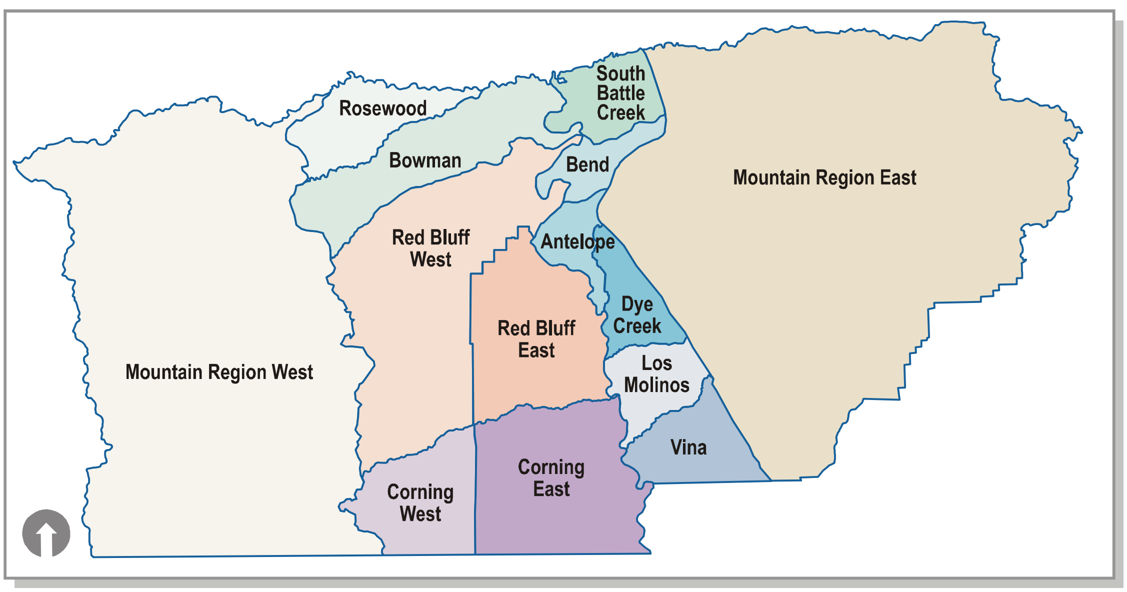


Figure 4-7
Tehama County Inventory Units

Many of the Inventory Units have been further divided into Inventory Sub-units based primarily on political boundaries, of which many represent irrigation or water districts. There are similarities and differences between the Inventory Sub-units regarding water source, land uses, management practices, and key issues and concerns. Table 4-5 summarizes the type of water supplier (urban or agricultural) and the major water source. Some users within the Inventory Sub-unit could use an alternative source; however, Table 4-5 identifies the primary water source distributed by the District. Mixed sources include both surface water and groundwater, though surface water is the larger source.

Table 4-5
Summary of Water Supplier and Water Source

Inventory Sub-unit	Municipal	Agricultural	Groundwater	Surface Water	Mixed Source
City of Red Bluff	X		X		
Proberta Water District		X		X	
El Camino Irrigation District		X	X		
Thomes Creek Water District		X		X	
City of Tehama*	X		X		
Gerber-Las Flores CSD*	X		X		
City of Corning	X		X		
Corning Water District		X		X	
Stanford Vina Ranch Irrigation Company		X			X
Deer Creek Irrigation District		X			X
Los Molinos MWC		X		X	
Rio Alto Water District	X				X
Anderson Cottonwood Irrigation District		X		X	
Mineral County Water District	X				X
Golden Meadows Estates CSD*	X		X		
Los Molinos CSD*	X		X		
Thomes Creek Water Users Association*		X		X	

* Denotes an organized area interviewed, but not an Inventory Sub-unit.

Further details about each Inventory Sub-unit are included in the following sections. Unless otherwise noted, data presented on the Inventory Sub-units was collected during the interview process. Every attempt was made to provide consistent descriptions of the Inventory units and sub-units. However, the following descriptions vary somewhat based on the availability of information. Section 5 contains specific data on water supply and demand in each Inventory Unit.

4.2.1 Red Bluff East Inventory Unit

The Red Bluff East Inventory Unit includes 985,000 acres in central Tehama County, as shown in Figure 4-8. It is bordered by the Sacramento River to the east and Thomes Creek to the south. Red Bluff East contains the urban areas of Red Bluff, Gerber, and Tehama. The primary crop types in the region are pasture and orchard. The majority of the Inventory Unit uses groundwater. This Inventory Unit includes the City of Red Bluff, Proberta Water District, El Camino Irrigation District, Thomes Creek Water District, and Elder Creek Inventory Sub-units as shown on Figure 4-9.

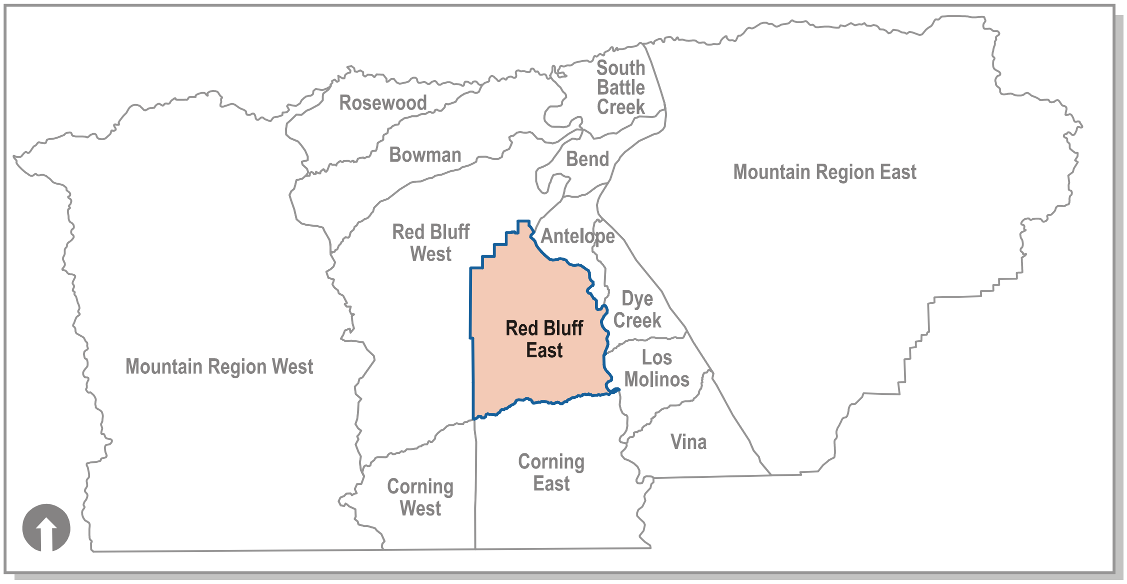


Figure 4-8
Red Bluff East Inventory Unit

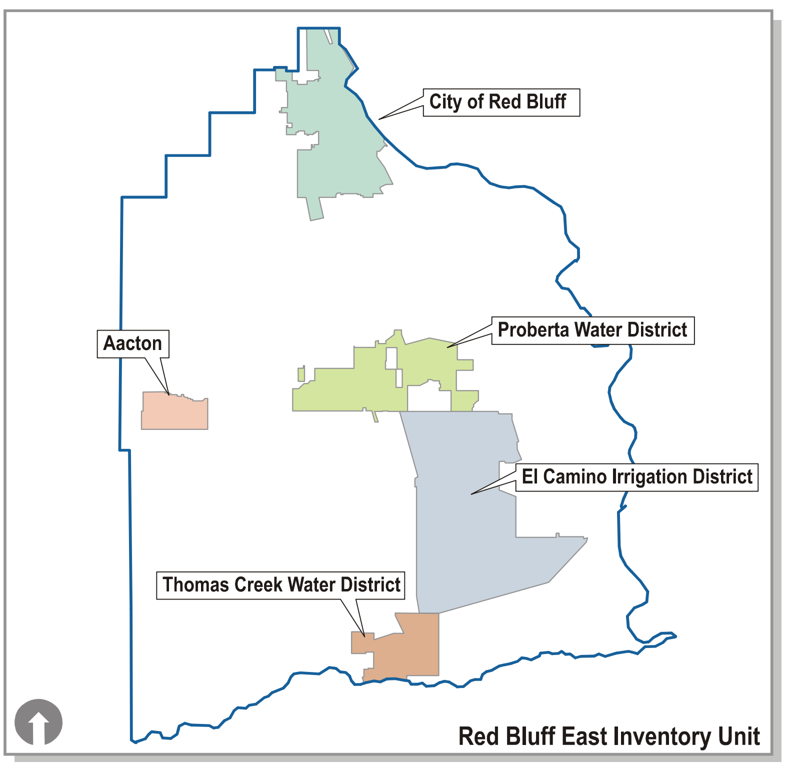


Figure 4-9
Sub-units within Red Bluff East Inventory Unit

City of Red Bluff Inventory Sub-unit

The City of Red Bluff began servicing water customers with groundwater in 1921. Prior to 1921, Sacramento River water supplied the City. Antelope Creek was used as an additional supply source until 1962. Currently, the City relies on groundwater from 14 wells and a 3 million gallon storage tank used for equalizing storage, fire flow, and emergency storage. A second storage tank, similar to the first, is planned; the City is seeking funding and construction is anticipated in the near future. The City of Red Bluff provides water and wastewater services to users within its City limits, as well as water services to the County. (See Figure 4-9 for District location.)

The district serves just over 7.5 square miles including 13,000 people and 4,000 connections. A total of 90 percent of water delivered is within City limits; 10 percent of water delivered is to County land (mostly the County Fairgrounds). The City also delivers 6 million gallons per year of reclaimed water for Caltrans landscaping.

The City of Red Bluff pumps groundwater from 14 City wells. (See Table 4-6 for well locations.) The wells produce between 500 gallons per minute and 2,500 gallons per minute (gpm); however, the majority of the wells produce between 800 and 1,000 gpm. Well levels range from 150 to 250 feet. Seasonally, water levels drop approximately 10 to 20 feet; and, the City does not consider this amount substantial. The water from all 14 wells, except well #13, is of good quality and is not treated. In 2001, tests from well #13 indicated high concentrations of iron and manganese. Bacteriological tests showed a presence of iron bacteria on the well casing. The well is now cleaned on a 5-year cycle.

Table 4-6
City of Red Bluff Well Locations

Well #	*Location*
1, 2, 3, 5, and 7	Central Red Bluff, west of the Sacramento River
4 and 14	High school pressure zone.
6	The most southern well, located in the Hospital pressure zone.
8	Between Reeds Creek and Brickyard Creek.
9, 11, and 12	Southern end of Red Bluff, south of Reeds Creek.
10	Central Red Bluff, east of the Sacramento River and East Sand Slough
13	Antelope School

Average per capita water use in 2000 was 311 gallons per day (gpd). A total of 80 percent of users are metered (including City facilities). The City expects to be fully metered in the next couple of years. The City believes they have minimal losses in their distribution system. In the fall of 2003, a new monitoring system (SCADA) will come online. Completion of metering and the SCADA system will locate losses, if any, that may exist. The City publishes best management practices for water conservation to encourage the public to reduce their water consumption. Additionally, the City conducts routine inspection looking for water wasters; otherwise, no formal conservation measures in place.

The majority of water customers do not have septic systems. Septic systems serve City properties east of, and up to, Payne's Creek Slough along Antelope Blvd. The City of Red Bluff discharges tertiary treated wastewater into the Sacramento River at approximately 1.7 million gallons per day (mgd).

The City of Red Bluff believes key issues that are essential for successful management of the district include awareness, understanding, and continued management of the following:

- Growth: Growth in the infill areas would most likely be commercial and would require additional infrastructure and fire protection. Upgrading the distribution system would be necessary to keep up with growth.

- Knowledge: Gain knowledge of the groundwater basin to evaluate the viability for storage and recharge.

- Supply: Is there enough water available to serve agricultural needs? The City does not object to water flowing downstream as long as local needs are met and there are reserves for dry years.

- Quality: Need to protect the quality of the groundwater to avoid the need for treatment. If treatment were required, there would be an increase in cost to produce quality water.

- Red Bluff diversion dam: The City would like the gates of the Red Bluff diversion dam closed during summer months to keep recreation opportunities on the lake. If the gates are open during summer months the boat ramps are dry. During the winter, the City believes the gates should be open to provide benefit for Reeds Creek; predominantly to provide for sediment flushing of the creek.

Proberta Water District Inventory Sub-unit

The following information is from the *Foundation for Development of a Comprehensive Water Management Plan*, Bookman – Edmonston Engineering, Inc., 1999.

CVP supplies to Proberta Water District began in 1961 with an entitlement of 5,500 acre-feet. A permanent transfer of 2,000 acre-feet to the Department of the Interior was made in 1998. The transfer has given the District revenue and the ability to lower customer cost for CVP supply. Proberta Water District currently has a CVP contract entitlement of 3,500 acre-feet, although average CVP delivery could be less depending on water year type. For example, in 1977, the CVP allocation for Proberta Water District was 25 percent of the full entitlement. Seasonal limitations also occur because of environmental concerns between September 15th and May 15th. Water is diverted from the Sacramento River at the Red Bluff Diversion Dam and conveyed through the Corning Canal. CVP water is delivered to farms in pipeline distribution systems; therefore, conveyance losses are minimal to none. (See Figure 4-9 for District location.)

Groundwater pumping utilizes the deeper aquifer zones. Percolation of groundwater would recharge the upper aquifer only; therefore, additional application of CVP water beyond crop needs would not serve to replenish groundwater supplies or change the groundwater basin yield. Seasonal variations in groundwater depth generally range from 10 to 25 feet.

El Camino Irrigation District Inventory Sub-unit

El Camino Irrigation District formed in 1921 to provide water for irrigation and domestic needs and uses. In 1927, the District purchased wells, a distribution system, water rights, and easements from California Tehama Land Corporation. The water rights were adjudicated in 1969. The District encompasses 7,450 acres, however it only has the infrastructure to serve 5,500 acres. (See Figure 4-9 for District location.)

The District also has two ponds for storage purposes with a total capacity of 10 acre-feet, however neither pond is currently in use. The District plans to use the ponds to store excess water pumped during off-peak power times. The District provides groundwater from 27 of 39 wells. The volume of groundwater produced is measured at the point of delivery using flumes based on miner's inches.

Most irrigation in the District is flood irrigation. The District delivers all water through a low-head pipe delivery system. The District estimates approximately 10 percent conveyance losses, mainly from leaks at pipe connections. The District requires growers have a permit to use drip irrigation or micro sprinklers. Approximately 500 to 600 acres within the District are irrigated through drip irrigation. There are little return flows; although some users have catchment ponds or pump back facilities.

The District expressed several concerns regarding local water resource issues. The District is concerned about neighboring groundwater extraction, groundwater level drawdown, and water being exported out of the County. The District hopes to maintain aquifer water levels so that there are no negative financial effects. The District also identified the need to slow conversion and keep agricultural lands within the land base.

With additional funding, the District would upgrade infrastructure, specifically for leak prevention, storage, metering, and well improvements. The District has an AB 3030 plan and has signed an MOU with the FCWCD to coordinate with the County AB 3030 plan.

Thomes Creek Water District Inventory Sub-unit

The Thomes Creek Water District has served its customers since the late 1950s. The District encompasses 1,824 acres; however, in 2003, only 1,335 acres were irrigated with CVP surface water from the District. Major crop types include pasture, alfalfa, almonds, oats, and oat hay. (See Figure 4-9 for District location.)

The District provides surface water to just four landowners. The landowners own the water distribution system; therefore, the District only supplies the water and does not perform any maintenance or construction on the system. Two landowners have previously left the District and sold their allocation of 2,000 acre-feet water to Reclamation for environmental uses. The District has a remaining CVP allocation of 6,400 acre-feet received from the Corning Canal. The District has seen a small trend towards increased surface water use because of the low cost of water and increase of land in production.

Between May 15th and September 15th water is available from the Corning Canal at anytime with 24-hour notice. During this time period, the District's water supply is sufficient, even during drought years. The Canal used to be drained in the wintertime; however, frost concerns have necessitated water availability throughout the winter. Therefore, the Canal is no longer drained during winter, though water levels in the canal are lowered from September 15th through May 15th, relative to the irrigation season. This timeframe corresponds to the time when the Red Bluff Diversion Dam gates are open and the Research pumping plant has a maximum capacity of 400 cfs. Conveyance system losses could occur through unlined canals, but no monitoring exists and any losses are not quantified.

The District practices several water conservation measures. A tailwater recovery system is in place. Water applied on the western portion of the District flows through canals, is collected in small reservoirs, and is directed to the eastern portion of the District. Remaining return flows enter Thomes Creek after leaving the eastern boundary of the District. Additionally, sprinklers irrigate 266 acres, and 100 acres are drip irrigated. These irrigation methods are less water intensive compared to flood irrigation. Several canals are also lined.

The District has some concerns about water supply availability and reliability, specifically when canal water levels are lowered. Low water levels from September 15th through May 15th could cause a decrease in crop productivity especially in a dry year if groundwater is not used to supplement the surface water supply. The District is also concerned about its potential ability to obtain external funding. Because the landowners own the water distribution system, it is difficult to use public funds for improvements to private systems.

City of Tehama Inventory Sub-unit

Although not classified as an Inventory Sub-unit, City of Tehama is discussed because water users are represented by an organized group that manages their water.

The City's early distribution system dates back to 1915, and included one well and a water tower. Prior to 1915, residents used Sacramento River water. In 1971, a second well was added. The original well was abandoned in 1991 because of contamination; the second well was pumped dry in 2002 and also abandoned. The water tower failed to meet Occupational Safety and Health Administration (OSHA) standards and has since been abandoned.

The City of Tehama supplies water services to residential and commercial/public users within the City limits, including a post office, museum, mini-mart, and Headstart school. All residents of the City of Tehama have septic tanks and there are no wastewater treatment services. In 2002, the population was 430 and the City supplied water to approximately 200 households.

Currently, all water delivered from the City to its customers is groundwater from two wells: Well No. 3 and Well No. 4. Well No. 3, drilled in 1994, is on 4th Street between B and C Streets. Well No. 4, drilled in 2002, is on 4th Street and G Street and can pump in excess of 2,000 gpm. The City has also upgraded to pressurized tanks, 6-inch lines, and fire hydrants to supply required fire flow. The City has not had problems with its current groundwater supply; even during drought years, supply has been available.

The City believes there could be substantial conveyance system losses. Because of the soil type, water lost quickly percolates and may not be discovered until maintenance activities are undertaken. Meters have been installed and should help reveal any water leaks in the future. The City estimated per capita water use from kilowatt per hour (kwh) used and the number of gallons pumped. It was estimated that each resident uses approximately 362 gpd; however, the City believes this number is actually much lower. Conveyance losses could account for the high reported usage. There is greater water usage in the summer; water meters installed in fall 2002 will provide further data.

Water conservation by customers is voluntary. The City of Tehama posts notices, especially during drought years, to promote conservation.

There have been no concerns about the quality of water supplied by the City. The groundwater is treated with chlorine.

The City is concerned with continuing to supply quality water at an affordable cost. State water quality testing requirements and upgrades to the system are expensive. The City of Tehama, Los Molinos, and Gerber are considering combining resources to share expenses, particularly the cost of equipment and labor. If external money were received, the City would replace laterals and the old 6-inch pipes, which are brittle asbestos and are at risk of cracking because of ground vibrations.

Gerber-Las Flores Community Services District

Although not classified as an Inventory Sub-unit, Gerber-Las Flores Community Services District is discussed because water users are represented by an organized group that manages their water.

The water distribution system in Gerber was installed in 1910 and operated by a private group until 1999. The system was leaking, undersized, and needed repair. In the 1970s, the town tried to buy the system. They succeeded in 1999, when they received grants and loans to purchase the water agency and install a completely new distribution system (except one 18" line along San Benito Ave.). The rehabilitation took approximately one year.

Gerber-Las Flores Community Service District (CSD) provides water and wastewater services to the urban area of Gerber, and wastewater services to Las Flores. Patterson Enterprises, a privately owned company, provides groundwater supplies to Las Flores. The CSD has 416 water connections in Gerber and 486 wastewater connections in Gerber and Las Flores. Gerber and Los Flores have small growth rates, less than one percent per year. There have been two attempts to build on the agricultural land surrounding the towns, but residents of Gerber defeated these propositions because the land is prime agricultural land.

Gerber-Las Flores CSD pumps water from three wells for domestic use, and has one additional well for irrigation supply. The three domestic wells are: Well #4 on the south end of Gerber, Well #5 near the center of Gerber, and Well #3 north of Gerber. The irrigation well is in the northeast corner of the wastewater treatment plant property. Discharge from the wastewater plant is used to irrigate crops on the plant site, and the irrigation well is used for backup if the wastewater is not adequate for irrigation. Water production records are only available for the time that the town has owned the supply system (2000-2002). Table 4-7 lists these records.

Table 4-7
Water Production (in gallons)

	2000	***2001***	***2002***
January	5,089,950	5,669,800	5,088,600
February	4,273,599	4,645,500	4,527,000
March	5,065,947	5,961,500	5,733,700
April	7,967,101	8,397,900	9,340,900
May	10,705,210	17,448,400	15,371,900
June	20,102,932	19,386,100	19,343,600
July	22,780,900	22,085,000	23,012,100
August	22,290,600	21,407,000	20,874,100
September	14,628,733	15,458,200	14,514,600
October	10,480,466	12,617,600	10,999,900
November	5,738,200	5,313,400	
December	5,282,900	5,958,800	

Conveyance losses in the system are minimal, mainly because it is so new. All homes and businesses are metered, which allows for leak detection. The CSD estimates that use calculated as a yearly average is approximately 300 gallons per household equivalent per day.

The Department of Health Services conducted a water quality source assessment and found that the quality was generally good. The Department was concerned about washing construction equipment or railroad operations, but these facilities are not currently in use. It is possible that past railroad operations could cause future water quality concerns, but there are no known areas of contamination. The CSD treated water supplies with chlorine for the first six months of operation, but has not needed to treat water since then.

The wastewater district was created in 1990 as a response to the 1983 floods. The town has an 18-foot elevation change from one end to another, with a slough on the lower end. In 1983, the septic systems failed and the slough had a layer of raw sewage on top of the water. The RWQCB required the towns to impose a building moratorium until they constructed a sanitary sewer to treat all wastewater.

Table 4-8 shows the amount of sewage collected by the CSD.

Table 4-8
Sewage Collection (in millions of gallons)

	1998	1999	2000	2001	2002
January	N/A	3	0	3.5	3.5
February	N/A	2.9	2.7	3	3.4
March	N/A	3.3	3.4	3.2	3.4
April	N/A	3	3	3.2	3.4
May	N/A	3	3.1	3.3	3.3
June	N/A	2.9	3.4	3.1	3.7
July	2.2	N/A	3.8	3.2	3.5
August	2.2	N/A	3.6	3.7	3.7
September	3.1	N/A	3.7	3.2	3.4
October	3.4	N/A	3.9	3.4	3.7
November	3.2	N/A	3.4	3.5	
December	3.2	N/A	3.4	3.3	
TOTAL			37.4	39.6	

N/A indicates months where flow meter problems prevented readings.

Gerber-Las Flores does not discharge any wastewater. During the winter, the water goes into two collection ponds (15 million gallons and 21 million gallons) to be stored until the irrigation season. The amount of water stored during the winter varies by water year type, with the ponds additionally filling ½ to 1 inch per day from rain. During the summer, this water is used to irrigate 38 acres of crops (strawberry clover and others) on the wastewater site. The evaporation from the ponds during the summer is greater than the treated wastewater inflow. The CSD does not have a discharge permit.

The CSD has several concerns regarding continued management of their water. The greatest concern is that pumping groundwater for transfers to other areas may affect local groundwater. The area's groundwater levels are assumed to be stable now, except for declines during drought years. Additional changes in groundwater levels could affect District supplies. The CSD is also concerned about the potential for new water quality issues in its wells. CSD employees are concerned about the rising costs associated with testing and permitting small systems. The District's wastewater permit has increased from $1200 per year to $2700 per year. The CSD Board is divided on the issue of metering the water users. They have decided to study meters for a year, and examine ways to structure rates. The CSD reads the water meters, but rates are not currently determined by meter readings.

The CSD has a new delivery system, so it does not have many immediate needs. The District is interested in extending a water line to install fire hydrants.

Elder Creek Water District Inventory Sub-unit

An interview was not conducted with the Elder Creek WD. This information is derived from the inventory analysis. The Elder Creek WD is in the center of the Red Bluff East Inventory Unit. The WD uses only groundwater to serve its agricultural customers. Pasture is the major crop in the WD. Limited acreages of olives, rice and other field crops are also grown within the WD. Unlined portions of the Corning Canal travel through the WD, which contributes to groundwater percolation. The WD reuses approximately 50 percent of percolated water.

Red Bluff East Independent Inventory Sub-unit

An interview was not conducted with the independent groundwater users in Red Bluff East. This information is derived from the inventory analysis. Independent users in Red Bluff East use groundwater to serve agricultural needs. Major crops grown in the area include orchards, pasture and a variety of field crops. Red Bluff East Independent also includes about 4,900 M& I users, which also rely on groundwater. Approximately 20 percent of groundwater used percolates back into the soil and is reused by the water users.

4.2.2 Red Bluff West Inventory Unit

The Red Bluff West Inventory Unit includes 1,900,000 acres in central Tehama County, as shown in Figure 4-10.

Red Bluff West contains the Rancho Tehama Reserve and is bordered to the south by Thomes Creek. Pasture and orchard are the primary crop types in the region, and the majority of the inventory unit uses groundwater. Figure 4-11 shows this inventory unit.

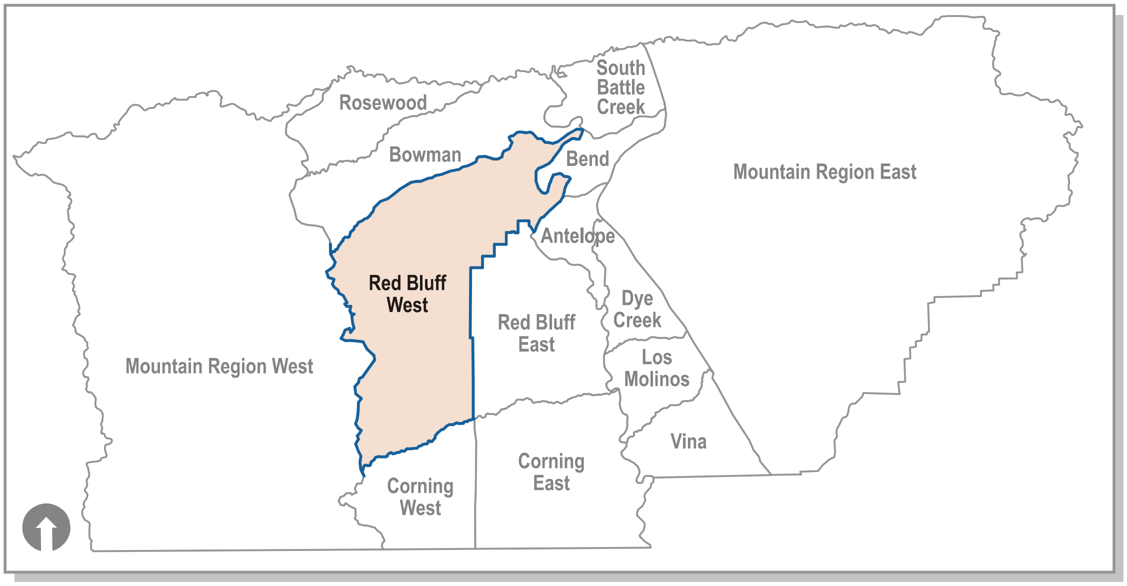


Figure 4-10
Red Bluff West Inventory Unit

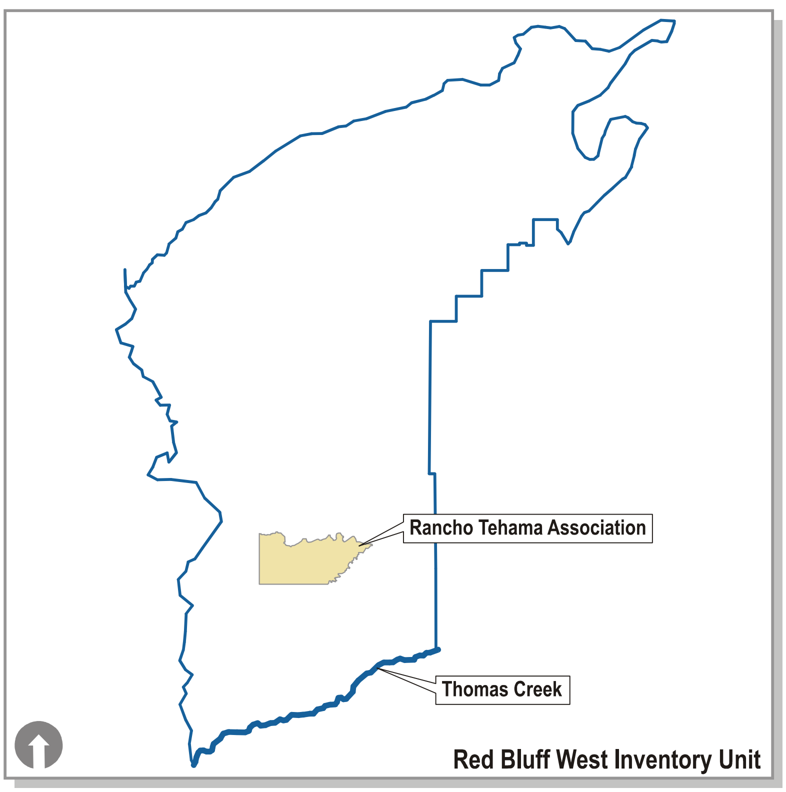


Figure 4-11
Sub-units within Red Bluff West Inventory Unit

Rancho Tehama Reserve Inventory Sub-unit

The following information is from "Groundwater Resource Evaluation of the West-Side Upland Area: Sacramento Valley."

The Rancho Tehama Reserve (RTR), established in 1969, is a planned development subdivision, operated by an incorporated owners association. The RTR covers an area of approximately 6.3 square miles and is approximately 18 miles southwest of the City of Red Bluff. Figure 4-11 shows the location of RTR.

Virtually all of the water used at RTR is supplied by groundwater. Groundwater is extracted to meet domestic and municipal requirements. Agricultural use of groundwater (livestock, crops, etc.) is not substantial. Domestic wells are individually owned and are driven by small capacity pumps producing approximately 15 to 100 gpm. Municipal wells are used primarily for pumping to maintain water levels in several reservoirs that serve as a source of fire protection.

Elder Creek, RTR's northern boundary, contributes significantly to groundwater recharge. In the winter months, flows from Elder Creek help recharge the aquifers; the creek is dry during the summer months. The timing and duration of the no-flow period varies depending on the yearly precipitation.

Golden Meadows Estates Community Services District

Although not classified as an Inventory Sub-unit, Golden Meadows Estates CSD is discussed because water users are represented by an organized group that manages their water.

Golden Meadows Estates CSD provides water to a subdivision west of Red Bluff. (From I-5, proceed west on Highway 36 for approximately 3 miles, turn right on McCoy, and the subdivision is on the right.) Golden Meadows Estates CSD encompasses approximately 25 acres, and currently has 25 household hookups, although 53 total hookups will be possible when the subdivision is complete.

The homes within the subdivision are on septic systems; therefore, there is no need for wastewater treatment services. Water is provided to residents from three groundwater wells. Two of these wells are typically artesian for six months of the year. Most household connections are not metered, and the CSD charges all customers a flat rate. Some connections are metered, but the CSD does not read the meters unless they are concerned that a customer is wasting water.

The CSD does not implement specific water conservation measures, but management consults customers observed wasting water. Seasonal variation in water use occurs at Golden Meadows Estates; customers typically use double the amount of water during summer, relative to winter use.

The quality of groundwater supplied by the CSD is good. The CSD has the capability to chlorinate the groundwater, but the groundwater does not require chlorination. The CSD does not have major water supply concerns because of the adequate supply of high-quality groundwater. The testing requirements for groundwater, however, are expensive. For example, typical testing bills of $300 increased to more than $2,500.

Thomes Creek Water Users Association

Although not classified as an Inventory Sub-unit, Thomes Creek Water Users Association (WUA) is discussed because an organized group that manages their water represents its water users.

Thomes Creek WUA, originally called "Thomes Creek Irrigation and Improvement Company," first claimed water from Thomes Creek in 1891. The name changed to Thomes Creek Water Users Association in the 1960s. Before 1962, the landowners did not have a written agreement stating how they would operate the system. A 1962 agreement formalized the current WUA boundaries, and established a maximum amount of water for each landowner based on water usage up to 1962. In 1962, the WUA provided irrigation water for 462 acres.

The Thomes Creek WUA supplies surface water primarily for agricultural uses; however, the water notice allows domestic uses, including lawn irrigation. The WUA currently encompasses 1,099 acres of land, with approximately half of those acres receiving water from the surface water system. The majority of the land within the WUA boundaries is irrigated pasture. Other crops include: alfalfa, wheat, olives, and almonds. Historically, rice was planted, but currently rice is not in production.

Thomes Creek WUA diverts surface water from Thomes Creek into a ditch system to provide water to landowners. Thomes Creek has no upstream storage, so the flow is dependent on rainfall and snowmelt runoff from the upstream watershed. Thomes Creek does not have water year-round; the flow stops in different months depending on the water year type. In the past, the WUA received water through October (in 1992), September (in 1993), and August (in 1994). Typically, the WUA starts diverting water at the beginning of April, and has a reliable supply through the beginning of August.

The WUA does not have a gauge at the diversion location, and it is not certain as to the diversion amounts. As a general estimate, the canal diverts 70 to 100 cfs. The water notice claims 10,000 miners' inches, but the WUA does not use the complete amount. The WUA typically operates the system (6 miles of unlined ditches) to maintain water with no return flow to the creek. Early in the irrigation season, however, there are times that the ditch system overflows. The system does not have a constructed overflow, so the water runs over land and back into the creek. The WUA does not measure these flows nor does it have an estimate of conveyance losses.

Some landowners within the district use only groundwater, but even those that receive surface water have groundwater wells as a backup supply. The WUA does not monitor groundwater, but the landowners notice a seasonal change in groundwater levels after Thomes Creek dries up. Also, they have noticed that in the past three years, some landowners have had to lower domestic wells or agricultural wells because water levels have decreased.

The WUA has pre-1914 water rights to divert water from Thomes Creek. There are not any storage facilities for the additional water. The WUA also is not currently involved in, or considering, any water transfers. Landowners within the WUA use water primarily for agriculture. The WUA, however, does not have estimates of irrigation efficiency, crop evapotranspiration, or deep percolation. Landowners do not currently provide water for environmental uses, such as water for managed wetlands or for fishponds. One landowner, however, does have an inactive fishpond.

The WUA does not have any official positions on water resources issues or concerns. Management and customers, however, expressed personal concerns about groundwater uses, including increased use within the County and sales to parties outside of the County. Increased use within the County has caused groundwater level declines in the south area (west of the Sacramento River); and, sales to outside parties could exacerbate these conditions.

The WUA recommended that the FCWCD implement debris removal from creeks. In the 1940s, 1950s, and 1960s, agencies prevented the buildup of debris in creek beds. Currently, the debris is left in place, and it causes the stream watercourse to change, which could potentially damage personal property. The FCWCD is not responsible for channel maintenance; however, when funding is available, the FCWCD conducts debris removal at various locations throughout the year as a service to the community.

With external funding, the WUA would improve its conveyance system to reduce losses. The original ditch system was constructed in the 1890s, although the WUA has moved the ditch to make it a gravity flow system. The WUA performs regular maintenance, including cleaning the ditch every 5 to 6 years and unclogging culverts. Improvements could help reduce losses and maintenance requirements. The WUA would also like to see increased storage, both within the Sacramento Valley and on Thomes Creek. It recognizes, however, that storage may be prohibitively expensive.

Red Bluff West Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Red Bluff West Inventory Unit. This information is derived from the inventory analysis. The independent users include both agricultural and M&I (municipal and industrial) users. Agricultural users primarily use groundwater, but also use a small amount of surface water from Thomes and Mill Creeks to irrigate pasture. Other crops within the region include walnuts and alfalfa.

Red Bluff West Independent includes approximately 4,400 M&I users. M&I use in Red Bluff West relies completely on groundwater sources. All M&I users have septic systems.

4.2.3 Corning East Inventory Unit

The Corning East Inventory Unit includes 1,200,000 acres in south central Tehama County, as shown in Figure 4-12.

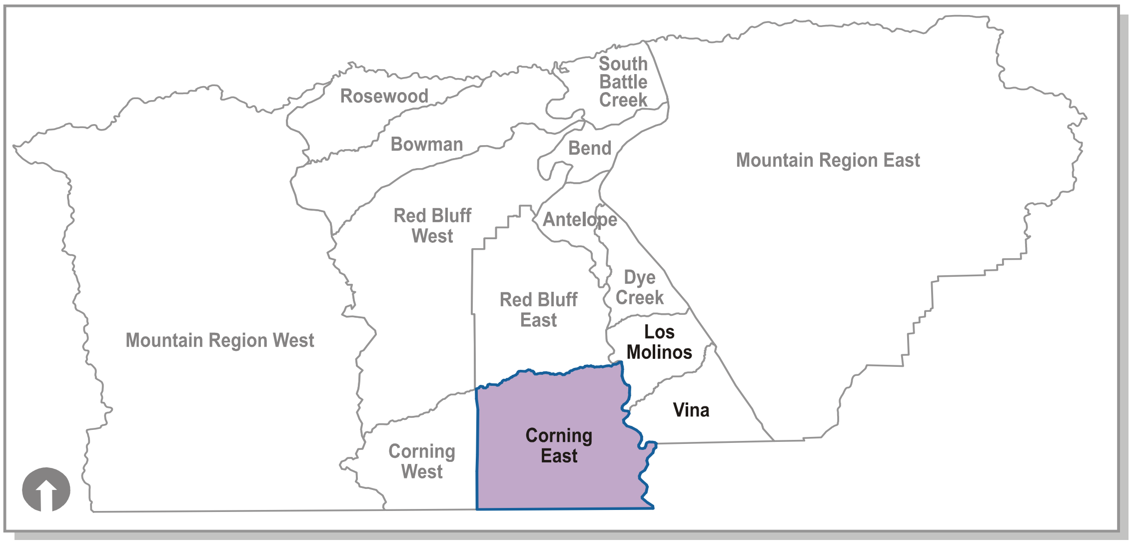


Figure 4-12
Corning East Inventory Unit

The Corning East Inventory Unit is bordered by the Sacramento River to the east, Thomes Creek to the north, and the Tehama – Glenn County border to the south. Corning East contains the City of Corning. The primary crop types in the region are eucalyptus, olives, orchards, and pasture. Both groundwater and surface water is used within the inventory unit. This Inventory Unit includes the City of Corning, Corning Water District, Kirkwood Water District, Aaction Tree Farm, Thomes Creek WD, and Corning East Independent Inventory Sub-units as shown on Figure 4-13.

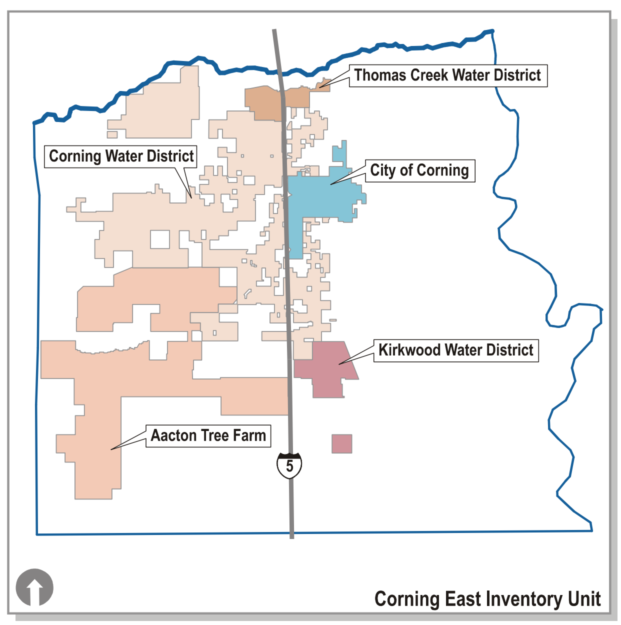


Figure 4-13
Sub-units within Corning East Inventory Unit

City of Corning Inventory Sub-unit

The City of Corning supplies water services to users within the City limits including sewage services to almost all its residents. Approximately 20 residents in outlying areas have septic tanks. In 2002, the population of Corning was approximately 6,800, an increase of 600 people over the past ten years. The City provides water to households, schools, businesses, and several heavy commercial users, including Bell Carter Olives, Petro Truck Stop, Travel Center of America Truck Stop, and Corning Truck and Blue Beacon Truck Washes. The City is expanding its service area in the west, south and southeast directions to accommodate growth.

The City delivers groundwater from seven wells; however, two wells were shut down because of methyl tertiary butyl ether (MTBE) and perchloroethyl (PCE) concerns. The City monitors the wells monthly for standing water level and drawdown and daily for chlorine residual. Monitoring for water quality also occurs twice weekly at seven locations for bacterial and fecal coliform. The City calculates conveyance losses by comparing yearly production to yearly delivery. The majority of losses occur through construction and pumping for required water quality testing. To reduce conveyance losses, the City has replaced 95 percent of the mains since 1999.

All water use in the City is metered. Users pay the initial meter rate for 4,000 gallons, then $0.98 per every 1,000 gallons used thereafter. Water use increases during the summer months. Average per capita daily use ranges from 459 to 499 gallons in June through September; average per capita daily use ranges from 219 to 370 gpd during October through May.

The City adopted a drought management plan in the mid 1990's for water conservation purposes, although the City has not needed to put the plan into effect. The City does not have an urban water management plan. The City expressed concerns of an adequate water supply for the future. The City's current planning horizon is 20 years. The City also hopes to maintain good water quality. With additional funding, the City would upgrade groundwater facilities.

Corning Water District Inventory Sub-unit

In 1958, landowners formed Corning Water District (WD). Prior to this time, the land west of Interstate-5 was not farmed because of a lack of water source. Agriculture in the area mainly consisted of cattle and sheep grazing. In spring of 1963, construction began on the initial phase of a distribution system; and in 1968, the district began delivering water. All landowners within the boundaries paid debt service and operations and maintenance fees for entitlement to water. Approximately 50 percent, however, chose to receive water from the District. (See Figure 4-13 for District location.)

Corning WD provides landowners with surface water from the Corning Canal, which diverts water from the Sacramento River at Red Bluff Diversion Dam. Corning WD has a CVP contract with Reclamation to receive water from the Sacramento River. The original contract was for 25,300 acre-feet per year, but the District sold 2,300 acre-feet to pay debts, and is left with 23,000 acre-feet per year. The Corning WD is a member of the Tehama Colusa Canal Authority, which manages the operations of the Tehama-Colusa and Corning Canals.

Corning WD encompasses about 10,800 acres. Most land within the District is irrigable, but some is Class 6 soil that is generally unsuited for cultivation. The primary crop within the District is olives, with smaller acreages of prunes, walnuts, and irrigated pasture.

Water use within the Corning WD is primarily agricultural. In 2001, landowners used approximately 12,000 acre-feet of water. Demands were largely dependent on agricultural commodity prices, which influence cropping acreages. In 2002, the District transferred 2,000 acre-feet of water to Proberta WD (also on the Corning Canal). Corning WD also provides some water to the Nomlaki tribe for wetlands (190 acre-feet in 2001) and some water for old rice fields that are now seasonal wetlands (290 acre-feet in 2001).

The District expressed several concerns about water supply availability and costs. The drought of 1976-1977 when CVP contract allocations were reduced 75 percent, left many surface water users with concerns about future supply reliability. Increasing fishery concerns at Red Bluff Diversion Dam are also an issue for supply reliability. When the Dam gates are raised in the spring, the Tehama-Colusa and Corning Canals do not receive enough water to supply all users. Corning WD can supplement by diverting water at Stony Creek, but fishery issues now exist there as well.

The District has seen surface water prices increase dramatically, which has caused landowners to convert to groundwater supplies. Historically, the District paid Reclamation $2 per acre-foot, and the farmers paid Corning WD $3.40 per acre-foot (including debt service and operations and maintenance). In 2003, the District pays Reclamation $13 per acre-foot, and charges the farmers $29.75 per acre-foot. Increased groundwater use has resulted in groundwater level declines on the west side of the District, which could further decrease available supplies to landowners.

The increasing cost of water drives efforts for water conservation and water use efficiency. CVP contract renewals require the District to develop a conservation plan. The District is also involved in the Mobile Irrigation Lab project, which aims to help farmers know water requirements of crops to increase water use efficiency on farms. Additionally, the District has a water recovery system that minimizes surface water leaving the District. The entire distribution system consists of pipes; therefore, conveyance losses are minimal. The District, however, has secured a grant for the initial phases of installing a SCADA system, which could be used to monitor for system losses.

Corning WD was concerned that the FCWCD emphasis on groundwater issues could overlook issues of surface water users. For example, the County has historically been concerned about the effects to groundwater from increased fishery protection projects. Corning WD believes the County should try to protect both surface and groundwater users in this scenario.

Kirkwood Water District Inventory Sub-unit

An interview was not conducted with the Kirkwood WD. The following information was derived from the inventory analysis. Kirkwood WD is in the southern portion of the Corning East Inventory unit. (See Figure 4-13 for District location.) Kirkwood WD serves agricultural water users from direct diversions out of the Tehama-Colusa Canal. Crops grown in the Kirkwood WD include pasture, prunes, grain and corn. Kirkwood customers use some groundwater to irrigate pasture, and groundwater runoff is reused on surface water fields. There are no conveyance losses within the WD.

Aaction Tree Farm Inventory Sub-unit

An interview was not conducted with the Aaction Tree Farm. The following information was derived from the inventory analysis. The Aaction Tree Farm is in the southeastern portion of the Corning East Inventory Unit. (See Figure 4-13 for District location.) The Tree Farm uses groundwater to irrigate about 9,000 acres of eucalyptus trees. There is little groundwater percolation; however, the Tree Farm reuses all of its water.

Thomes Creek Water District Inventory Sub-unit

See Red Bluff East Inventory Unit
(See Figure 4-17 for District location.)

Corning East Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Corning East Inventory Unit. This information is derived from the inventory analysis. Corning East Independent is comprised of both agricultural and M&I users. Agriculture is the main water use and is supplied by groundwater and surface water. Groundwater is the major water source for agriculture. Surface water sources include the Sacramento River and the Stony Creek South Canal. Surface water is used to irrigate some pasture and curcurbits in the region. Groundwater is used to irrigate all other crops, the majority being almonds, prunes, olives, walnuts, grain and corn. Corning East Independent M&I users rely fully on groundwater sources. All users are on septic systems.

4.2.4 Corning West Inventory Unit

The Corning West Inventory Unit includes 600,000 acres in south central Tehama County, as shown on Figure 4-14. It is bordered by Thomes Creek to the north and the Tehama – Glenn County border to the south. The primary crop types in the region are pasture and orchard. Although surface water is used along the northern border of the inventory unit (Thomes Creek), groundwater is Corning West's primary water source.

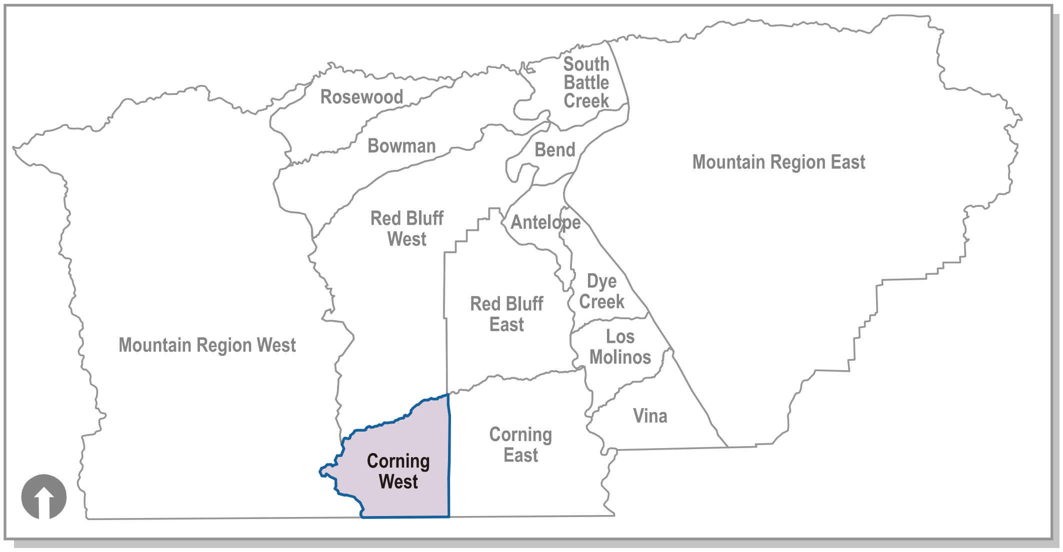


Figure 4-14
Corning West Inventory Unit

4.2.5 Bend Inventory Unit

The Bend Inventory Unit includes 200,000 acres in north central Tehama County, as shown on Figure 4-15.

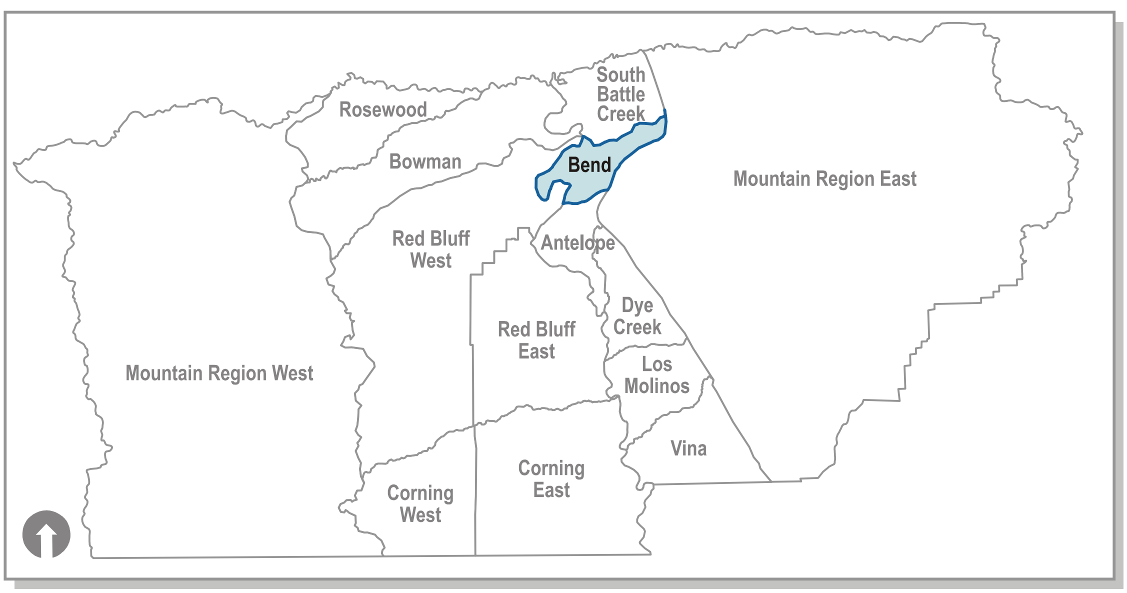


Figure 4-15
Bend Inventory Unit

It is bordered by the Sacramento River to the west and Paynes Creek flows through the northern part of the inventory unit. The Bend Inventory Unit contains the community of Bend. The primary crop types in the region are pasture, orchards, and grains. Local surface water diversions from Paynes Creek are the main water source for the Inventory Unit.

4.2.6 Antelope Inventory Unit

The Antelope Inventory Unit includes 200,000 acres in north central Tehama County, as shown on Figure 4-16.

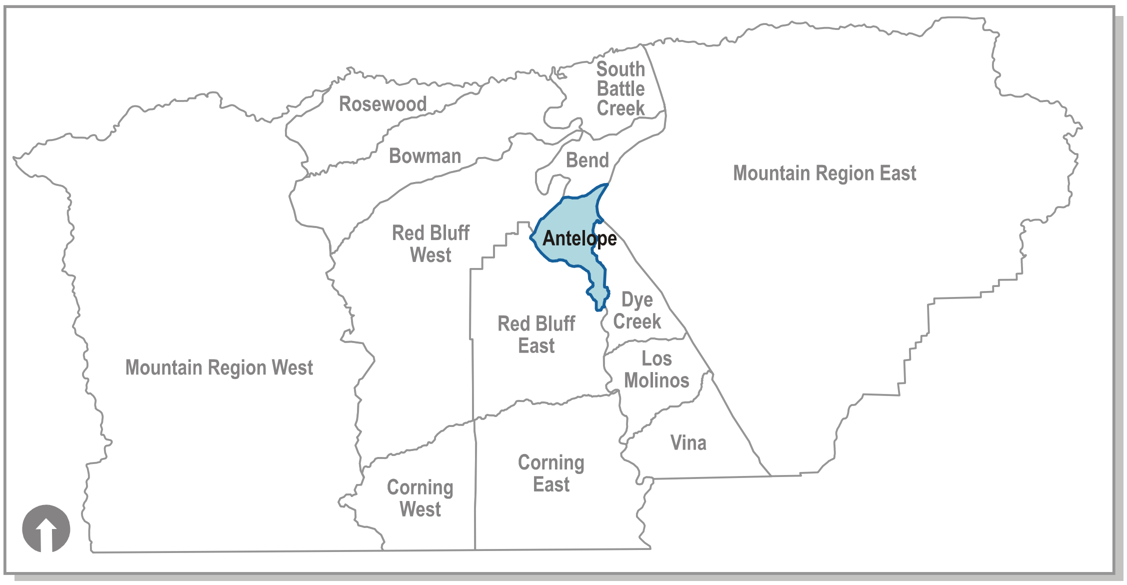


Figure 4-16
Antelope Inventory Unit

It is bordered by the Sacramento River to the west and Antelope Creek flows through the southeastern part of the inventory unit. The Antelope Inventory Unit contains the Community of Dairyville. The primary crop types in the region are orchards and pasture. Groundwater is the primary water source for the inventory unit. This inventory unit includes the Los Molinos Mutual Water Company, City of Red Bluff, and Antelope Independent Inventory Sub-units as shown on Figure 4-17.

Los Molinos Mutual Water Company Inventory Sub-unit

Los Molinos Mutual Water Company (LMMWC) began as a land company. The land was subdivided and water lines were installed; the District formally became LMMWC in 1948. (See Figure 4-17 for District location.)

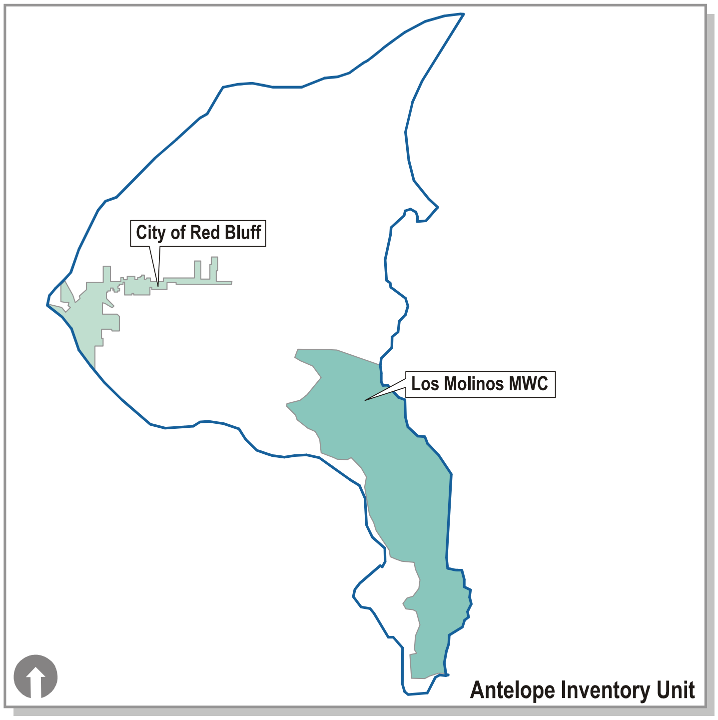


Figure 4-17
Sub-units within Antelope Inventory Unit

Los Molinos supplies its users with surface water only and does not own any wells or have any surface water storage facilities. LMMWC boundaries include Cone Grove Road to the north, the foothills to the east, Thomes Creek to the south, and the Sacramento River to the west. This land encompasses 15,000 acres of which the MWC irrigates 7,000.

Los Molinos has a pre-1914 water right to Mill and Antelope Creeks. Los Molinos also purchased water from Antelope Creek from the City of Red Bluff. In 1920, Mill Creek was adjudicated. Mill Creek is the MWC's main source of surface water. There are two diversions off of Mill Creek: Upper and Ward, which irrigate the northern and southern sides of Mill Creek, respectively. Los Molinos also uses approximately half of the flows from Antelope Creek. Antelope Creek is spring-fed and typically has more consistent flows than Mill Creek, which receives water from snowmelt. LMMWC diverts water into the Main Canal and Hiline Canal off Mill Creek and into Antelope Canal off Antelope Creek.

The MWC supplies water primarily for agricultural purposes. Pasture is the major crop in MWC's area, although prunes and walnuts are also present. Landowners producing almonds have substituted groundwater for surface water because of its reliability when needed for frost protection. Crops are irrigated on a 14-day rotation; however once into July, the rotation can stretch to 21-24 days depending on water availability. Because of the irrigation season and cropping cycles, seasonal variation in water use exists.

MWC's conveyance system loses water to seepage and evaporation because many of the canals are unlined. Los Molinos has been converting open ditches to closed pipelines to reduce losses and conserve water. Approximately 30 percent of the canals are closed pipelines. Additionally, Los Molinos is replacing concrete lined ditches with plastic pipe to further reduce losses.

Los Molinos participates in a water exchange with the DFG. During May and June, Los Molinos diverts less water from Mill Creek in order to maintain flows for spring-run salmon. Additionally, after October 15th, Los Molinos diverts less water to benefit fall-run salmon. DFG repays Los Molinos with water from Dye Creek via two wells, capable of 4000 gpm and 350 gpm. If Los Molinos does not use all of the water owed to them, Los Molinos can 'bank' the water for later use (banked water must be used within 3 years). Also on request by DFG, Los Molinos will close all diversions for a couple of days at a time for pulse flows to enhance fish transport flows.

Water supply availability is a major concern of the MWC. During the summer, crop rotations are lengthened and water demand increases. LMMWC had plans to work with Orange Cove ID to improve the MWC's water use efficiency. However, the project was not funded and has not been implemented.

City of Red Bluff

See Red Bluff East Inventory Unit
(See Figure 4-17 for District location.)

Antelope Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Antelope Inventory Unit. This information is derived from the inventory analysis. Independent users include agricultural and M&I users. Agriculture is irrigated by both groundwater and surface water sources. Groundwater sources represent the majority of supply for irrigated agriculture. Major crops irrigated with groundwater include almonds, prunes and walnuts. Surface water is used to irrigate some acres of alfalfa, pasture, prunes and walnuts. Agricultural users divert surface water flows from Antelope Creek at Edwards and Los Molinos WWC diversions. Conveyance losses occur; however, they either percolate to the ground or return to the Sacramento River. Antelope Independent M&I users rely only on groundwater. All users are on septic systems.

4.2.7 Dye Creek Inventory Unit

The Dye Creek Inventory Unit includes 300,000 acres in central Tehama County, as shown on Figure 4-18.

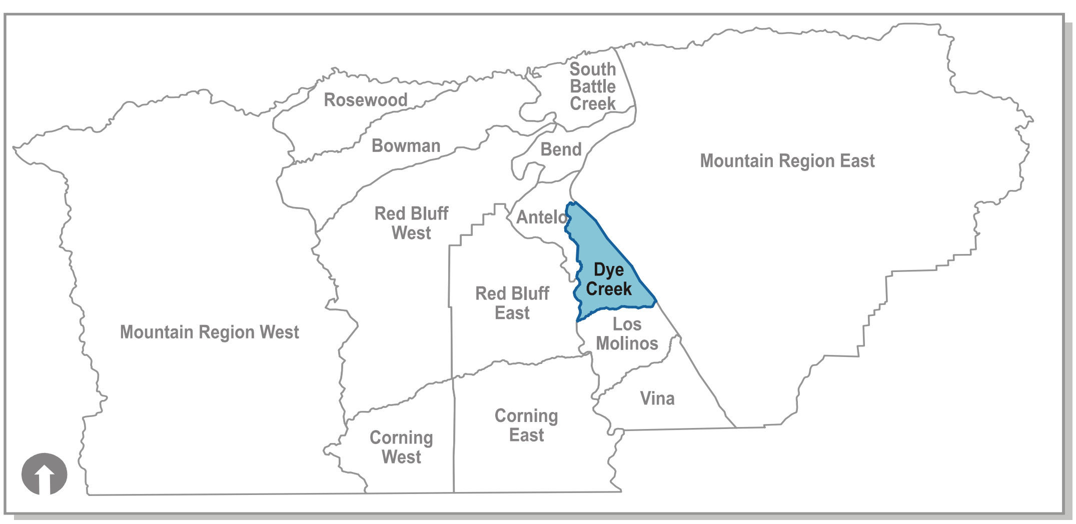


Figure 4-18
Dye Creek Inventory Unit

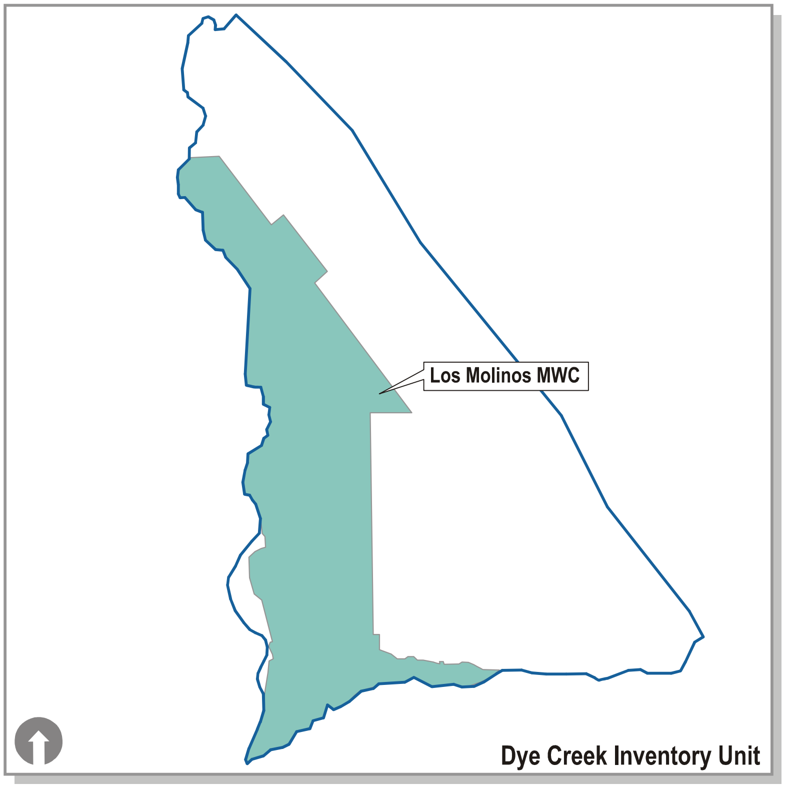


Figure 4-19
Sub-units within Dye Creek Inventory Unit

It is bordered by the Sacramento River to the west and Paynes Creek flows through the northern part of the inventory unit. The primary crop types in the region are orchards and pasture. Mixed water is the main water source for the inventory unit. LMMWC and Dye Creek Independent Inventory Sub-units are included in this Inventory Unit as shown on Figure 4-19.

Los Molinos Mutual Water Co. Inventory Sub-unit (see Antelope Inventory Unit)

Dye Creek Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Dye Creek Inventory Unit. This information is derived from the inventory analysis. Independent users use both groundwater and surface water to meet agricultural and M&I needs. Surface water is diverted from a riparian diversion on the Sacramento River and a water rights diversion from Mill Creek. Surface water is used to irrigate pasture, orchards and some outdoor landscape. Independent users in the Dye Creek Inventory Unit primarily use groundwater as a supply source to irrigate crop and for M&I uses.

4.2.8 Los Molinos Inventory Unit

The Los Molinos Inventory Unit includes 300,000 acres in south central Tehama County, as shown on Figure 4-20. Los Molinos is bordered by the Sacramento River to the west, Mill Creek to the north, and Deer Creek to the south. The Los Molinos Inventory Unit contains the City of Los Molinos. The primary crop types in the region are orchards and pasture. The inventory unit uses a mixed water source of both surface and groundwater. The LMMWC, Stanford-Vina Ranch Irrigation Company, and DCID Inventory Sub-units are included in this Inventory Unit as shown on Figure 4-21.

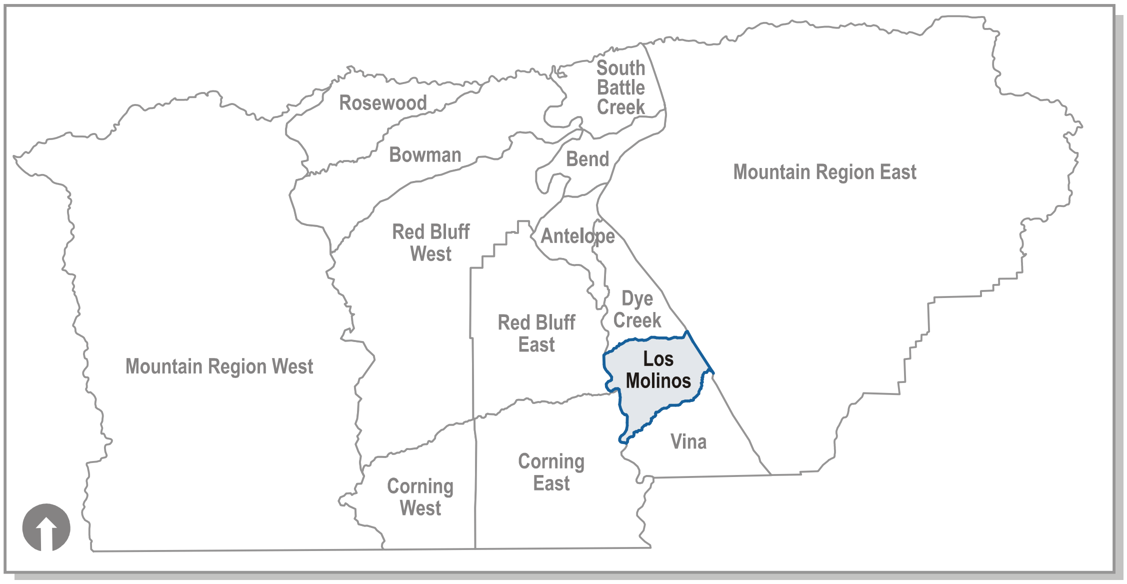


Figure 4-20
Los Molinos Inventory Unit

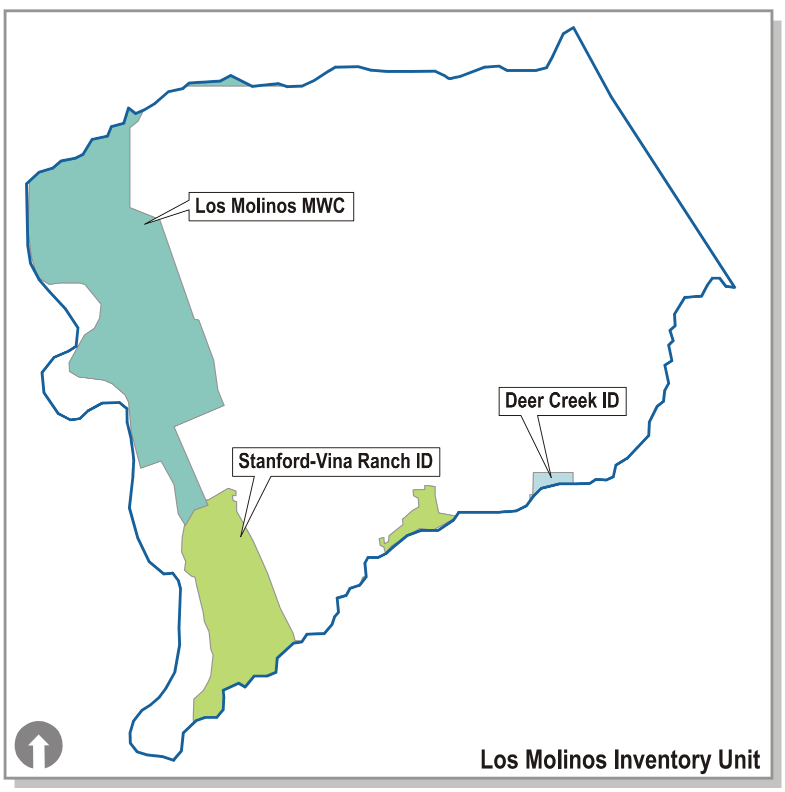


Figure 4-21
Sub-units within Los Molinos Inventory Unit

Los Molinos Mutual Water Co. Inventory Sub-unit

(see Antelope Inventory Unit)

Stanford Vina Ranch Irrigation Co. Inventory Sub-unit

(The following information was obtained from Tehama County Permit Application to Extract Groundwater for Off Parcel Use, Deer Creek Irrigation District, 2003)

SVRIC was established in 1918. SVRIC encompasses about 6,500 acres. Approximately 5,000 acres are in agricultural production; major crop types include orchard (almonds, walnuts, and prunes), pasture and alfalfa, and grain. Both surface water and groundwater are used for irrigation at about 60 percent and 40 percent, respectively. Surface water supplies to SVRIC are diverted from Deer Creek (Deer Creek is adjudicated; 66 percent of the flow is granted to SVRIC). SVRIC has three diversions; the Cone Kimball, the North Main, and the South Main. The Cone Kimball diverts from the north side of Deer Creek, the North and South Main canals divert from the north and south side of the SVRIC diversion dam.

Prior to 2002, none of the SVRIC diversions had recording equipment. Recording equipment was installed on the South Main canal in 2002. SVRIC diversions are manually measured and recorded daily by the SVRIC watermaster. Table 4-9 shows the estimated daily diversions between 1997 and 2000.

Table 4-9
SVRIC Diversion: Water Years 1997-2000

	Average Daily Diversion (cfs)				***Totals***	
Month	***South Main***	***North Main (n)***	***North Main (w)***	***Cone Kimball***	***Total Ave. Daily (cfs)***	***Monthly Total (acre-feet)***
April	14.8*	4.4*	12.4*	3.8*	35.4*	1,712
May	30.1	4.7	11.4	4.0	50.2	2,994
June	40.1	6.6	11.3	5.5	63.5	3,673
July	48.2	6.3	15.3	5.7	75.5	4,621
August	42.4	6.3	14.9	5.5	69.1	4,239
September	25.7	5.3	13.0	4.8	48.8	2,895
October	12.9	2.4*	12.8*	5.8*	33.8*	743
Totals (acre-feet)	12,140	1,955	4,667	1,687	NA	20,448

Note: N. Main (n) and N. Main (w) are the northern and western splits off the North Main Diversion.
* Averages do not include April 1998 and October 1997, where no diversion occurred.

Los Molinos Community Service District

Although not classified as an Inventory Sub-unit, Los Molinos Community Service District is discussed because an organized group that manages their water represents its water users.

Los Molinos formed a CSD to purchase the water system from a private owner in 1996, and then secured $2.3 million in grants and loans to rehabilitate the system. Los Molinos CSD provides water to the town of Los Molinos. The residents of Los

Molinos use septic systems; therefore, there is a significant need for wastewater treatment services. The CSD currently has 350 connections. Growth in Los Molinos is fairly slow; a 40-unit migrant worker subdivision has been suggested, but planning has not yet been completed.

The CSD delivers groundwater to its residents from four wells. One of the wells is 650 feet deep; however, it is only open from 550 to 650 feet because it is gravel packed. This well is the primary well and produces soft, warm water with about 10 parts per million (ppm) of arsenic. The second well, built in the 1930s, is 250 feet deep and cased to 50 feet. The CSD typically does not use the third well, with a 25 horsepower (hp) pump. The fourth and most recent well is the Stanford well.

All connections to the system are metered. Because the distribution system is so new, it has very few conveyance losses.

Los Molinos Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Los Molinos Inventory Unit. This information is derived from the inventory analysis. Independent users use surface water and groundwater to meet primarily agricultural and some M&I needs. Surface water is diverted from Mill Creek to irrigate pasture and prunes. Conveyance losses occur because of unlined canals. Most losses percolate into the ground or are consumed by riparian vegetation along the canals. Independent users also pump groundwater. M&I users rely fully on groundwater. Additionally, agricultural users irrigate close to 1,000 acres with groundwater during an average year.

4.2.9 Vina Inventory Unit

The Vina Inventory Unit includes 400,000 acres in south central Tehama County, as shown on Figure 4-22. It is bordered by the Sacramento River to the west, Deer Creek to the north, and the Tehama – Glenn County border to the south. The Vina Inventory Unit contains the City of Vina. The primary crop types in the region are orchards and pasture. Mixed water is the main water source for the Inventory Unit. Stanford Vina Ranch Irrigation Company and DCID are included in this Inventory Unit as shown on Figure 4-23.

Stanford Vina Ranch Irrigation Co. Inventory Sub-unit (see Los Molinos Inventory Unit)

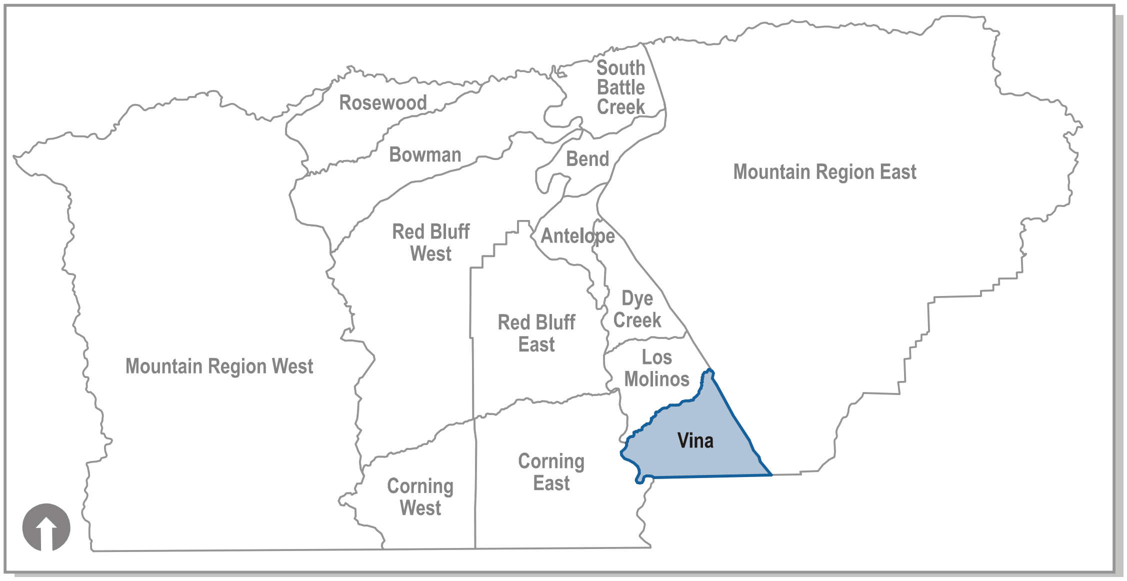


Figure 4-22
Vina Inventory Unit

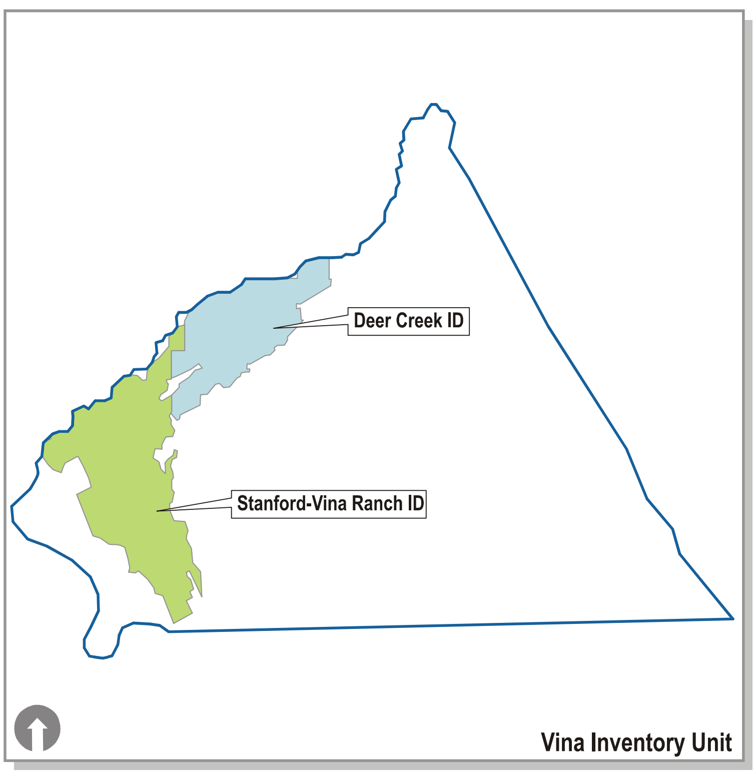


Figure 4-23
Sub-units within Vina Inventory Unit

Deer Creek Irrigation District Inventory Sub-unit

The following information was obtained from Deer Creek's Water Exchange Pilot Program Application document.

Deer Creek Irrigation District (DCID) encompasses 2,200 acres. Both surface water and groundwater are used to irrigate the 1,900 acres that are in agricultural production; however, surface water irrigates approximately 80 percent of the acreage. Major crop types within DCID include orchard (almonds, walnuts, and prunes), pasture, and grain. DCID receives surface water from Deer Creek (Deer Creek is adjudicated; 33 percent of the flow is granted to DCID). Table 4-10 shows DCID diversions from Deer Creek between April and October of 2000.

Table 4-10
DCID Diversion: Water Year 2000

Month	Average Daily Diversion (cfs)			Average Monthly Total	
	Minimum	Maximum	Average	(cfs)	(acre-feet)
April	18	42	28	826	1,635
May	15	33	21	661	1,309
June	26	37	32	951	1,889
July	31	36	34	1,052	2,083
August	28	31	29	909	1,800
September	22	33	27	817	1,618
October	5	28	14	419	830
Total				5,638	11,163

DCID, in cooperation with Tehama County and DWR, is a part of a study to evaluate scenarios to increase fish transportation flows in Deer Creek. The Deer Creek Water Exchange Pilot Program assesses the feasibility of a future surface water/groundwater exchange whereby DCID would bypass surface water that it would have diverted for irrigation in exchange for a like amount of groundwater. In 2003, DCID, in conjunction with DWR, was issued an export permit through County Ordinance 1617 by the Tehama County Board of Supervisors for the Pilot Project. This is the first permit issued of this type in the past ten years.

Vina Independent Inventory Sub-unit

An interview was not conducted with the independent groundwater users in the Vina Inventory Unit. This information is derived from the inventory analysis. Groundwater is the largest water source for agricultural and M&I users. Agricultural users irrigate almonds, prunes and walnuts with groundwater. Surface water users in Vina Independent divert water by means of riparian rights from Mill and Singer Creeks. Surface water is used to irrigate pasture.

4.2.10 Bowman Inventory Unit

The Bowman Inventory Unit includes 900,000 acres in north central Tehama County, as shown on Figure 4-24. The Sacramento River to the east and Cottonwood Creek (which forms the Shasta – Tehama border) to the northeast, form Bowman's borders;

the South Fork of Cottonwood Creek flows through the western part of the inventory unit. The primary crop types in the region are pasture and orchards. Surface water is the main water source for the inventory unit. This inventory unit includes Anderson Cottonwood Irrigation District, Rio Alto Water District, and Bowman Independent Inventory Sub-units as shown on Figure 4-25.

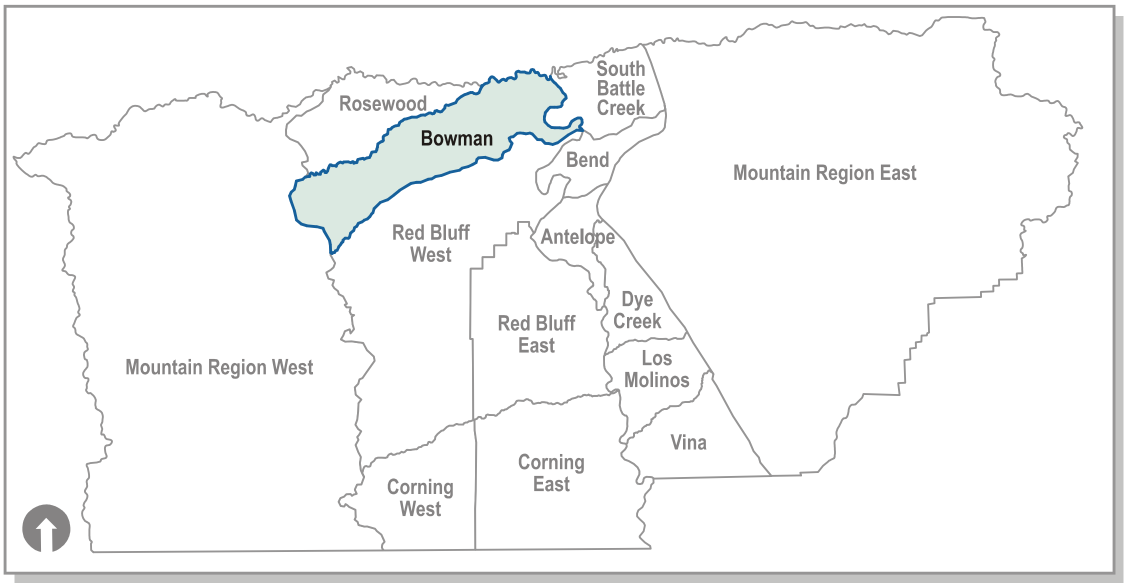


Figure 4-24
Bowman Inventory Unit

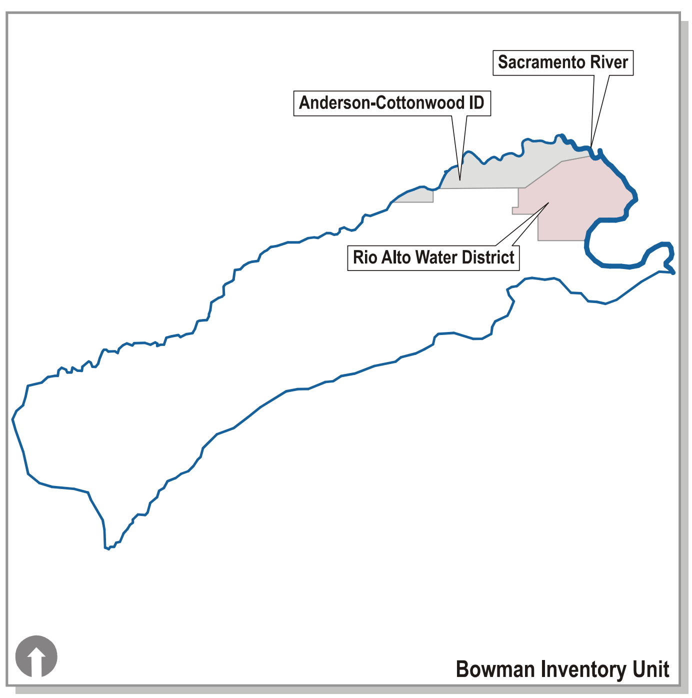


Figure 4-25
Bowman Inventory Unit

Anderson-Cottonwood Irrigation District Inventory Sub-unit

The ACID Inventory sub-unit includes approximately 32,000 acres and extends south from the City of Redding within Shasta County to northern Tehama County. ACID holds the third oldest water rights on the Sacramento River with a total Settlement Contract of 175,000AF, (165,000 AF base supply, 10,000 AF project supply).

The District encompasses the City of Anderson and the town of Cottonwood. While the District includes these two urban areas, it does not provide M&I water to any urban water users. Approximately 90 percent of ACID's customers irrigate pasture for haying or livestock grazing. The remaining customers irrigate orchard and other food crops.

ACID relies totally on surface water diverted from the Sacramento River near Redding. ACID diverts water through unlined canals. The diversion has a capacity of 450 cfs. Annual total District water requirements for normal and dry years are approximately 121,000 AF and 147,000 AF respectively.

The majority of the District's distribution system was constructed between 1916 and 1917. Consequently, the District experiences significant seepage losses with annual seepage estimates as high as 32,000 AF during normal years and 39,000 AF during drought years. (DWR 2000) The District has received a DWR water conservation grant to investigate the feasibility of lining the canals. Early indications are that the District could reduce annual seepage loses by as much as 20,000 AF by lining their canals.

Rio Alto Water District Inventory Sub-unit

Rio Alto Water District formed in 1969 to serve residents in the community of Lake California. The community encompasses 6,600 acres, of which approximately 2,200 acres are developed. The District provides water and sewage services to primarily household users and few commercial users. In 2001, the District served 1,620 users. (See District location on Figure 4-25.)

The District provides groundwater from five wells. Well No. 1 is currently not in service and Well No. 2, an old agricultural well, is for emergency use only. Well Nos. 3 and 4 pumps 200 gallons per minute and 675 gallons per minute into storage reservoirs, respectively. Well No. 5 is under construction and the District expects it to be completed by Fall 2003. The well will pump 1,000 gallons per minute. The District also has three reservoir tanks to store groundwater, with capacities of 100,000 gallons, 500,000 gallons and 1.35 million gallons.

Water use within the District increases during May through September. Most of the increased water use is a result of nonagricultural irrigation. The District monitors wells monthly for static levels and drawdown. Water quality is also tested every three years for general physical and chemical constituents, every four years for inorganics and organics, and annually for nitrates.

The District calculates conveyance losses by measuring the units of water produced compared to the units of water delivered. The District estimates approximately 8 to 10 percent of water is lost through conveyance. The water system is designed to provide 275 gallons per resident. The District conserves water through pricing mechanisms. A base rate is applied to the first 2,000 cubic feet of water used, and then users are charged $0.56 for each additional 100 cubic feet. The District monitors customer's normal monthly uses and investigates any monthly increases of 10 percent or more above normal.

In addition to groundwater, the District has a surface water contract from Reclamation for 500 acre-feet of water per year to fill Lake California. The District turned the contract over to the property owners in 1979 to maintain the lake. Property owners are currently using 300 acre-feet of water per year to fill Lake California.

Approximately 40 to 45 percent of the residents rely on the District's sewage services and the remaining households have septic tanks. During the winter, the wastewater treatment plant discharges 200,000 gallons per day into the Sacramento River. During the summer, the average discharge is less than 100,000 gallons per day with approximately 80 percent of the water used for landscape irrigation and the rest discharged into the river.

The District expressed the need for improved coordination among county departments regarding the implementation and expansion of AB 3030. The District is concerned about groundwater levels and groundwater quality. As additional funding becomes available, the District will upgrade its wastewater projects. For example, the District would install a new clarifier because the existing one is approximately 30 years old.

Bowman Independent Inventory Sub-unit

An interview was not conducted with the independent users in the Bowman Inventory Unit. This information is derived from the inventory analysis. Independent users include both agricultural and M&I users. Agricultural users have both groundwater and surface water supplies. Users divert about 300 acre-feet of surface water from the Sacramento River through riparian diversion. The water is used to irrigate pasture. Bowman independent users irrigate prunes, alfalfa, curcurbits and pasture with groundwater. Groundwater also serves about 3,200 M&I users.

4.2.11 Rosewood Inventory Unit

The Rosewood Inventory Unit includes 450,000 acres in north central Tehama County, as shown on Figure 4-26.

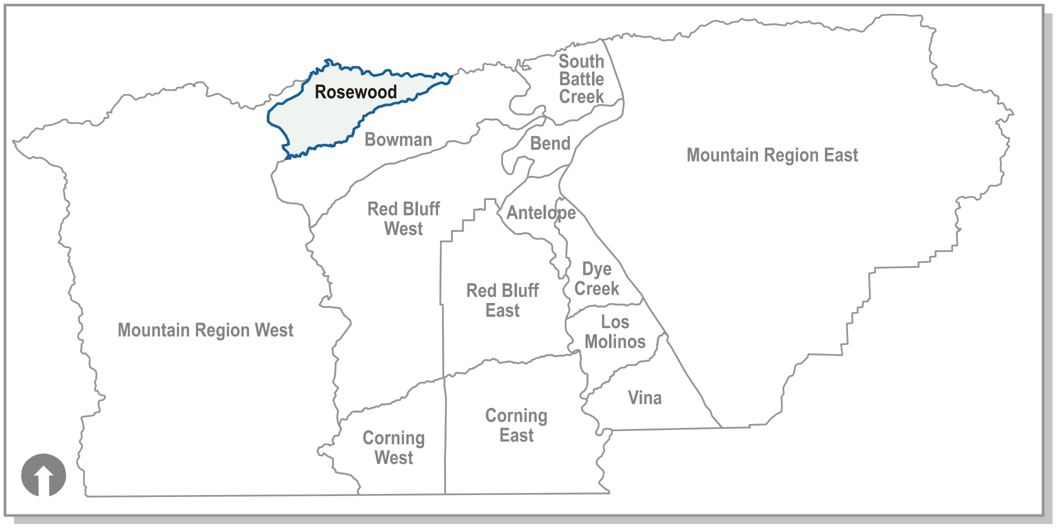


Figure 4-26
Rosewood Inventory Unit

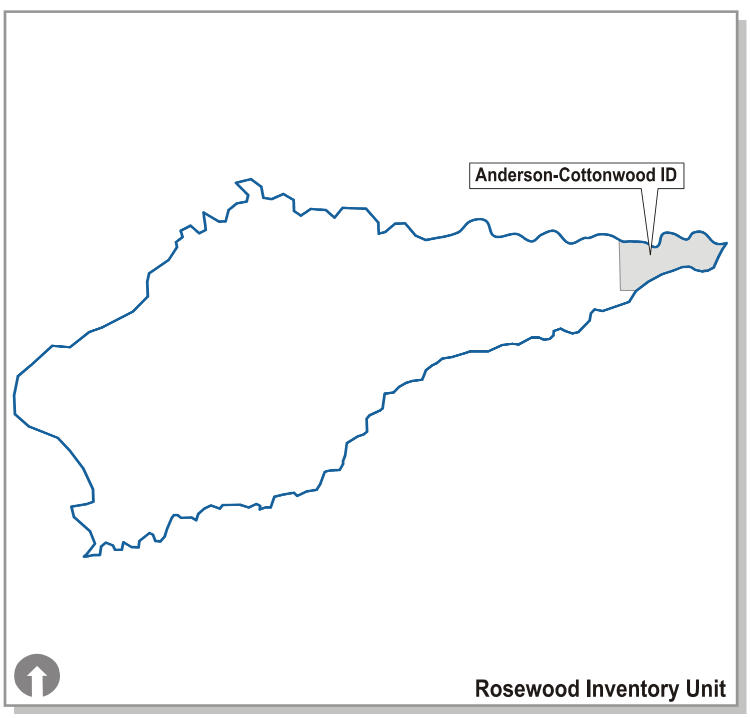


Figure 4-27
Sub-units within Rosewood Inventory Unit

Cottonwood Creek (which forms the Shasta – Tehama border) to the north and the South Fork of Cottonwood Creek to the southeast, form Rosewood's borders. The primary crop types in the region are pasture and orchards. Groundwater is the main water source for the inventory unit. Anderson-Cottonwood Irrigation District Inventory Sub-unit is included in this Inventory Unit as shown on Figure 4-27.

Anderson Cottonwood Irrigation District Inventory Sub-unit (See Bowman Inventory Unit)

Rosewood Independent Inventory Sub-unit

An interview was not conducted with the Rosewood Independents. This information is derived from the inventory analysis. Rosewood Independents rely completely on groundwater to serve agricultural and M&I needs. Agriculture for Rosewood Independents is limited to pasture and few orchard fields. There is little groundwater percolation in the area.

4.2.12 South Battle Creek Inventory Unit

The South Battle Creek Inventory Unit includes 400,000 acres in north central Tehama County, as shown on Figure 4-28.

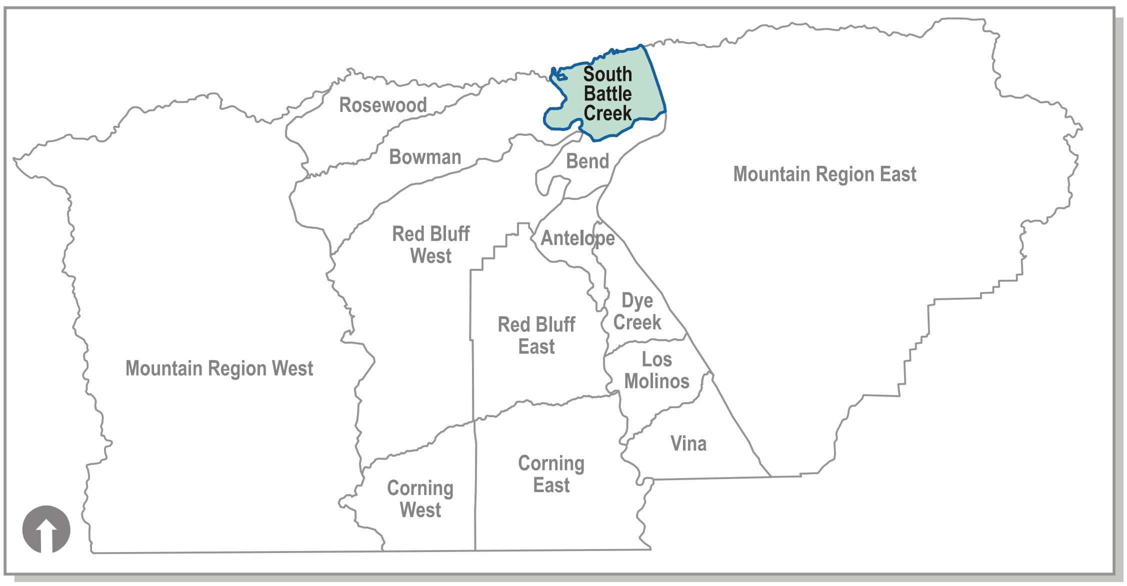


Figure 4-28
South Battle Creek Inventory Unit

South Battle Creek Inventory Unit is bordered by the Sacramento River to the west and Battle Creek (which forms the Shasta – Tehama border) to the north. The primary crop types in the region are pasture and orchards. Surface water from Battle Creek is the main water source in the inventory unit for irrigation purposes.

4.2.13 Mountain Region West Inventory Unit

The West Mountain Inventory Unit is shown on Figure 4-29. It is bordered by Cottonwood Creek (which forms the Shasta – Tehama border) to the north, the Trinity – Tehama border to the west, the Mendocino – Tehama border to the southwest, and the Glenn – Tehama border to the south.

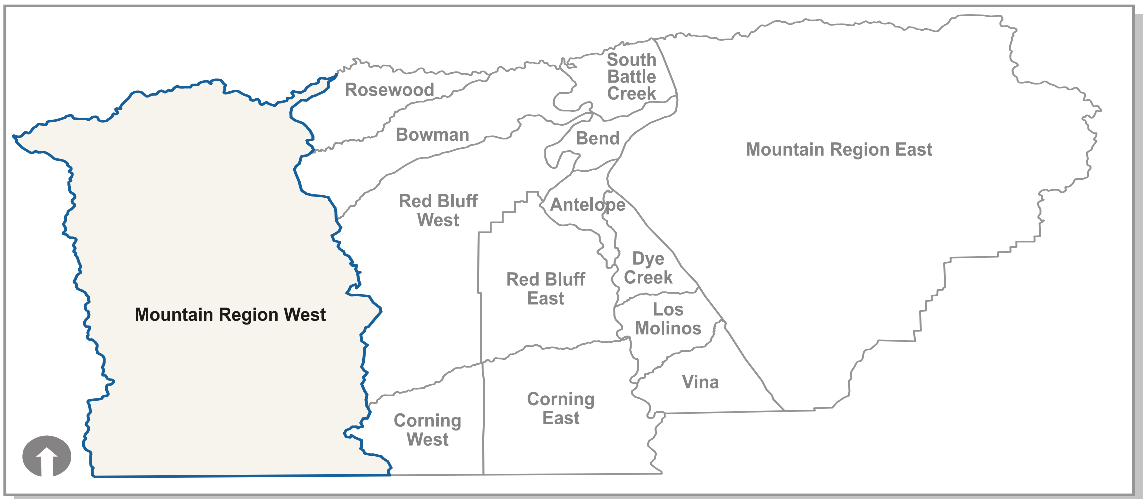


Figure 4-29
West Mountain Inventory Unit

The South Fork of Cottonwood Creek flows through the central part of the inventory unit and Thomes Creek flows through the southern part. The West Mountain Inventory Unit contains the cities of Lowrey and Paskenta. The primary crop types in the region are orchards and pasture, though very little agriculture exists. Groundwater is the main water source for the few locations within the Inventory Unit that use it.

4.2.14 Mountain Region East Inventory Unit

The East Mountain Inventory Unit is shown on Figure 4-30.

Battle Creek and the Shasta – Tehama County line border to the north, the Plumas – Tehama County line border to the east, and the Butte – Tehama County line border to the south to form East Mountain's borders. Paynes Creek and Antelope Creek flow through the north central part of the inventory unit and Mill Creek and Deer Creek flow through the south central part. The East Mountain Inventory Unit contains the

City of Mineral. The primary crop types in the region are pasture and vineyard. Surface water is the main water source for the inventory unit. This Inventory Unit includes Mineral County Water District Inventory Sub-unit as shown on Figure 4-31.

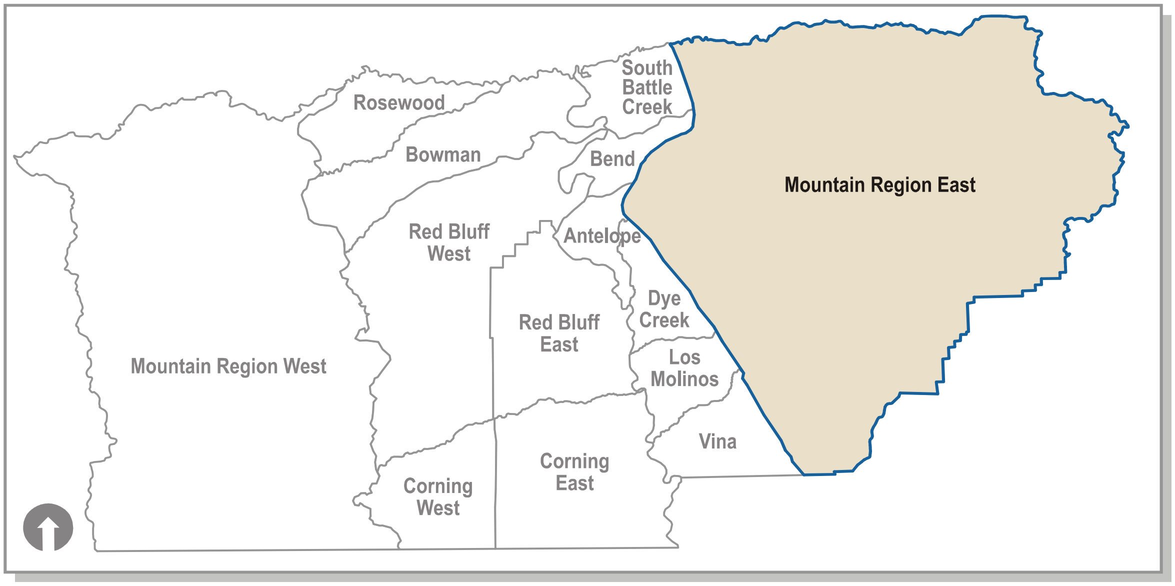


Figure 4-30
Mountain Region East Inventory Unit

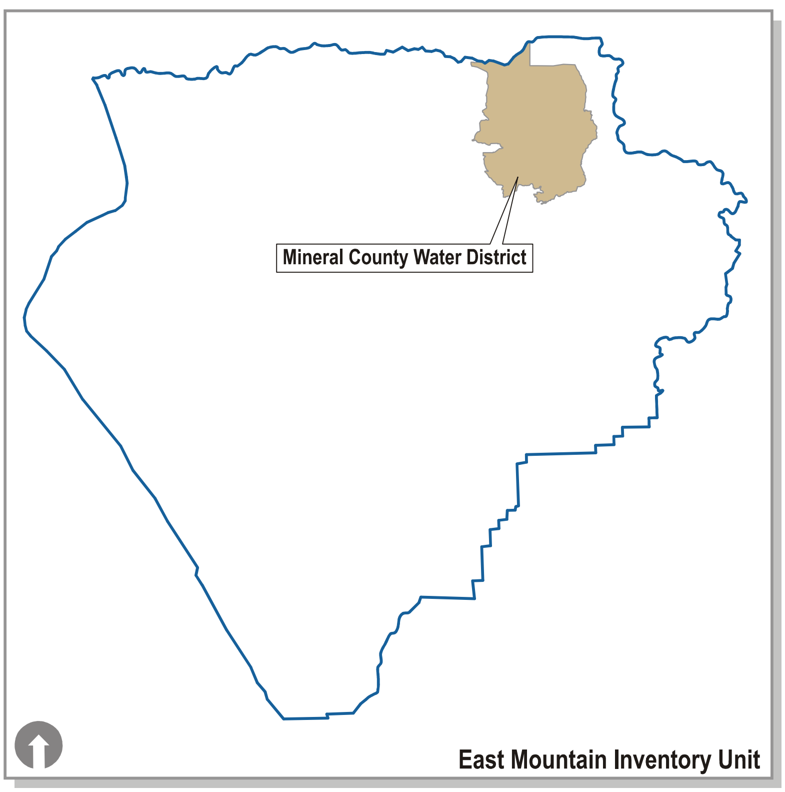


Figure 4-31
Sub-units with East Mount Inventory Unit

Mineral County Water District Inventory Sub-unit

Mineral's water system has been in place since 1928. Until 2002, a private owner operated the system, but the system was not in compliance with the Clean Water Act. The private owner used water from two springs and three groundwater wells; however the wells were not a viable source of water due to insufficient quality and quantity of water. During periods of higher demand, the springs would not provide enough water to supply the users. When supply was not adequate, the owner would divert water from Martin Creek and supply it to users without additional treatment. During these times, all drinking water had to be boiled because of water quality concerns, and the Department of Health Services imposed fines that grew from $400 per day to $1500 per day.

The town citizens served by this system tried to buy the system in 1991. They formed three Boards, but the first two were not able to buy the system. Finally, the Public Utilities Commission (PUC) filed for receivership of the system because it had been out of compliance for several years. The PUC then helped the Board negotiate with the owner for purchase. The newly formed District closed escrow on the system on August 28, 2002. A building moratorium, originally imposed because of sewage treatment concerns, has been extended until sufficient water supply can be proven for several years.

Mineral County Water District provides surface and groundwater to its customers. The Districts area encompasses the unincorporated community of Mineral, along Highway 36, approximately 45 miles east of Red Bluff. The population of Mineral is 300 and the District serve 173 connections. In addition to the residential customers, the water system serves the Mineral Store and Lodge, a gas station, and an elementary school.

Wastewater is managed through a sewage system; there are no septic systems in Mineral. The District collects sewage from all connections. Sewage ponds are on the south side of the Martin Creek crossing. The District continues to supply groundwater from two springs, Spring No. 1 and Spring No. 2, and surface water from Martin Creek. During the winter, the springs supply the full amount of water needed, because the Creek is too turbid, even with filtration, to be used as a water supply. From June through August, an increase in vacationers and a decrease in supply from the springs require use of Martin Creek to supplement the springs. The springs provide less supply during the summer because of increased riparian use of groundwater and no rainfall. In the summer, the springs only provide about half of the water needed. Mineral also has 4 redwood tanks (50,000, 20,000, 15,000 and 10,000 gallons) for water storage.

Water is provided from Martin Creek through a 6-inch line that yields 40 to 50 gpm. Another 20 gpm will be added after a filtration system is installed. Groundwater Spring No. 1 is above the storage tanks and Spring No. 2 is about one mile east of the storage tank site. Additionally, the previous system owner installed three wells, which originally helped provide water to meet demand. The first well was unproductive from the time it was drilled. Well #2 had adequate quantities of water (approximately 1000 gpm), but it had poor quality water with biological contaminants. Well #3 started at 50 gpm with poor quality (high iron levels), but has since decreased to supply approximately 3 gpm for several minutes every 3 to 4 days.

All household connections are metered, and the meters are read to help determine leaks. Although meters are installed, the previous owner did not keep reliable records to determine historic water use. Water use typically increases during the summer vacation season. When necessary, Mineral promotes water conservation. Colored flags are used to denote water conservation, and during this time, no outside watering is allowed. Mineral currently does not participate in any water related environmental activities.

Several water quality issues exist, primarily regarding surface water from Martin Creek. Giardia is a concern because the Creek passes through rangeland. The spring water is currently chlorinated, and once the filtration system is in place, the Creek water will be filtered and chlorinated. The District cannot guarantee the quality of water from the place of filtration to residences, however, because of the old distribution system (piping from Martin Creek was constructed in 1928).

The District expressed several concerns about water supply and funding. Mineral needs another water source, potentially another spring to be located on Forest Service lands. With only 90,000 gallons of storage, they are concerned about water supply needed for fire protection. Additionally, because of the moratorium, Mineral cannot continue to build on its remaining lots until a reliable water source is identified. Furthermore, reports dating back to 1991 indicate the tanks are in poor condition. Three of the four redwood tanks have plastic liners. Liners extend useful life of the tank for a period of time, but the redwood begins to weaken over time and the tanks become unusable.

Mineral has not received adequate external funding from the County. With external funding, the District would implement a feasibility study to update the distribution system.

Mineral's location and concerns are very different from others water districts within the County. The District feels that a real connection does not exist between Mineral and the valley.

East Mountain Independent Inventory Sub-unit

An interview was not conducted with the independent users in the East Mountain Inventory Unit. This information is derived from the inventory analysis. Independent users' major source of water is surface water diverted from Battle, Paynes, and Upper Antelope Creeks. Most of the conveyance losses within the distribution system are from the Battle Creek diversions. Paynes and Upper Antelope Creeks have relatively short diversion canals with minimal losses. Conveyance losses generally percolate into the groundwater basin.

References

Bennett, Archie J. vs. Reed, Charles W., 1957. *Judgement No. 7814 in the Superior Court of the State of California in and for the County of Tehama*.

Bookman-Edmonston Engineering, Inc. 1999. Foundation for Development of a Comprehensive Water Management Plan. Prepared for: Bureau of Reclamation, Corning Water District, Proberta Water District and Thomes Creek Water District.

Bureau of Reclamation, 2003. *CVPIA Contract Renewal process*. Accessed May 12, 2003. Available at http://www.mp.usbr.gov/cvpia/3404c/index.html

Bureau of Reclamation, 2002. *Sacramento River Settlement Contractors Contract Renewal Effort*. Accessed April 20, 2003. Available at http://www.mp.usbr.gov/srsc/index.html

Camp Dresser & McKee, 2001. *Butte County Water Inventory and Analysis*.

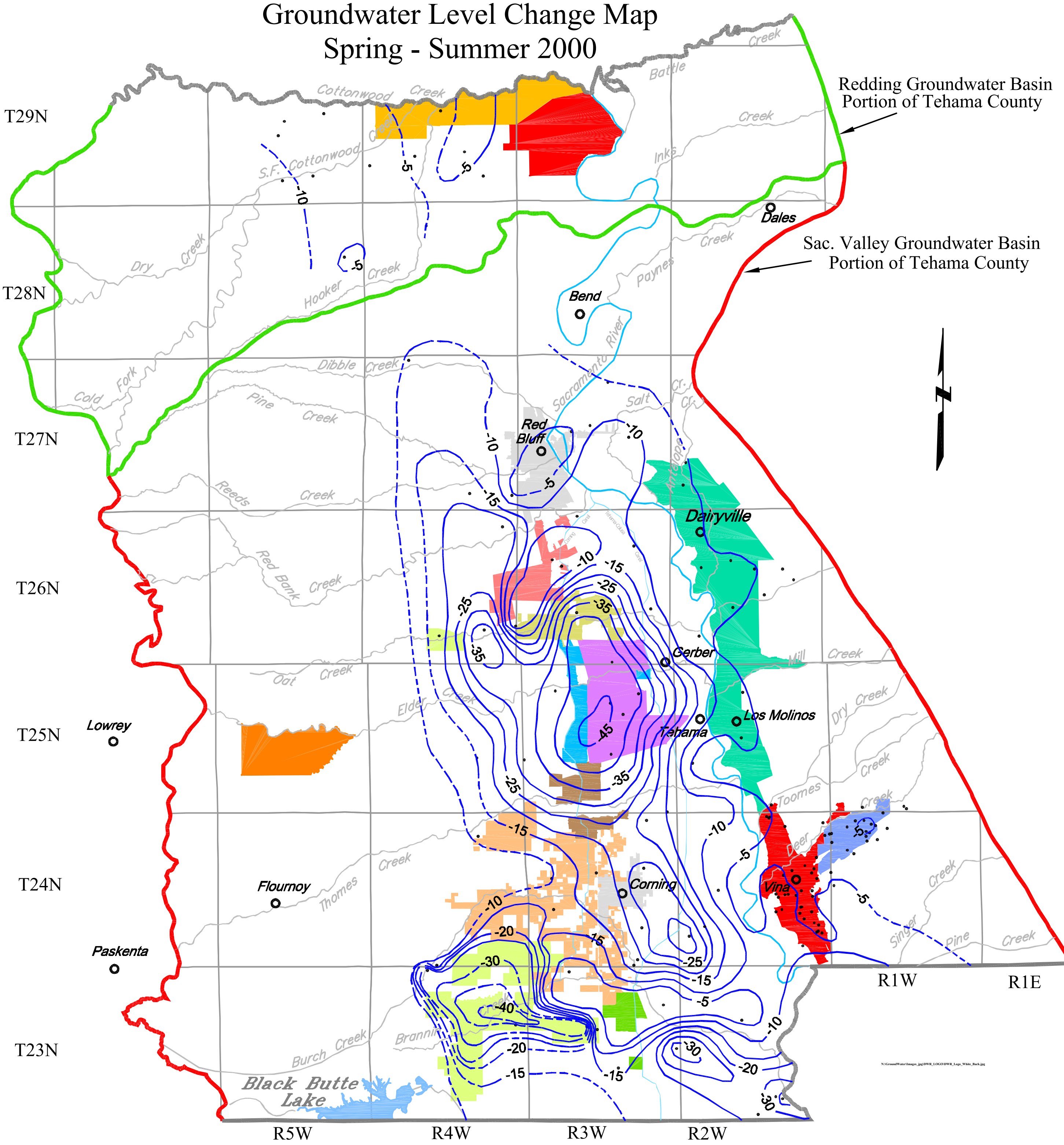
Deer Creek Irrigation District, 2003. *Tehama County Permit Application to Extract Groundwater for Off Parcel Use.*

Fakunding, Chriss M., 2003. *Tehama County Water Suppliers.XLS* (Department of Water Resources, Office of Water Use Efficiency, Urban Council Support)

United States Bureau of Reclamation and United States Fish and Wildlife Service, 2002. *Draft Temporary Forbearance of a Water Right Entitlement Held By The Orange Cove Irrigation District on Mill Creek, Tehama County, California- Environmental Assessment.*

Tehama County
Groundwater Level Change Map
Spring - Summer 2000

Draft



● Well Location used for Contours

- 20

Groundwater Elevation Contour
dashed where uncertain
Contour Interval = 5 feet

Sac. Valley Groundwater Basin Boundary

Redding Groundwater Basin Boundary

Tehama County Line

0 1 2 3 4 5 10
MILES

NOTE: Location of groundwater contours should be considered approximate. Change in groundwater level contours represent data collected from wells that produce from mixed aquifer zones between ~80 to 300 feet. Groundwater level data from perched aquifer zones and from aquifers deeper than 300 feet were not included in the contouring data set.

Source: California Department of Water Resources, Northern District

Figure 4-6

Tehama County Groundwater Level Change Map, Spring - Summer 2000

Section 5
Water Supply and Demand

This section describes the methodology and results of the water supply and demand portion of the project. The methodology section explains the steps used to calculate water supply and demand and outlines the selection process for the average and drought year scenarios. The following sections present the analysis results for agricultural, urban, and environmental demands and supplies from surface water, water reuse, and groundwater sources. Water demand and supply data was developed by DWR Northern District, Land and Water Use section.

5.1 Methodology

The water budget was completed using the "applied" water methodology, which accounts for the measured and managed component of the water cycle. Applied water, as defined in Bulletin 160-98, is, "The amount of water from any source needed to meet the demand of the user. It is the quantity of water delivered to any of the following locations: 1) The intake to a city water system or factory; 2) The farm headgate or other point of measurement; 3) A managed wetland, either directly or by drainage flows." (DWR 1998) The amount of water delivered at these locations was confirmed through interviews with water districts and other purveyors. (Refer to Section 4.)

The use of applied water methodology is beneficial for a number of reasons. In Bulletin 160-98 and in Bulletin 160-03 (currently being developed), DWR used applied water methodology; therefore, water budgets developed for Tehama County are consistent with the methodology used in the Bulletin, allowing for an "apples to apples" comparison of information. Additionally, use of the applied water methodology is familiar and consistent with Tehama County's current accounting methods of diverted and pumped water.

5.1.1 Water Demand Methodology

The following sections discuss the approach used to determine current agricultural, urban, and environmental water demand under differing hydrologic conditions. Initially, an inflow-outflow analysis (mass balance) calculated the water demand for each of these areas independently. The analysis examined supplies, depletions, percolation, and outflow. The data from this analysis was compiled to create a database of the applied water budget for the entire county in order to describe the linkages between water demand, available supply, and water losses within Tehama County's hydrologic system. The following sections detail the adopted process for evaluating water demand for each of the agricultural, urban and environmental sectors.

Agricultural Water Demand

Irrigated acreages by crop were calculated using DWR 1999 land use data projected to year 2000 agricultural cropping trends. Tehama County Agricultural Commissioner's Reports and a subsequent review of the data with district managers were used to confirm the year 2000 data. Figure 5-1 identifies the land use types within the county. As shown on the figure, deciduous orchard (shown as pink) and subtropical (such as citrus, olives and eucalyptus; shown as red) land uses represent a large percentage of crops grown in Tehama County. Appendix D contains land use data within each inventory unit that corresponds to graphics in Figure 5-1.

Evapotranspiration (ET) is a plant's (trees, crops, and other vegetation) demand for water, and includes evaporation from soils surrounding the plant, water retained by the plant, and the water given off during plant growth (transpiration). The amount of water transpired by crops depends on humidity, temperature, wind, solar radiation, crop stage and type, and irrigation frequency. The ET values are met from a combined source of irrigation and precipitation. Only the managed irrigation component, or evapotranspiration of applied water (ETAW), was included in the water budget using the applied water methodology. Soil moisture derived from precipitation is considered in the total ET requirement of the crop, but crop water use from precipitation is not reported as applied water use because precipitation is not considered managed water under this methodology. To satisfy crop ETAW, irrigation water (referred to as applied water) is applied in an amount generally exceeding ETAW to account for the level of management and inherent losses associated with various irrigation methods.

The analysis estimated agricultural water demand by multiplying the required applied water per acre for each crop type by the total associated acreages of each crop. Given that land use acreages incorporate ditches and other non-irrigated areas, a 3.5 percent reduction of the total crop acreage was taken to more accurately calculate water demand (DWR 1999). The water demand of each crop type was summed by Inventory Sub-unit, Inventory Unit, and subsequently totaled for the county to arrive at the final agricultural water demand. Agricultural water demand for an average year is 308,600 acre-feet and 367,100 acre-feet in a dry year, excluding conveyance losses. (Refer to Tables 5-1 and 5-4.)

Urban Water Demand

Total urban water production (including residential, commercial, and industrial demands) was compared to year 2000 U.S. Census Bureau block population data to obtain per-capita water demand. Unincorporated self-supplied areas of the county generally do not maintain municipal water production data. Representatives of community water systems were contacted in an effort to collect data on water supply and demand within these areas. For example, data were collected in mountainous areas of Tehama County where some residents rely on surface water from springs. In areas where data are not available, data were extrapolated from similar areas with known water production and per-capita demand data.

The analysis also considered seasonal changes in water demand. During the winter, there is limited outdoor water demand; therefore, the analysis uses winter to estimate the amount of water demand for indoor purposes. Outdoor use is estimated by subtracting indoor use (defined by winter use) from the total use during summer months.

Further analysis was conducted to determine the amount of water that is either returned to the hydrologic system or depleted through consumption. The analysis assumes indoor water use returns to the system via water treatment or as groundwater percolation through a septic tank. Outdoor water use during summer months is either depleted by ETAW of landscape irrigation and evaporation from pools or returned to the system by deep percolation from excess irrigation. The indoor and outdoor water use was calculated by Inventory Unit and for the county as a whole to determine the total urban demand.

In addition to per-capita consumption, data were collected during interviews concerning changes in water demand behavior during drought periods (i.e., what practices were common during the drought between 1988 and 1994); what, if any restrictive programs were or would be implemented during a drought; and how water demand is forecasted to change. Urban water demand in an average year is 23,100 acre-feet and 25,400 acre-feet in a dry year, excluding conveyance losses. (Refer to Tables 5-1 and 5-4.)

Environmental Water Demand

Environmental water demand includes water required for uses such as managed wetlands, in-stream flows, and fish ponds. Regulatory-mandated in-stream flow requirements were documented. Additional data regarding voluntary in-stream flow releases was requested during interviews and discussed in terms of management practices, but not quantified. The acreage of managed wetlands and fish ponds, as well as quantities of required applied water, was taken from the DWR land use data. Interviews, either in person or by phone, were conducted with resource managers of these types of projects to obtain data regarding water practices. The ETAW for various habitat types were incorporated into the applied water demand. The data were totaled by Inventory Unit and for the entire county to obtain final environmental water demand. Environmental water demand in an average year is 4,100 acre-feet and 8,200 acre-feet in a dry year. (Refer to Tables 5-1 and 5-4.)

5.1.2 Water Supply Methodology

Managed water supplies were classified as surface water or groundwater. The water source was determined using DWR's 1999 land use survey data updated to year 2000 through interviews with water purveyors, which indicates whether each parcel has a supply from groundwater, surface water, or a mixed source (both groundwater and surface water). Figure 5-2 (located at the end of this section) shows water sources within each Inventory Unit in the County. The associated figure, based on DWR source water data, indicates that the majority of lands rely of groundwater as the water source. Information was verified during interviews with water suppliers, which is especially important in surface water service areas. Some landowners within surface water service areas have opted to use groundwater and are not receiving surface water from the districts. Land within a surface water service area that is currently only using groundwater was reported as only having a groundwater supply available.

Surface water includes local surface water rights, such as diversions from Deer, Mill, Antelope, and Thomes Creeks, as well as supplies from the CVP through facilities such as the Tehama Colusa Canal or Corning Canal. Surface water supplies were evaluated at the diversion points serving lands within Tehama County. Water that is reused downstream, such as agricultural return flows, or water that is reapplied, such as treated wastewater, was considered a reuse water supply.

Records of groundwater volumes extracted are generally not available; therefore water demand calculations were used to assess groundwater demand in most areas of the county. In areas where groundwater is the only water supply, the total amount of pumped groundwater was determined by summing the individual calculations of groundwater supplied for agricultural, environmental and urban demand. For areas with a mixed water source, groundwater was calculated as the difference between the total applied groundwater and the amount supplied as surface water. Groundwater extraction within a given area, such as a water district, may be provided from either district owned or private wells. Calculated groundwater extraction using the applied water methodology was compared to the seasonal change of groundwater in storage (using spring and summer water level measurement data) as a means to cross check groundwater extraction volumes. An example of the drawdown contour map is shown as Figure 4-6, which reflects the difference between 2001 water levels in spring and summer.

Surface water rights were researched and reviewed in order to determine various rights held within the county (Refer to Section 4). In addition, surface water users were interviewed to gather data regarding diversion and delivery records. Various groundwater users were also interviewed to gauge the availability of pumping records and gather anecdotal information where records are not available.

5.2 Definition of Average, Dry, and Wet-Year Scenarios

Historic hydrologic records were reviewed to identify appropriate periods of record that could be used to represent average, dry, and wet water demand and supply conditions in Tehama County. Calculation of water demand and supply under these different hydrologic conditions provides stakeholders with information on estimated water demand and available supply under differing conditions and allows for a comparison of the variability of water demand and available supply during different hydrologic conditions.

Both the average and dry-year scenarios result in quantification of water demand and supply. The wet-year scenario assumes water demands consistent with those reported under the average-year scenario and focuses on identifying areas where water supply would be expected to exceed water demand.

5.2.1 Average-Year Scenario

The purpose of the average-year type scenario is to establish a countywide estimate of typical water demand and supply given current land use and population conditions under near average hydrologic conditions. Data spanning the period of record were reviewed to select a year where variables that effect managed water use near to historic averages. By using information from one year that was near historic averages, the average year water demand represents the actual estimated water use in that year for each sector.

Average-Year Scenario

2000 cropping pattern
2000 precipitation
2000 ET values
2000 urban per-capita data

Within the agricultural sector, average-year water demand was estimated assuming a full crop pattern, and precipitation and ET values near historic averages. A full crop pattern assumes that lands that are regularly planted or have established crops are cultivated as part of the water inventory. Average-year environmental water demand analysis will assume all current environmental programs using managed water are operational, and precipitation and ET values are near the historic average. The average-year urban demand was estimated by applying near average historic per-capita municipal and industrial water demand to year 2000 population data, which represents the highest population in Tehama County on record.

Surface water supply availability is assumed consistent with those allowed under existing water rights or contracts. Water right and contract holders were asked during interviews to confirm water supply during average hydrologic conditions. The average-year type scenario was characterized by the following components:

- 2000 precipitation, ET, and runoff data;
- 1999 land and water use data projected to year 2000 agricultural cropping pattern;
- 2000 per-capita water use with year 2000 population estimates.

Precipitation monitoring at the Red Bluff airport monitoring station (1965-2000) indicates that year 2000 equaled 100 percent of the historic average precipitation. Year 2000 was classified as an above average water year for runoff; slightly greater runoff as compared to the mean for October – March, and slightly lower runoff for April – July as compared to the mean. Figure 5-3 presents both the precipitation and the amount of runoff sampled at Deer Creek as a percent of the historic average. The graph demonstrates that year 2000 runoff and precipitation are near 100 percent of the historic average.

The ET value for all crop types combined in year 2000 were 93 percent of the historic average. The majority of individual crops were above 85 percent of the average. As an example, Figure 5-4 displays the ET values for prunes and eucalyptus. The high degree of similarity between year 2000 as compared to the historic average for precipitation, runoff, and ET values was a key factor for selecting the year. Additionally, the year 2000 was used in DWR's upcoming Bulletin 160-03 as the representative average-year type.

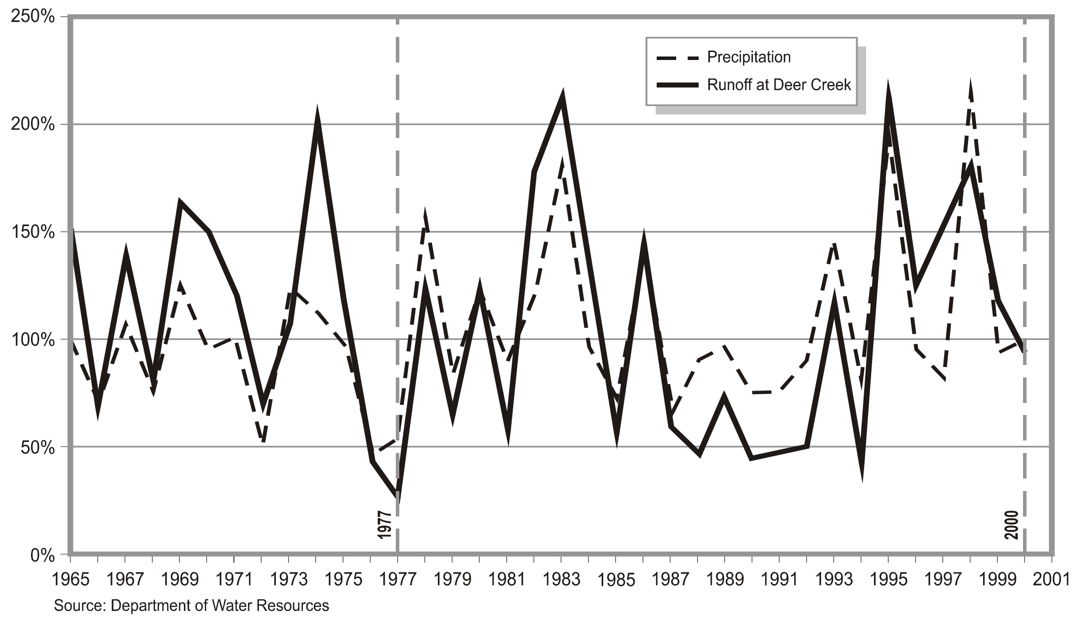


Figure 5-3
Precipitation and Runoff (% of Historic Average)

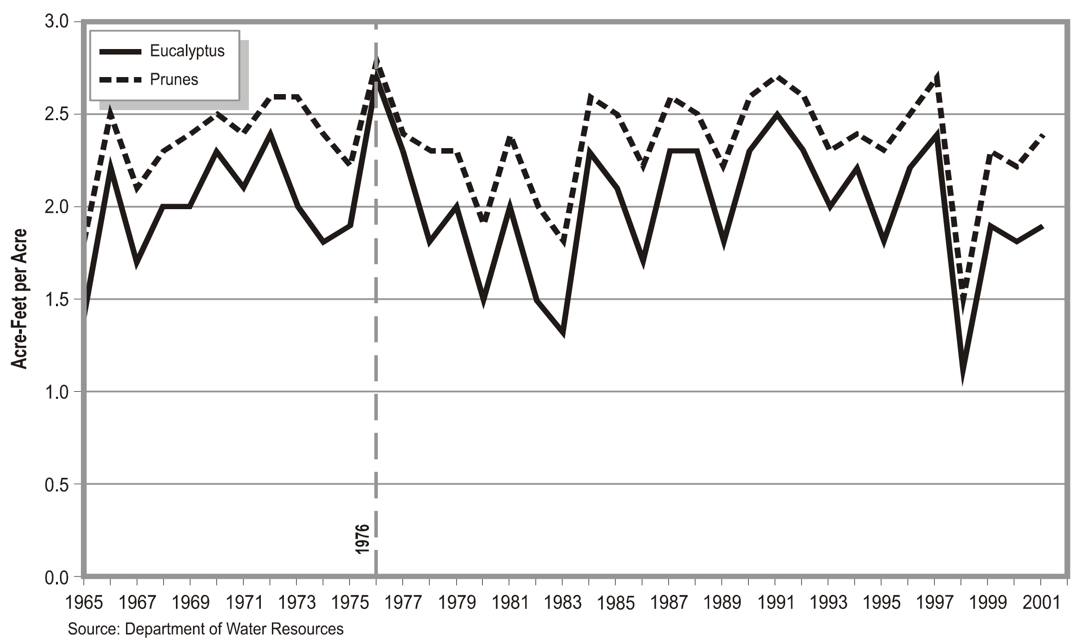


Figure 5-4
Unit Evapotranspiration (ET) Values

5.2.2 Dry-Year Hydrologic Scenario

The purpose of the dry-year type scenario is to examine an extreme scenario to draw conclusions about maximum water demand and reduced available supplies. Within the agricultural sector, maximum water demand was estimated assuming a full crop pattern, low precipitation and high ET. Similarly, dry-year environmental water demand will assume no reduction in environmental water programs, coupled with low precipitation and high ET of vegetation. The dry-year urban demand was estimated by applying the maximum historic per-capita municipal and industrial water demand to year 2000 population data, which represents the highest number of population in Tehama County on record.

Dry-Year Scenario

2000 cropping pattern
1977 precipitation
1976 ET values
1988 urban per-capita data

Dry-year type water supply was estimated by assigning delivery cutbacks based on a review of water delivery contracts, water rights, stream flow data, and interviews with local water suppliers.

Characteristics associated with high water demand and reduced water supply could not be found in a single year, therefore information from several years was combined to create the dry-year type scenario. The dry-year type scenario was characterized by the following components:

- 1977 precipitation and runoff data;
- 1976 ET values;
- 1999 land and water use projected to 2000 agricultural cropping trends;
- 1988, representing maximum per-capita municipal and industrial water demand, adjusted to 2000 population estimates; and
- The maximum allowable and historic curtailment in surface water delivery based on existing contracts and water rights.

In 1977, annual precipitation was 54 percent of average. The previous year experienced even lower precipitation amounts; however, 1977 was selected because a second dry year further magnifies the drought conditions in natural waterways. Due to the lack of precipitation, 1977 had extremely low runoff values (lowest over the period of record). For example, Figure 5-3 presents both the precipitation and the amount of runoff sampled at Deer Creek as a percent of the historic average. The graph demonstrates that runoff and precipitation are at low values in 1977.

The year 1976 was selected as the representative year for ET values. This year had the highest ET values for the period of record. Figure 5-4 displays the ET values for prunes and eucalyptus. The values are representative of the ET for additional crops grown in Tehama County in 1976. The graph shows that both crops have peak ET values during this year. High ET values correspond to necessary increases in applied water, exacerbating drought conditions by contributing to increased water demand during low water availability.

Two potential dry year scenarios were analyzed to represent the maximum historic and the maximum potential cutback scenarios. The first scenario assumes a 75 percent cutback in CVP supplies, which represents the maximum historic CVP cutback. In this scenario, the CVP would impose cutbacks of 75 percent of each districts CVP contract. Many of the CVP contractors in Tehama County do not fully utilize their contract amounts; therefore, the demands represent less than a 75 percent reduction of CVP supplies. The second scenario assumes a 100 percent cutback in CVP supplies, eliminating a supply source completely. This scenario represents the maximum potential cutback allowed in the CVP contracts; however, the CVP has not historically implemented cutbacks of this magnitude. The former scenario is more realistic; therefore, most of the analysis in this section refers to the 75 percent CVP cutback scenario. The majority of surface water supply in Tehama County, however, is not CVP supplies, but rather local stream diversions. In fact, reductions in local stream diversions during a dry year are the major factor in water shortages.

5.2.3 Wet-Year Hydrologic Scenario

The wet hydrologic period was developed differently as compared to both the average and dry hydrologic periods. The emphasis of the wet-year scenario was to identify the location and magnitude of water available during wet years in excess of that which is available and managed under the average-year scenario. Both surface water and groundwater were considered. Water demand was assumed to be consistent with calculations completed under the average-year scenario.

5.3 Summary of Average-Year Inventory

The following sections present and discuss data on water demand, supply, net groundwater extraction and water shortages during an average year in Tehama County. Data is presented by inventory units within Tehama County. The inventory unit values represent the sum of values of the associated Inventory Sub-units. See Chapter 1 for inventory Sub-units within each inventory unit. Appendix D includes complete inventory data for all Inventory Sub-units.

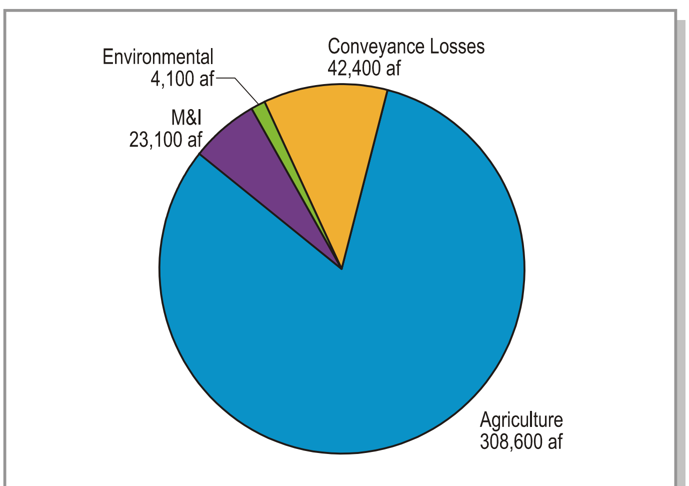
5.3.1 Demands

Agriculture, municipal and industrial demands, and the environment comprise water demands within Tehama County. Table 5-1 summarizes water demand by sector in each inventory unit. The table also includes estimates of conveyance losses, which are incorporated into total water demand. The values in the Table 5-1 represent water demand during an average water year, when precipitation and ET values are at historic averages.

Table 5-1 Summary of Tehama County Water Demand in an Average-Year					
Applied Water (Acre-feet)					
Inventory Unit	**Agriculture**	**M & I**	**Environmental[1]**	**Conveyance Losses[2]**	**Total Water Demand**
Red Bluff East	75,000	8,100	0	2,300	**85,400**
Red Bluff West	2,100	1,800	0	0	**3,900**
Corning East	113,900	4,600	0	1,300	**119,800**
Corning West	3,200	100	0	400	**3,700**
Bend	1,700	200	200	200	**2,300**
Antelope	24,000	2,200	0	5,100	**31,300**
Dye Creek	24,600	1,300	2,000	10,400	**38,300**
Los Molinos	16,800	2,100	1,900	7,600	**28,400**
Vina	22,500	200	0	9,800	**32,500**
Bowman	10,200	2,100	0	4,200	**16,500**
Rosewood	2,000	200	0	200	**2,400**
South Battle Creek	7,300	0	0	600	**7,900**
West Mountain	200	100	0	0	**300**
East Mountain	5,100	100	0	300	**5,500**
County Total	**308,600**	**23,100**	**4,100**	**42,400**	**378,200**

Source: Department of Water Resources 2003
1- Includes data for wildlife refuges, rice straw decompositions, and rice land duck clubs.
2- Includes conveyance losses for agricultural, wildlife refuge, and environmental supplies.

Figure 5-5 (located at end of section) further illustrates water demand in Tehama County by Inventory Sub-unit. The pie charts represent proportional water demand, by illustrating the values in Table 5-1. Figure 5-6 summarizes total water demand in the County.



Source: Department of Water Resources 2003

Figure 5-6
Tehama County Water Demand in Average Year

Agriculture is the largest user of water in the County, approximately 80 percent of total water demand. Most of the agricultural water demand occurs during the summer months for irrigation purposes. Corning East and Red Bluff East Inventory Units, both west of the Sacramento River, have the highest agricultural demand in the County. Pasture and orchards, which are relatively high water use crops, represent the majority of crops within these inventory units. In general, inventory units on the valley floor, east and west on the Sacramento River, have the highest demand for the agricultural water.

Total M&I demand in Tehama County is about 6 percent of total water demand. M&I demand is generally proportional to population. The largest use of M&I water is in the Red Bluff East Inventory Unit, which includes the City of Red Bluff, Tehama County's largest incorporated city, as well as the smaller urban areas of Gerber, Las

Flores and the City of Tehama. Corning East, which includes the City of Corning, also has relatively high M&I demands.

Environmental water demands only occur in Bend, Dye Creek, and Los Molinos Inventory Units. The Bend Inventory Unit uses 200 acre-feet of water for fall flooding of private wetlands, and the remaining environmental water demand is for year-round maintenance of ponds near Mill Creek upstream of the LMMWC diversions.

Conveyance losses account for about 11 percent of total water demand in the county. Conveyance losses are a result of percolation into the groundwater, spillage from the system, evapotranspiration by canal riparian areas and water surface evaporation. Losses are relatively high in the Dye Creek, Los Molinos and Vina Inventory Units, which are all east of the Sacramento River. These units have agencies with longstanding surface water rights and old water distribution systems with dirt canals and relatively high percolation. Conveyance losses in the Corning East and Red Bluff East Inventory Units are lower than those on the east side of the County. These units receive CVP water from the Tehama Colusa and Corning Canals. Conveyance losses contribute to groundwater recharge and provide water to riparian habitat; therefore, they could benefit both water supply and the environment.

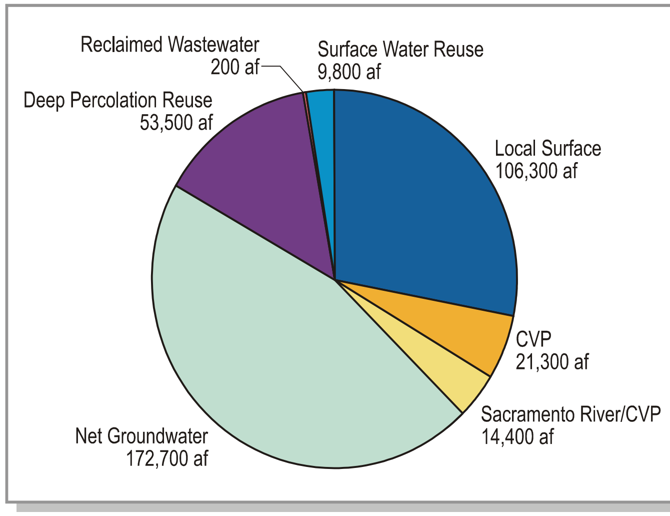
5.3.2 Supplies

Table 5-2 summarizes the water supply of Tehama County in a normal water year. Total water supply is derived from six different sources: local stream diversions, CVP contractor's water delivered from the Tehama Colusa and Corning Canals, Sacramento River riparian users, groundwater, reclaimed wastewater and surface water reuse. In general, the amount water supply corresponds with the water demand of the inventory unit. Supply, however, does not exceed water demand in an average year.

Table 5-2
Summary of Tehama County Water Supplies in an Average-Year

	Water Supplies (Acre-feet)							
Inventory Unit	**Local Stream Diversion**	**CVP[1]**	**Sacramento River/CVP**	**Net Ground-water**	**Deep Percolation Reuse**	**Reclaimed Wastewater**	**Surface Water Reuse[2]**	**Total Water Supply**
Red Bluff East	0	9,500	0	57,100	16,700	200	1,900	**85,400**
Red Bluff West	200	0	0	2,600	1,100	0	100	**4,000**
Corning East	2,200	11,800	600	85,200	17,000	0	3,000	**119,800**
Corning West	2,400	0	0	500	500	0	200	**3,600**
Bend	1,600	0	200	0	400	0	100	**2,300**
Antelope	13,300	0	0	14,300	3,700	0	0	**31,300**
Dye Creek	31,100	0	0	4,100	1,700	0	1,400	**38,300**
Los Molinos	21,200	0	400	2,100	4,300	0	400	**28,400**
Vina	24,900	0	0	3,000	4,500	0	100	**32,500**
Bowman	0	0	12,100	1,200	2,400	0	800	**16,500**
Rosewood	0	0	1,100	900	300	0	100	**2,400**
South Battle Creek	4,400	0	0	1,500	600	0	1,400	**7,900**
West Mountain	0	0	0	200	100	0	0	**300**
East Mountain	5,000	0	0	0	200	0	300	**5,500**
County Total	**106,300**	**21,300**	**14,400**	**172,700**	**53,500**	**200**	**9,800**	**378,200**

Source: Department of Water Resources 2003
1- CVP water from the Corning and Tehama-Colusa Canals.
2- Reuse is for agriculture, municipal and industrial and wildlife refuge supplies only.



Source: Department of Water Resources 2003

Figure 5-8
Tehama County Total Water Supply in an Average Year

Figure 5-7 (located at end of section) further illustrates water supply in Tehama County. The pie charts represent proportional water supply within each Inventory Sub-unit. Figure 5-8 summarizes total water supply in the County.

Inventory units with the largest surface and groundwater supplies are in the Sacramento Valley Groundwater Basin. Groundwater represents the majority of supply, approximately 46 percent of the total County supply. Groundwater extraction within a given area, such as a water district, may be provided from either district owned or private wells. Red Bluff East and Corning East have the largest groundwater supplies, together accounting for about 82 percent of total groundwater supply in the County. The total Sacramento Groundwater Basin has net groundwater extractions of 168,900 acre-feet, or 98 percent of the total, relative to 3,600 acre-feet in the Redding Groundwater Basin.

Inventory Units in the Mountain Regions and the Redding Groundwater Basin have relatively smaller total water supplies during an average year. These units have less agriculture and urban development; therefore, they also have less water demand.

Local stream diversions are the second largest water source in the County and the largest surface water supply (28 percent). Dye Creek, Los Molinos and Vina Inventory Units have the largest local stream diversions in the County. Deer, Mill, and Antelope Creeks generate the majority of local supplies for these inventory units.

Only two inventory units, Red Bluff East and Corning East, receive CVP water from the Tehama Colusa and Corning Canals. These units also have the largest agricultural water demand in the County. Anderson Cottonwood Irrigation District, in the Bowman and Rosewood Inventory Units, has a Sacramento River Settlement Contract. Similarly, water districts in Corning East, Bend, and Los Molinos Inventory Units have riparian rights to Sacramento River water.

Surface water reuse accounts for about 3 percent of total water supply. In general, areas with high surface water reuse have lower conveyance losses. The potential of surface water reuse increases with newer, improved conveyance systems. Surface water reuse is largest in Red Bluff East and Corning East Inventory Units. These units have upgraded their conveyance systems, and therefore, can reuse more surface water. Surface water reuse is lower in Dye Creek, Los Molinos, and Vina Inventory Units, which all have older conveyance systems.

The City of Red Bluff and Gerber-Las Flores CSD uses 200 acre-feet of wastewater for irrigation of landscape and pasture, respectively.

5.3.3 Net Groundwater Extractions

Table 5-3 summarizes net groundwater extraction in each inventory unit. Net groundwater extraction in the inventory unit was calculated from total groundwater supply less any percolation (from either surface water or groundwater supplies) in each Inventory Sub-unit. Several Inventory Sub-units, including LMMWC, SVRIC, and DCID, showed more percolation than groundwater extractions. These units rely on surface water supplies that also percolate to the ground. If percolation was larger than groundwater extraction, net groundwater extraction was estimated to be zero (rather than declaring that there was net groundwater percolation).

Corning East and Red Bluff East Inventory Units have the largest amounts of net groundwater extraction, together about 82 percent of the County total. Total net groundwater extractions in the Sacramento Valley Groundwater Basin Inventory Units are 221,500 acre-feet, relative to 7000 acre-feet in the Redding Groundwater Basin.

The amount of percolation relates to the conveyance losses shown in Table 5-1. Dye Creek and Vina Inventory Units have the largest conveyance losses, and additionally, most surface water percolation. As discussed above, the water suppliers with surface water rights to streams on the west side of the County have older unlined distribution systems that result in high levels of groundwater percolation. These areas also have limited groundwater extraction because the agencies provide surface water, so the groundwater extractions are lower. Therefore, the net groundwater extraction in these areas is relatively low.

Inventory units with lined canal systems could cause decreases in groundwater percolation.

Higher amounts of net groundwater extraction do not necessarily indicate areas of groundwater overdraft because this analysis does not take natural recharge into account. As discussed in Section 3, natural groundwater percolation through precipitation, runoff, and streams provide much of the groundwater recharge within the county.

Table 5-3
Summary of Groundwater Extractions in an Average-Year

Inventory Unit	***Inventory Sub-unit***	***Groundwater Extraction (Acre-feet)***			
		Total Groundwater	***Surface Water Deep Percolation[1]***	***Groundwater Deep Percolation[1]***	***Net Groundwater Extractions***
Red Bluff East	City of Red Bluff	3,600	0	300	3,300
	Proberta WD	1,100	500	300	300
	Elder Creek WD	2,200	900	600	700
	El Camino ID	11,600	0	2,700	8,900
	Thomes Creek WD	100	400	0	0
	Independent	55,300	800	10,600	43,900
Red Bluff West	Rancho Tehama Reserve	400	0	200	200
	Independent	3,300	0	900	2,400
Corning East	City of Corning	2,900	0	300	2,600
	Thomes Creek WD	500	200	100	200
	Corning WD	9,800	1,500	1,500	6,800
	Kirkwood WD	500	0	100	400
	Aaction Tree Farm	20,100	0	1,900	18,200
	Independent	69,700	100	12,600	57,000
Corning West		1,000	300	200	500
Bend		400	400	100	0
Antelope	City of Red Bluff	700	0	100	600
	Los Molinos MWC	100	500	0	0
	Independent	17,200	900	2,600	13,700
Dye Creek	Los Molinos MWC	700	6,600	100	0
	Independent	5,100	200	800	4,100
Los Molinos	Los Molinos MWC	3,000	1,500	600	900
	Stanford-Vina Ranch IC	900	2,000	100	0
	Independent	2,700	1,000	500	1,200
Vina	Stanford-Vina Ranch IC	4,000	3,500	800	0
	Deer Creek ID	800	3,000	200	0
	Independent	3,800	100	700	3,000
Bowman	Anderson-Cottonwood ID	1,400	1,800	300	0
	Rio Alto WD	400	400	100	0
	Independent	1,800	100	500	1,200
Rosewood	Anderson-Cottonwood ID	200	200	0	0
	Independent	1,100	0	200	900
South Battle Creek		2,100	200	400	1,500
West Mountain		300	0	100	200
East Mountain	Mineral County WD	0	0	0	0
	Independent	200	300	100	0
Total		**229,000**	**27,400**	**40,600**	**172,700**

Source: Department of Water Resources 2003
1-Deep percolation is recharge of a deep groundwater aquifer by surface water or groundwater sources.

5.3.4 Shortages

Currently, during a normal water year, Tehama County would not likely experience any water shortages. Table 5-1 and Table 5-2 show that the County water supply during an average water year would be adequate to meet demands. All inventory units in the County have enough water supplies to meet their needs.

5.4 Summary of Dry-Year Inventory

The following sections present and discuss data on water demand, supply, net groundwater extraction and water shortages during a dry year. Data is presented by inventory units within Tehama County. Section 5.2.2 explains data assumptions for the dry year scenario. The scenario describes a dry year with reduced local stream diversions and a 75 percent cutback of CVP supplies. Supply is supplemented with increased groundwater use; however, increased pumping costs and limited infrastructure restrict the amount of groundwater that can be extracted. The scenarios also reflect increases in demand for water, resulting in water shortages in the County. Appendix D includes complete inventory data for all Inventory Sub-units.

5.4.1 Demands

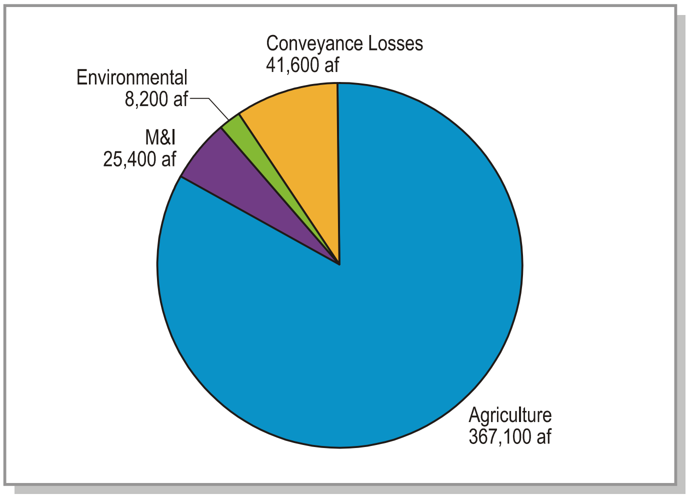
Table 5-4 displays Tehama County water demand in a dry water year. Water demand in a dry year is generally larger than an average year because of less precipitation, higher crop ET values, and increased urban demands.

Table 5-4
Summary of Tehama County Water Demand in a Dry-Year

Applied Water (Acre-feet)					
Inventory Unit	***Agriculture***	***M & I***	***Environmental[1]***	***Conveyance Losses[2]***	***Total Water Demand***
Red Bluff East	86,700	9,500	0	2,300	**98,500**
Red Bluff West	2,300	1,800	0	0	**4,100**
Corning East	144,400	4,400	0	1,300	**150,100**
Corning West	3,800	100	0	400	**4,300**
Bend	2,000	200	200	200	**2,600**
Antelope	27,700	2,500	0	4,700	**34,900**
Dye Creek	27,400	1,600	4,000	11,400	**44,400**
Los Molinos	19,200	2,600	4,000	6,400	**32,200**
Vina	25,400	200	0	9,000	**34,600**
Bowman	11,300	2,100	0	4,500	**17,900**
Rosewood	2,200	200	0	200	**2,600**
South Battle Creek	8,000	0	0	700	**8,700**
West Mountain	200	100	0	0	**300**
East Mountain	6,500	100	0	500	**7,100**
County Total	**367,100**	**25,400**	**8,200**	**41,600**	**442,300**

Source: Department of Water Resources 2003
1- Includes data for wildlife refuges, rice straw decompositions, and rice land duck clubs.
2- Includes conveyance losses for agricultural, wildlife refuge, and environmental supplies.

Figure 5-9 (located at end of section) and Figure 5-10 summarizes water demand in a dry year by Inventory Sub-unit and demand in the whole county, respectively. Relative to an average water year, water demand in a dry year from all sectors increases by 63,800 acre-feet (17 percent). Water demand per inventory unit during a dry year is relatively proportional to that during an average year. Red Bluff East and Corning East continue to have the highest water demand in the County.



Source: Department of Water Resources 2003

Figure 5-10
Tehama County Total Water Demand in a Dry Year

Agricultural water demand increases by approximately 20 percent relative to demand during an average year. Because of dry conditions, irrigation starts earlier in the season, necessitating more water. In addition, the soil has less moisture and crop ET is higher, requiring more water for irrigation.

M&I demands also increase during a dry year. The increase is primarily because of higher demand for landscape irrigation during summer months. Red Bluff East Inventory Unit has the largest increase in M&I demand, about 15 percent greater than an average year.

Environmental water demand doubles in Dye Creek and Los Molinos Inventory Units, mainly because these areas participate in dry year programs to benefit the environment. These programs, described in more detail in Section 6, pump increased groundwater to reduce surface water diversions.

Conveyance losses decrease slightly during a dry year because of the smaller surface water supply, less potential for percolation, evaporation and spillage, and stricter management of a smaller supply. Conveyance losses only decrease about 2 percent from an average year. Similar to an average year, the inventory units with the oldest distribution systems have the largest conveyance losses. Red Bluff East has relatively high conveyance losses because the Corning Canal, an unlined delivery canal, has conveyance losses as it travels through this region.

5.4.2 Supplies

Table 5-5 summarizes water supply in a dry year. CVP supplies are reduced 75 percent from the contract amount. Only two inventory units, Red Bluff East and Corning East, are affected by the decrease in CVP supply because only water districts within these units have CVP contracts. The remaining inventory units experience other effects associated with a dry year, mainly a reduction in local stream diversions.

Table 5-5
Summary of Tehama County Water Supplies in a Dry-Year

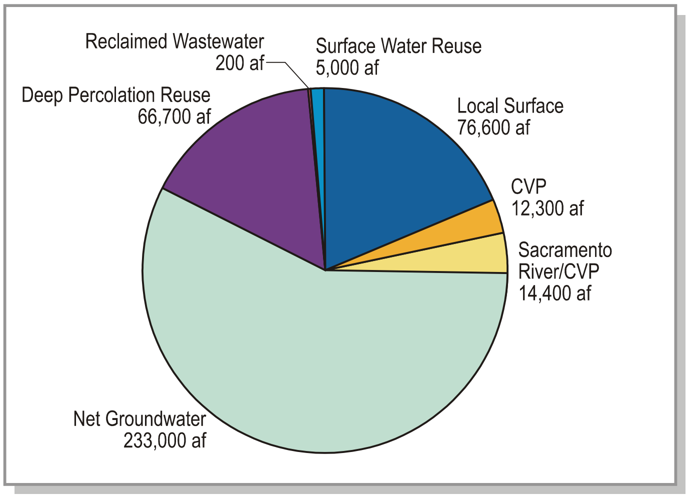
	Water Supplies (Acre-feet)							
Inventory Unit	**Local Stream Diversion**	**CVP[1]**	**Sacramento River/CVP[3]**	**Net Ground-water**	**Deep Percolation Reuse**	**Reclaimed Wastewater**	**Surface Water Reuse[2]**	**Total Water Supply**
Red Bluff East	0	4,600	0	71,800	19,000	200	400	**96,000**
Red Bluff West	100	0	0	2,700	1,200	0	0	**4,000**
Corning East	800	7,700	500	108,900	22,600	0	1,000	**141,500**
Corning West	1,300	0	0	700	400	0	100	**2,500**
Bend	1,800	0	300	0	400	0	100	**2,600**
Antelope	10,400	0	0	19,300	5,100	0	100	**34,900**
Dye Creek	24,400	0	0	5,600	3,900	0	600	**34,500**
Los Molinos	12,800	0	400	9,200	5,300	0	200	**27,900**
Vina	15,600	0	0	10,300	5,300	0	-100	**31,100**
Bowman	0	0	12,700	1,600	2,200	0	800	**17,300**
Rosewood	0	0	1,200	1,000	300	0	100	**2,600**
South Battle Creek	4,400	0	0	1,700	700	0	1,400	**8,200**
West Mountain	0	0	0	200	100	0	0	**300**
East Mountain	5,000	0	0	0	200	0	300	**5,500**
County Total	**76,600**	**12,300**	**15,100**	**233,000**	**66,700**	**200**	**5,000**	**408,900**

Source: Department of Water Resources 2003
1- CVP water from the Corning and Tehama-Colusa Canals. CVP water is cutback 75 percent from total allocations.
2- Reuse is for agriculture, municipal and industrial and wildlife refuge supplies only.
3- Sacramento River riparian users water is not cutback.

In general, in a dry year, net groundwater supply accounts for about 57 percent of total supply, local stream diversions are about 19 percent, Sacramento River riparian users supplies account for 4 percent and surface water reuse is about 1 percent of total water supply. Groundwater extraction within a given area, such as a water district, may be provided from either district owned or private wells. The Sacramento Groundwater Basin accounts for 228,500 acre-feet or 98 percent of net groundwater, relative to 4,300 acre-feet, or 2 percent of net groundwater extractions in the Redding Groundwater Basin.

During a dry year, local stream diversions decrease by 26 percent, relative to supply during a normal year, because of lower precipitation and snowmelt in local rivers and creeks. Vina and Los Molinos Inventory Units have the largest decreases in local stream diversions, 37 percent and 32 percent, respectively. Reductions in local stream diversions are the most severe loss of water and the most widespread among the inventory units.

Sacramento River riparian user's supplies increase in a dry year relative to an average year because in average year they are not using their total water rights allocations. Therefore, these units can increase surface water supplies to compensate for dry year conditions. Sacramento River supply in Bend, Bowman, and Rosewood Inventory Units increases a total 700 acre-feet in a dry year.



Source: Department of Water Resources 2003

Figure 5-12
Tehama County Total Water Supply in a Dry Year

Compared to an average year, net groundwater increases by about 35 percent. Each inventory unit turns to groundwater supply to compensate for higher water needs and smaller surface water supplies. For example, in a dry year, Corning East Inventory Unit loses about 43 percent of total surface water supply. To mitigate for losses and increases in water demand, Corning East increases groundwater extraction by about 28 percent over average year supply. Figure 5-11 (located at end of section) illustrates Tehama County water supply in a dry year by Inventory Sub-unit and Figure 5-12 shows total supply in the County during a dry year.

5.4.3 Net Groundwater Extractions

Groundwater extraction within a given area, such as a water district, may be provided from either district owned or private wells. Table 5-6 summarizes groundwater extractions during a dry year.

Net groundwater extraction during a dry year increases by about 35 percent over net groundwater extraction in a normal year. The 28 percent reduction in local stream diversions and the 75 percent cutback in CVP supplies results in a higher dependency on groundwater as the primary supply source.

Total percolation from both groundwater and surface water sources decreases about 8 percent during a dry year relative to an average year. Deep percolation from groundwater sources increases during a dry year; however, the increase is not substantial because of the larger increase in groundwater extractions. Therefore, during a dry year, the increased groundwater extractions and the decreased total percolation result in a net lowering of the groundwater tables.

Table 5-6						
Summary of Groundwater Extractions in a Dry-Year						
		Groundwater Extraction (Acre-feet)				
Inventory Unit	***Inventory Sub-unit***	***Total Groundwater***	***Surface Water Deep Percolation***	***Groundwater Deep Percolation***	***Net Groundwater Extractions***
Red Bluff East	City of Red Bluff	4,900	0	500	4,400
	Proberta WD	4,600	100	1,100	3,400
	Elder Creek WD	2,400	900	600	900
	El Camino ID	13,500	0	3,100	10,400
	Thomes Creek WD	1,800	400	400	1,000
	Independent	64,000	800	11,500	51,700
Red Bluff West	Rancho Tehama Reserve	400	0	200	200
	Independent	3,500	0	1000	2,500
Corning East	City of Corning	2,800	0	300	2,500
	Thomes Creek WD	1,700	200	300	1,200
	Corning WD	12,300	900	2,000	9,400
	Kirkwood WD	600	0	100	500
	Aaction Tree Farm	29,300	0	3,300	26,000
	Independent	84,800	100	15,400	69,300
Corning West		1,100	200	200	700
Bend		400	400	100	0
Antelope	City of Red Bluff	900	0	100	800
	Los Molinos MWC	400	500	100	0
	Independent	23,300	600	4,200	18,500
Dye Creek	Los Molinos MWC	2,700	5,300	200	0
	Independent	6,800	100	1,100	5,600
Los Molinos	Los Molinos MWC	6,100	1,100	700	4,300
	Stanford-Vina Ranch IC	4,700	1,300	700	2,700
	Independent	3,700	800	700	2,200
Vina	Stanford-Vina Ranch IC	10,900	2,600	1,500	6,800
	Deer Creek ID	1,500	2,300	300	0
	Independent	4,400	0	900	3,500
Bowman	Anderson-Cottonwood ID	1,500	1,900	300	0
	Rio Alto WD	400	0	100	300
	Independent	2,000	100	600	1,300
Rosewood	Anderson-Cottonwood ID	200	200	0	0
	Independent	1,200	0	200	1000
South Battle Creek		2,400	200	500	1,700
West Mountain		300	0	100	200
East Mountain	Mineral County WD	0	0	0	0
	Independent	200	400	100	0
Total		**301,700**	**21,400**	**52,500**	**233,000**

Source: Department of Water Resources 2003

5.4.4 Shortages

Water shortages in Tehama County occur because of decreases in surface water supplies from less precipitation and higher ET values. Table 5-7 summarizes water shortages and total water supply and demand in Tehama County during a dry year with decreases in surface water and groundwater. This particular scenario reduces CVP contact allocations by 75 percent, local stream diversions, and other County water supplies. This analysis of water shortages does not consider groundwater overdraft. Groundwater in the Sacramento Valley generally recovers quickly.

Table 5-7
Summary of Water Supply, Demand, and Shortages in a Dry-Year

Inventory Unit	Surface Water Supply [1] (Acre-feet)	Total Groundwater Supply (Acre-feet)	Total Water Demand (Acre-feet)	Total Water Shortage (Acre-feet)
Red Bluff East	5,000	91,200	98,500	**2,300**
Red Bluff West	100	3,900	4,100	**100**
Corning East	10,000	131,500	150,100	**8,600**
Corning West	1,300	1,100	4,300	**1,900**
Bend	2,200	400	2,600	**0**
Antelope	10,500	24,600	34,900	**0**
Dye Creek	25,000	9,500	44,400	**9,900**
Los Molinos	13,400	14,500	32,200	**4,300**
Vina	15,500	16,800	34,600	**3,400**
Bowman	13,600	3,900	17,900	**400**
Rosewood	1,300	1,400	2,600	**0**
South Battle Creek	6,300	2,400	8,700	**0**
West Mountain	0	300	300	**0**
East Mountain	6,900	200	7,100	**0**
County Total	**111,100**	**301,700**	**442,300**	**30,900**

Source: Department of Water Resources 2003
1-CVP contract allocations are cutback 75 percent.

Increased groundwater use mitigates a portion of the shortage; however, the County does not have adequate groundwater infrastructure to cover all water shortages. Without the infrastructure, the lack of streamflow and cutbacks in CVP supply during a dry year create water shortages in Red Bluff East and Corning East Inventory Units.

In general, inventory units with greater reliance on surface water supplies and relatively higher conveyance losses experience the larger shortages. The cutbacks in CVP supply do not affect the Dye Creek, Los Molinos, and Vina Inventory Units; however, these districts face larger water shortages than most other units. Dry year conditions and high conveyance losses deplete these units' surface water supplies to the point of a shortage. They also do not have the groundwater facilities to extract more water to cover the shortages. Additionally, the influence of the EWP and other environmental programs to purchase water rights could further contribute to water shortages in the County.

Several inventory units do not have water shortages during a dry year. Excluding the Antelope Inventory Unit, all other units without water shortages use less than 10,000 acre-feet of water annually. The Antelope Inventory Unit has a large groundwater supplies in both dry and normal years, lessening the potential to experience a water shortage as long as groundwater levels remain constant.

Table 5-8 summarizes water shortages and total water demand and supply during a dry year with 100 percent CVP cutbacks. Again, the further decrease in CVP supplies only affects Red Bluff East and Corning East Inventory Units because only water districts within these units have CVP contracts. Red Bluff East does not have any alternate surface water supply; therefore, they must rely completely on groundwater sources.

Groundwater supply does not increase over the above scenario even though further cutbacks occur. Therefore, any further decreases in surface water supplies would contribute to the water shortages.

Table 5-8
Summary of Water Supply, Demand and Shortages in a Dry-Year

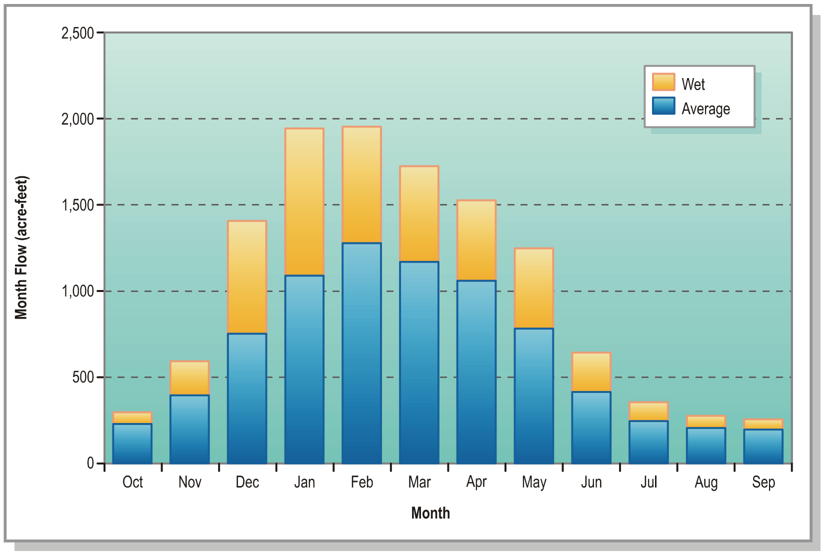
Inventory Unit	***Surface Water Supplies[1] (Acre-feet)***	***Total Groundwater (Acre-feet)***	***Total Water Demand (Acre-feet)***	***Total Water Shortage (Acre-feet)***
Red Bluff East	0	91,100	96,200	**5,100**
Red Bluff West	100	3,900	4,100	**100**
Corning East	1,300	131,500	148,800	**16,000**
Corning West	1,300	1,100	4,300	**1,900**
Bend	2,200	400	2,600	**0**
Antelope	10,500	24,600	34,900	**0**
Dye Creek	25,000	9,500	44,400	**9,900**
Los Molinos	13,400	14,500	32,200	**4,300**
Vina	15,500	16,800	34,600	**2,300**
Bowman	13,600	3,900	17,900	**400**
Rosewood	1,300	1,400	2,600	**0**
South Battle Creek	6,300	2,400	8,700	**0**
West Mountain	0	300	300	**0**
East Mountain	6,900	200	7,100	**0**
County Total	**97,400**	**301,700**	**437,700**	**40,000**

Source: Department of Water Resources 2003
1-CVP contract allocations are cutback 100 percent

5.5 Qualitative Wet-Year Analysis

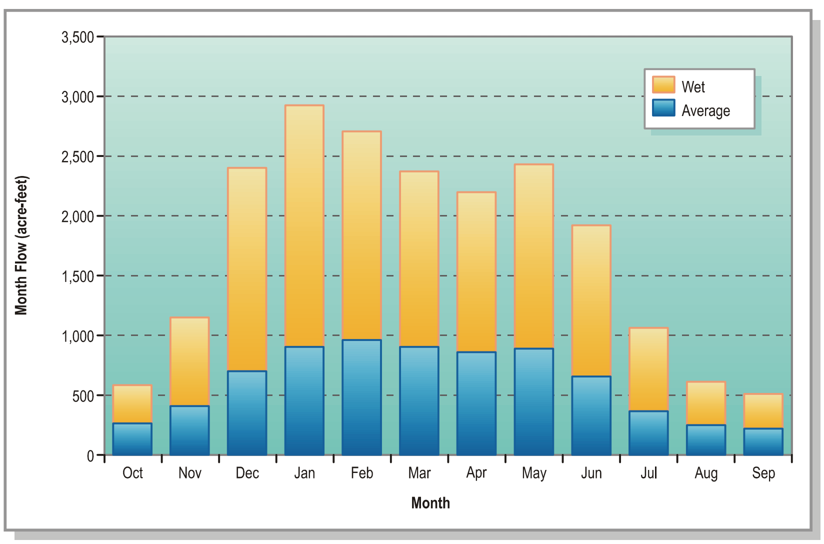
Water demand during a wet year would generally be at or below demand during an average year. The majority of demand is from agricultural and landscape irrigation, which has higher ET at higher temperatures. Wet years would not affect temperature, and therefore, would not affect that component of demand. The applied water is also dependent on the amount of soil moisture present at the beginning of the irrigation season. The soil moisture would likely be higher after a wet winter, which would decrease demand. The decrease in demand would vary from year to year; therefore, this analysis conservatively assumes that demand is the same as in average years.

During a wet year, monthly flows increase during the winter months and into the spring or early summer. Increased flows contribute to the water supply; however, the exact amount is difficult to quantify. Figures 5-13 to 5-16 illustrate monthly flows of four Tehama County creeks. The data is taken from U.S. Geological Survey (USGS) gaging stations on Elder, Deer, Cottonwood and Mill Creeks and represents the average of monthly flows during the period of record versus the average of monthly flows for all wet year classifications during the period of record[1]. Data is reported in acre-feet per day.



Source: USGS 2003

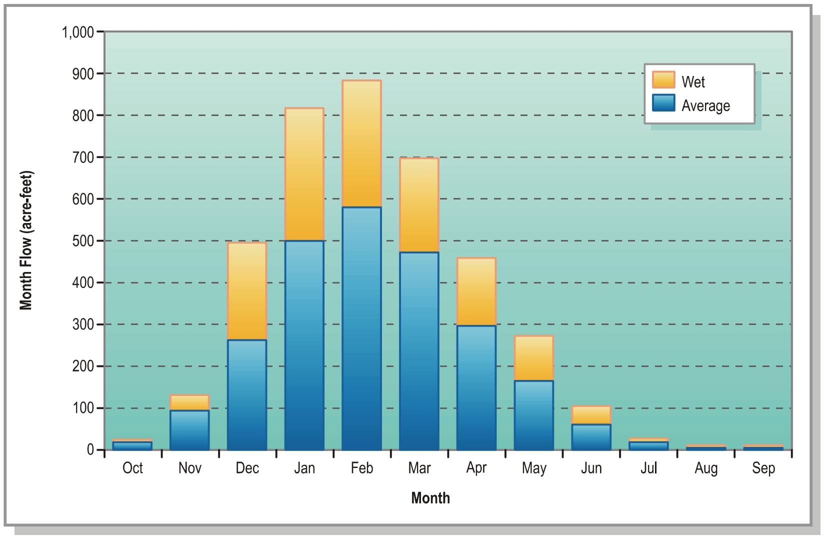
Figure 5-13
Deer Creek Monthly Average Flow for the Period of Record and Wet Year Classifications



Source: USGS 2003

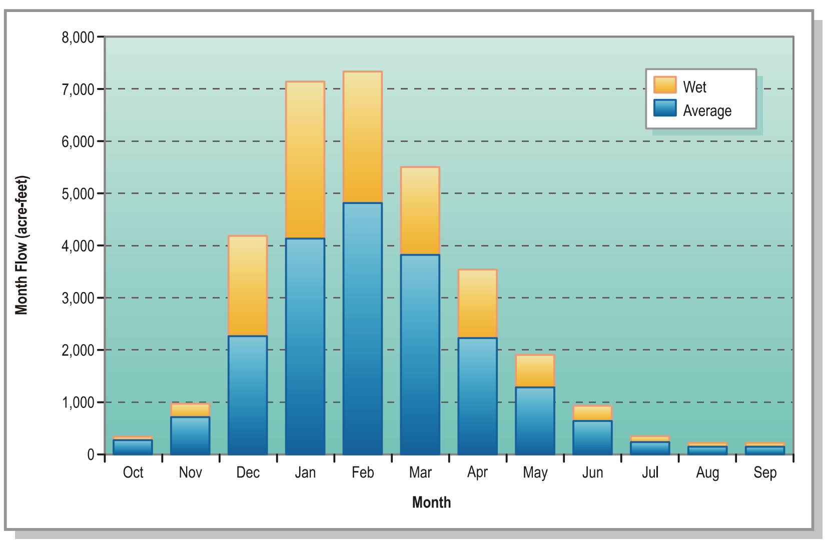
Figure 5-14
Mill Creek Monthly Average Flow for the Period of Record and Wet Year Classifications

1 The period of record varies for each USGS gaging station. Wet year classifications were determined from the Sacramento Valley Index.



Source: USGS 2003

Figure 5-15
Elder Creek Monthly Average Flow for the Period of Record and Wet Year Classifications



Source: USGS 2003

Figure 5-16
Cottonwood Creek Monthly Average Flow for the Period of Record and Wet Year Classifications

In Cottonwood Creek, monthly average flows during wet years range from 3,000 to 7,000 acre-feet per day during December through March, relative to the flows during the period of record ranging from 2,000 to 5,000 acre-feet per day. Increased flows under wet conditions continue through July, although flows are only 116 acre-feet per day above average years. This translates into an average of 3,480 acre-feet of additional water during the month of July from Cottonwood Creek.

During wet years, flows in January show the largest increases over flows during the period of record for all creeks. Elder Creek flows in January during wet years increase 317 acre-feet per day, or 63 percent, over flows during the period of record. This provides an additional 9,510 acre-feet of water during January. Table 5-9 summarizes the maximum increases in supply during wet years for all four creeks.

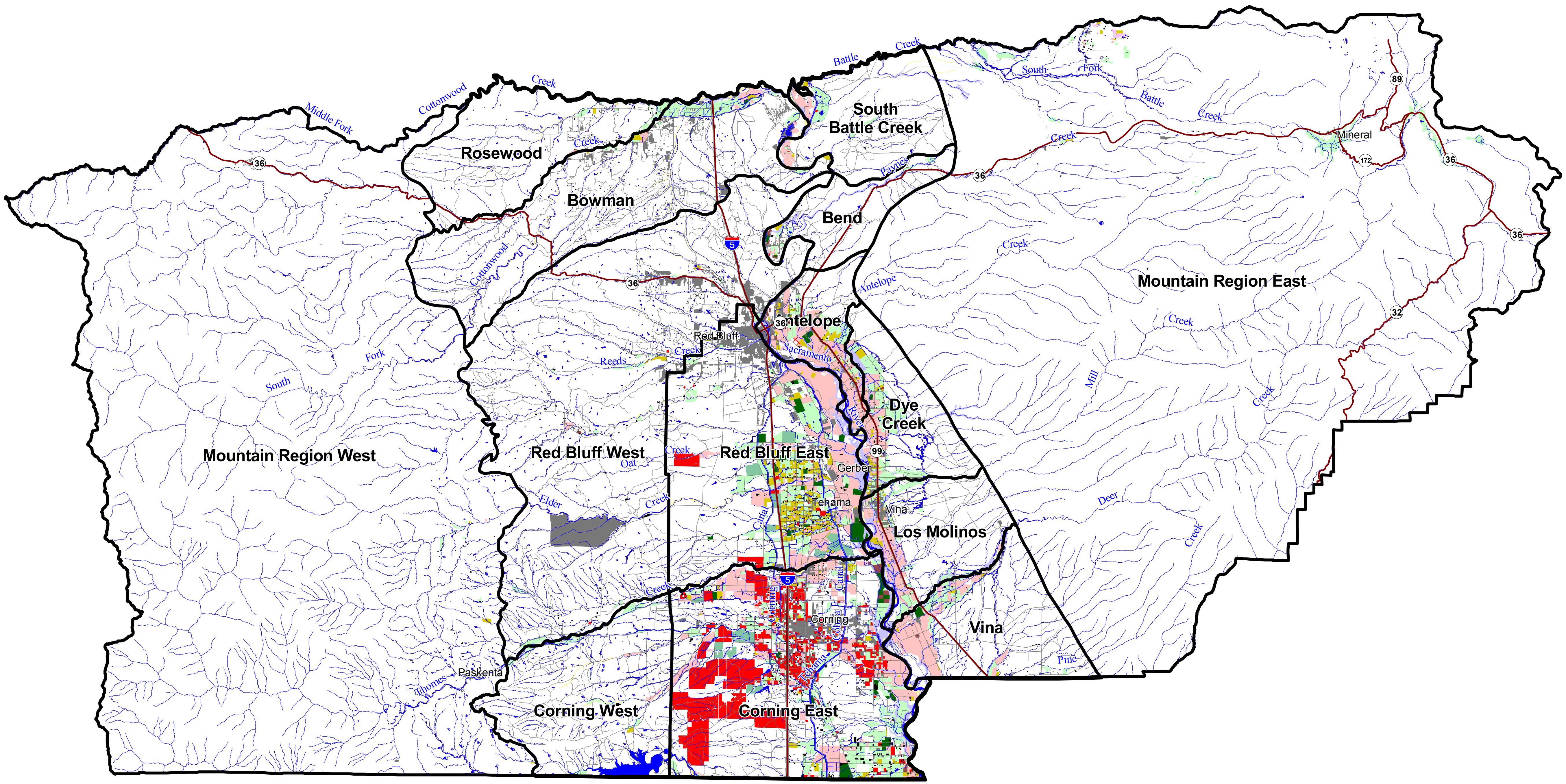
Table 5-9
Summary of Maximum Supply during Wet Years and the Period of Record

Creek	***Maximum Flow, Period of Record, (Acre-feet/day)***	***Maximum Flow, Wet Years (Acre-feet/day)***	***Percent Difference***	***Additional Supply (Acre-feet)***	***Month***
Cottonwood Creek	4,124	7,129	73%	90,140	January
Elder Creek	500	817	63%	9,512	January
Deer Creek	1,081	1,938	79%	25,722	January
Mill Creek	893	2,921	227%	60,865	January

Source: USGS 2003

During wet years, Deer and Mill Creeks have higher flows throughout the year. In Deer Creek, under wet year conditions, flows range from about 230 to 2,000 acre-feet per day. During the period of record, the range is about 180 to 1,200 acre-feet per day. Monthly flows during wet years in Mill Creek increase substantially over flows during average years. In fact, flows increase greater than 100 percent during each month of the year. The total increase in water supply throughout the year from Mill Creek would be above 400,000 acre-feet.

Although this water is not required to meet immediate water demands, it provides other benefits. Additional water would percolate to the aquifers, recharging groundwater levels for future use. It would also provide environmental benefits to fisheries and riparian vegetation by providing the pulse flows necessary for some species. Higher flows and more precipitation would also lower crop ETAW, as previously discussed.



Data Source: Department of Water Resources, Northern District
1999 Tehama County Land Use Survey

Land Use (1999)

Subtropical	Idle	Water	Truck Crops
Deciduous Orchard	Native Barren	Pasture	Urban
Field Crops	Native Riparian	Rice	Vineyard
Grain	Native Vegetation	Semi Ag & Incidental	

N

5 0 5 Miles

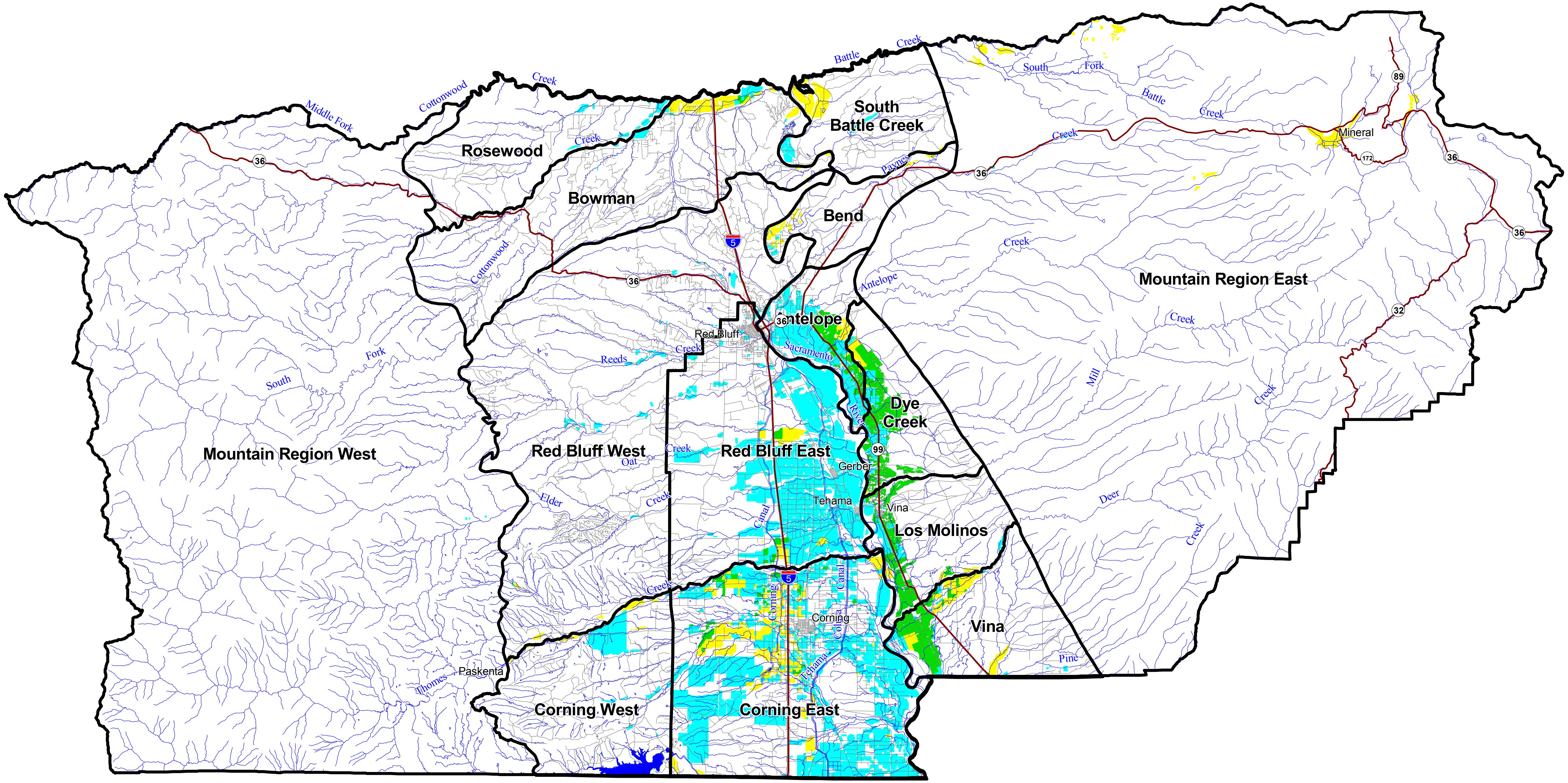
1:411,840

CDM

August 2003

Figure 5-1
Land Use

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-1 Land Use
DATE: Aug 18, 2003 4:28 PM



Data Source: Department of Water Resources, Northern District
1999 Tehama County Land Use Survey

CDM

August 2003

Water Source (1999)

- Surface Water Source
- Mixed Water Source
- Ground Water Source

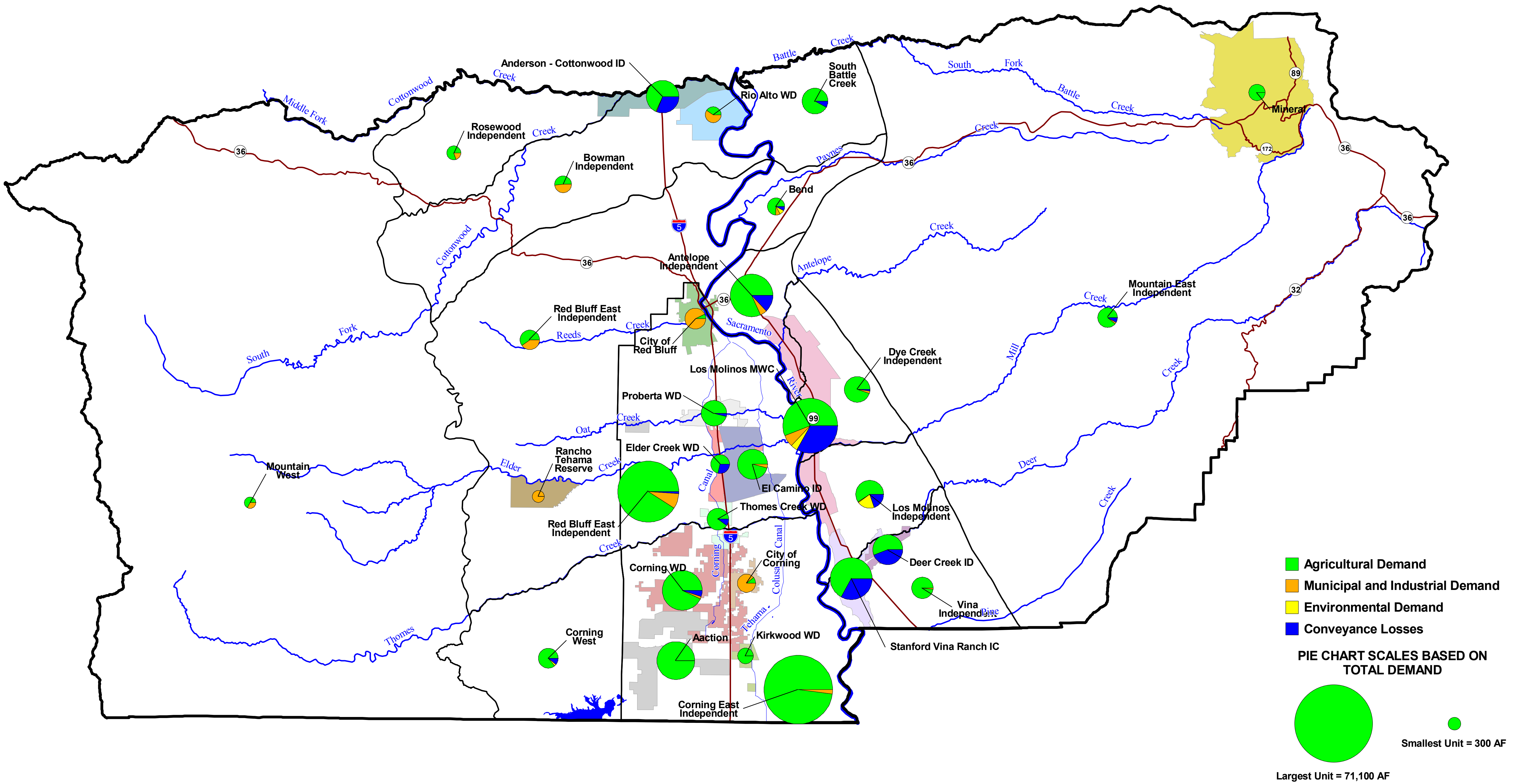
N

5 0 5 Miles

1:411,840

Figure 5-2
Water Source

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-2 Water Source
DATE: Aug 18, 2003 4:27 PM



Data Source: Department of Water Resources, Northern District

CDM

August 2003

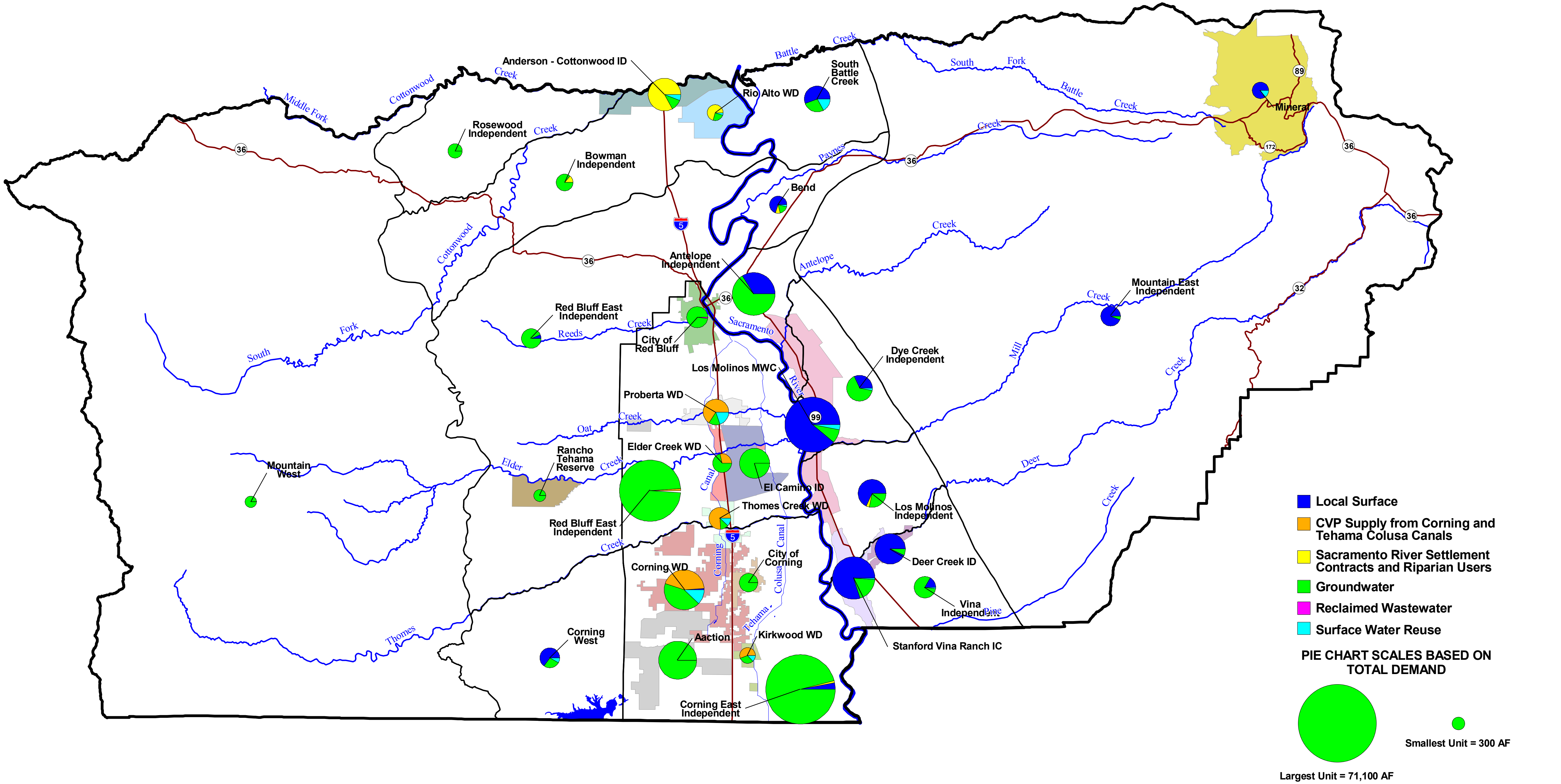
N

5 0 5 Miles

1:411,840

Figure 5-5 Average Year Water Demand

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-5 Average Year Water Demand
DATE: Aug 18, 2003 4:27 PM



Data Source: Department of Water Resources, Northern District

CDM

August 2003

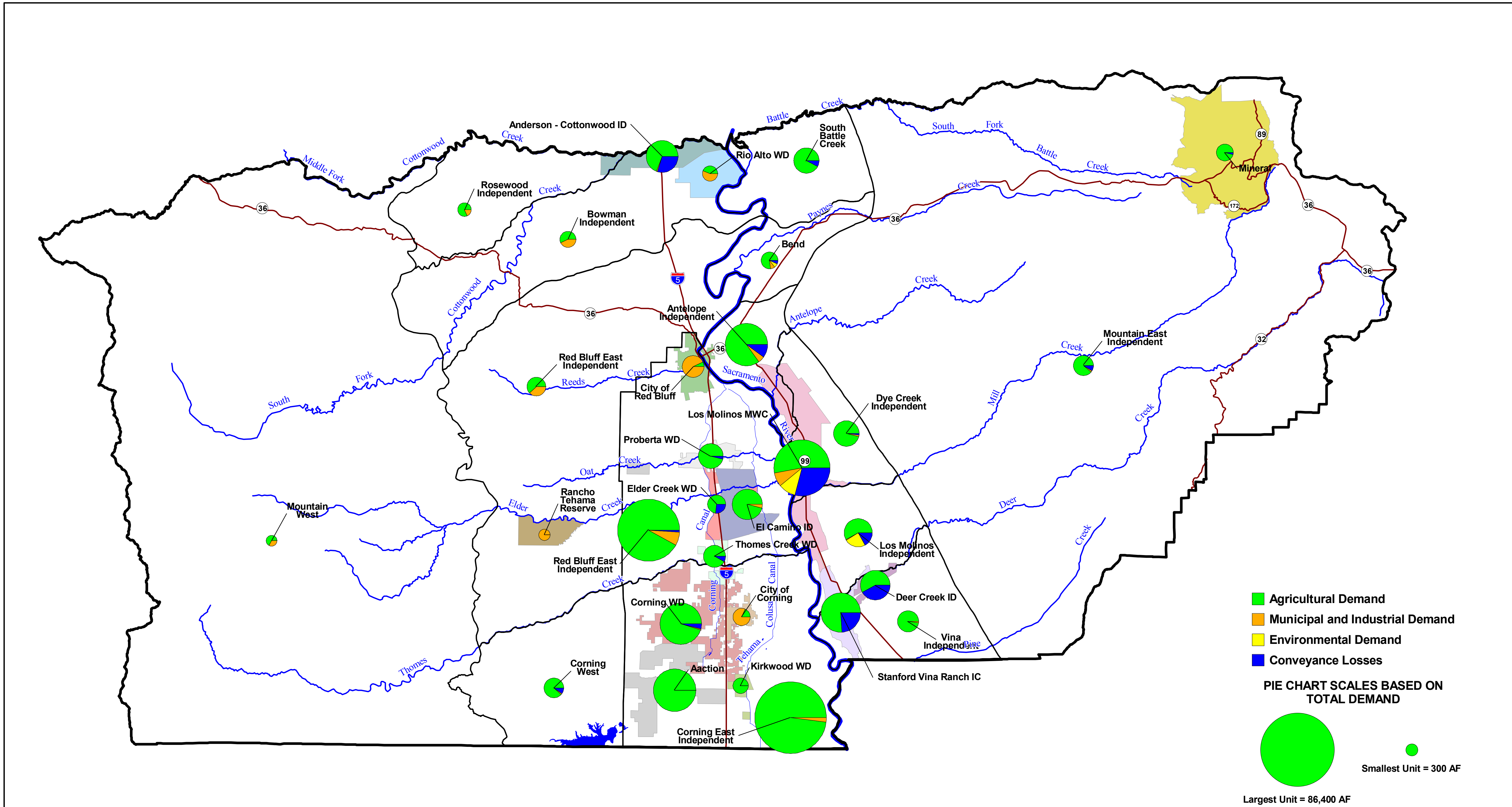
N

5 0 5 Miles

1:411,840

Figure 5-7
Average Year Water Supplies

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-7 Average Year Water Supply
DATE: Aug 19, 2003 1:56 PM



Data Source: Department of Water Resources, Northern District

August 2003

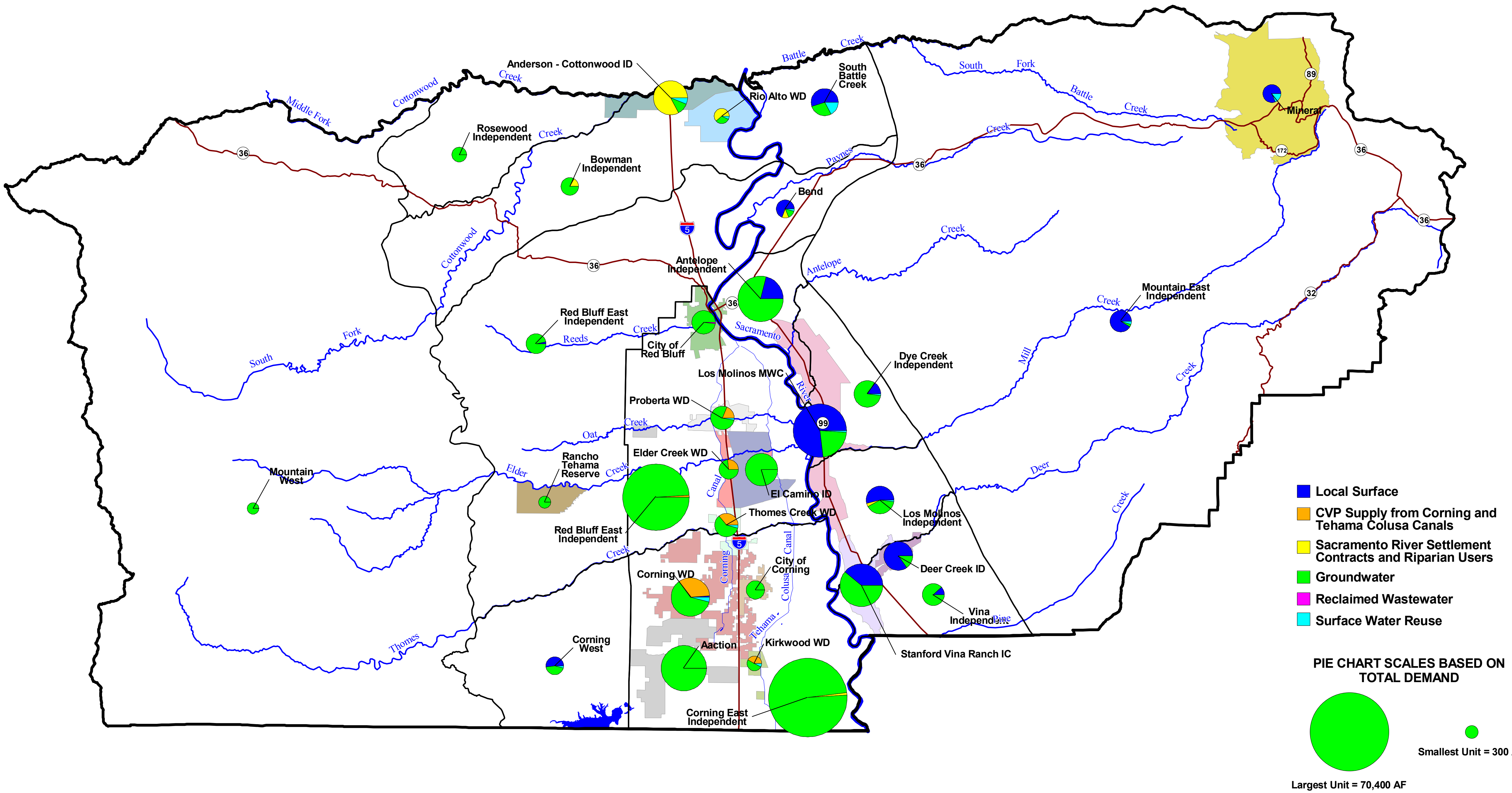
N

5 0 5 Miles

1:411,840

Figure 5-9
Drought Year Water Demand (75% CVP Cutback)

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-9 Drought Year Water Demand 75% Cutback
DATE: Aug 19, 2003 1:56 PM



Data Source: Department of Water Resources, Northern District

CDM

August 2003

Figure 5-11 Drought Year Water Supplies (75% CVP Cutback)

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 5-11 Drought Year Water Supply 75% Cutback
DATE: Aug 19, 2003 1:57 PM

Section 6 Water Quality and Environmental Activities

The water quality and environmental activities being performed in Tehama County tend to focus on:

- The restoration of endangered species and habitats;
- The application of the watershed management process as the means to address a broad range of environmental and stakeholder issues, and provide long-term solutions; and
- The protection and remediation of water associated with man's activity.

This section summarizes the activities being conducted in Tehama County for the protection and enhancement of the natural environment and the groups that are performing this work.

6.1 Water Quality Issues

The following sections discuss surface water and groundwater quality concerns in Tehama County.

6.1.1 Surface Water Quality

The Central Valley Regional Water Quality Control Board (CVRWQCB) monitors surface water quality throughout the Central Valley, including Tehama County. The CVRWQCB developed a Basin Plan for the Sacramento River, San Joaquin River, and their tributaries in 1975. "Basin Plans consist of a designation or establishment for the water within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives" (CVRWQCB 1998). The Plan for the Sacramento River and San Joaquin River Basin identifies seven surface water bodies within Tehama County. These water bodies include the Sacramento River, Battle Creek, Cottonwood Creek, Antelope Creek, Mill Creek, Thomes Creek, and Deer Creek. The beneficial uses that need to be protected within all seven streams include agricultural irrigation and stock watering, contact and non-contact recreation, warm and cold freshwater habitat, coldwater migration, warm and cold water spawning, and wildlife habitat. Several of the streams have additional beneficial uses of public water supply and canoeing and rafting. Water quality objectives are listed for each use, along with a general implementation plan for the protection or restoration of the various uses.

In terms of existing water quality issues, the only water body within Tehama County that is listed on the State of California's 303(d) list of impaired surface waters is the portion of the Sacramento River that flows through the County (SWRCB 2003). It is listed due to toxicity caused by an unknown pollutant at this time. Tehama County is implementing regional monitoring studies and watershed management programs to address surface water quality concerns. (See Section 6.2 for further discussion.)

6.1.2 Groundwater Quality

The Tehama County Department of Environmental Health tracks groundwater quality concerns. Additionally, DHS regulates the quality of public drinking water supplies, which are typically from groundwater within Tehama County.

The groundwater quality issue of recent concern relates to increased levels of fecal coliform[1] and nitrates[2]. This potential groundwater contamination is in the Antelope area, which is the unincorporated area just east of the City of Red Bluff. Farms and ranches in this area have been converted to residential development, including some areas of fairly dense development. Twelve public water systems supply water to area residents, but these systems serve only a fraction of the area. The remaining residents have individual groundwater wells. No wastewater collection and treatment systems exist in this area; therefore, residents typically have septic systems for individual wastewater disposal (DWR 2003).

DHS regularly tests the public water systems and the City of Red Bluff's water system, and it has found these systems to provide safe drinking water. DWR and the Tehama County Department of Environmental Health conducted tests of private wells in 1985 and 1990 for coliform and nitrate; both tests produced similar results. DWR, the Tehama County Department of Environmental Health, and the CVRWQCB began to monitor the groundwater in this area for contamination again in 2002. The tests found elevated levels of coliform and nitrate levels from previous tests. Table 6-1 illustrates results from these tests. Table 6-1 focuses on the number of wells with nitrate concentrations exceeding 45 mg/l because this concentration is the drinking water criterion (DWR 2003).

Table 6-1
Groundwater Quality Samples in the Antelope Area

	1985 and 1990	2002
Wells tested for nitrate	78	88
Wells with nitrate > 45 mg/l	4 wells (5%)	18 wells (20%)
Wells with elevated nitrate (between 22.5 – 45 mg/l)	26 (33%)	28 wells (32%)
Wells tested for coliform		48
Wells with coliform present	2 wells	10 wells (48%)

Source: DWR 2003

1 Fecal coliform is one of several organisms found in the waste of warm-blooded animals, and is generally used as an indicator that constituents from wastewater may be present (DWR 2003).

2 DWR sampled for nitrate because the human body turns nitrate into nitrite, which can prevent blood from carrying oxygen from the lungs to the rest of the body. This condition can be particularly dangerous to infants (DWR 2003).

DWR also sampled water provided by residents, and found 24 samples out of 170 total (14 percent) exceeded drinking water standards for nitrate. Most samples from both DWR and resident samples that exceeded drinking water standards for nitrate were from the more dense residential area west of Trinity Avenue and north of Antelope Boulevard (DWR 2003).

DWR examined potential sources for the nitrate and coliform. Nitrate sources can include fertilizer application, runoff from agricultural husbandry operations, or percolation from septic systems. Because the largest concentration of wells with nitrate is within the residential areas, DWR concluded that the most likely sources are the individual septic systems (DWR 2003).

Currently local agencies are investigating grant funding opportunities to construct a sewage collection system and treatment plant.

6.2 Countywide Environmental Activities

Tehama County includes 12 watersheds recognized by the State of California and U.S. Environmental Protection Agency (US EPA) including Middle Fork Eel, South Fork Trinity, Sacramento-Lower Cow-Lower Clear, Lower Cottonwood, Lower Thomes, Cottonwood Headwaters, Upper Elder-Upper Thomes, Upper Stony, Upper Cow-Battle, Mill-Big Chico, Upper Butte, and North Fork Feather (US EPA 2003).

California Department of Fish and Game *Natural Diversity Database: Special Status Plants, Animals, and Natural Communities of Tehama County* (DFG 1999) lists over 80 "special status" plants, animals, and natural communities as known and potential residents in Tehama County. The plants and animals with the highest status are two grasses and two crustaceans found only in vernal pool habitats, and winter-run and spring-run Chinook salmon. Both the Federal and state government list these six species as endangered. The protection and or restoration of the habitats that support these species are also primary goals in the restoration process.

Tehama County contains two important and threatened habitats: freshwater habitat for salmonid and vernal pools. Vernal pool complexes exist along the I-5 and Sacramento River corridor in Tehama County, as Figure 6-1 illustrates. Keeping complexes intact and preventing pools from becoming isolated are important elements in protecting this unique ecosystem and the species it supports (Snow 1998).

Only a few streams exist in the Central Valley that still provide suitable habitat for salmon to spawn and rear their young and several are located in Tehama County. The Anadromous Fish Restoration Program places a high priority for restoration on Battle, Antelope, Mill, and Deer Creek because of the presence of salmonids in these waterways (USFWS 2001).

6.2.1 Water Conservation

Water conservation in Tehama County is generally a voluntary action by the water customers. Some water and irrigation districts make efforts to promote conservation during dry years. Because supplies are adequate during an average year, conservation generally does not occur. During dry years, the City of Red Bluff and several other small districts run routine inspections for customers wasting water or post notices promoting conservation. The City of Corning developed a drought management plan for water conservation purpose; however, the City has not implemented the plan.

CVP contract renewals require a district to develop a water conservation plan and implement conservation and water use efficiency measures according to the plan. In Tehama County, Kirkwood, Corning, Proberta, and Thomes Creek Water Districts have CVP contracts. Thomes Creek Water District has installed a tailwater recovery system to redirect return flows and make them available for reuse. The District's customers also use efficient irrigation systems for crops, including sprinklers and drip irrigation.

6.2.2 Endangered Species Act

Most of the activities associated with protecting endangered species found in Tehama County involve the restoration of winter-run and spring-run Chinook salmon and the protection of vernal pool habitat. Activities to restore the Chinook salmon are discussed in this section under Habitat Enhancement and Protection and in Sections 6.3, Watershed Groups and Activities, and 6.4, Fish Enhancement Activities.

As mentioned earlier, vernal pools provide habitat for several plant and crustacean species that are listed as endangered or threatened by the Federal government and or the State of California (USFWS 2002, Patricia 1997). They include the Hairy Orcutt Grass (*Orcuttia pilosa*), Slender Orcutt Grass (*Orcuttia tenuis*), Vernal Pool Fairy Shrimp (*Branchinecta lynchi)*, and Vernal Pool Tadpole Shrimp (*Lepidurus packardi)*. Activities to protect this habitat from urbanization, agricultural conversion, unsuitable grazing regimes, and non-native plants have included mapping of the remaining habitat, acquiring property or conservation easements, pilot testing management alternatives, and public outreach and education (Lis et. al. undated, Vendlinsk 2000). The primary government agencies involved in the protection include the US EPA, USFWS, DFG, and Natural Resource Conservation Service. Private groups with a focus on vernal pool protection are TNC, the California Native Plant Society and the Butte Environmental Council.

As part of the Northern Sacramento Valley Sustainable Landscape Project, the locations of vernal pool areas were mapped in Tehama County in the late 1990's (Snow 1998). TNC purchased two areas that contain vernal pool habitat and now operates them as conservation preserves (TNC undated brochures). TNC continues to work with government agencies and conservation groups to target other critical areas for acquisition or conservation easements. The two conservation preserves operated by TNC in Tehama County are Vina Plains and Dye Creek. Both preserves have been pilot testing different cattle grazing regimes and prescribed burnings to demonstrate how ranching can be compatible within vernal pool habitats. All the government agencies and private groups mentioned earlier conduct public education and outreach through workshops, regular meetings, presentations, school programs, field trips, and newsletters.

6.2.3 Habitat Enhancement/Protection

Various activities are being performed throughout Tehama County to enhance, restore, and protect a variety of habitat types beyond vernal pools. These habitats include instream, riparian, and upland areas. Instream and riparian habitats are important elements for the salmonid fisheries enhancement and restoration programs. The upland habitats are important elements within watershed management programs.

The Natural Resources Projects Inventory lists over 50 environmental enhancement projects for Tehama County (California Biodiversity Council undated). Appendix E includes the names and brief descriptions of these projects. Of these projects, 30 of them involve habitat restoration, enhancement and protection including:

- Direct ecosystem restoration (restore riparian vegetation, non-native and noxious weed abatement, erosion control, restore natural geomorphologic processes to stream channels, and addition of gravel to increase spawning habitat); and

- Protection against future ecosystem degradation (development of watershed management plans, land acquisition and easements along flood plains and upland areas to create contiguous or continuous natural areas, rangeland management, fuels management, and mitigation of levee and flood control work along the Sacramento River).

6.2.4 Surface Water/Groundwater Supplies for Environmental Uses

Numerous programs are being implemented in Tehama County to enhance and restore instream flows. Providing adequate instream flows is one of the cornerstone elements of the salmonid enhancement/restoration program. Minimal instream flow regimes are being established for all streams with native salmonid populations on a seasonal basis. These needs are then being considered in compilation with current demands from agricultural and hydroelectric users, along with current supplies. The activities involve:

- Purchasing of water rights from willing sellers;

- Working with power generators to increase downstream releases;

- Working with agricultural users to reduce surface water diversions during critical periods in the fishes' lifecycle; and

- Locating groundwater supplies for farmers to use in order to reduce their dependence of surface waters.

Most of these activities are associated with the salmon and steelhead enhancement/restoration programs being conducted on Mill Creek, Battle Creek, Deer Creek and the Sacramento River. These programs and the individual projects to maximize instream flows are discussed in more detail in Section 6.4.

6.2.5 Water Quality Restoration/Protection

The activities to restore and protect the quality of surface waters in Tehama County are primarily implemented through the National Pollutant Discharge Elimination System (NPDES), regional monitoring studies, and watershed management programs.

The NPDES programs control point source discharges from both publicly owned wastewater treatment plants and industrial facilities. Stormwater discharges from urban areas and, possibly agricultural nonpoint discharges in the future, are also controlled under NPDES. Permits to discharge require the discharges meet certain water quality standards, monitor both the discharges and the receiving waters, and implement treatment and best management practices to control pollutants found in the wastewater and runoff.

Special studies are being conducted to characterize the quality of surface waters and the effectiveness of management alternatives. Monitoring water quality is the classic method for identifying environmental impacts, problems, and improvements. Regional monitoring programs are being implemented under the Sacramento River Basin National Water Quality Assessment program being implemented by USGS. Specialty studies to investigate the control of pesticides and metals are being performed by the State Water Resource Control Board, Regional Water Quality Control Board, Sacramento County Regional Sanitation District, Natural Resource Conservation District, and US EPA.

Watershed groups that are discussed in Section 6.3 are also implementing water quality activities through individual watershed management plans. Protecting and restoring water quality is one of the key goals to any watershed plan. Currently, the main focus has been on public outreach and the education of residents and landowners on the impacts their activities can have on water quality.

6.3 Watershed Groups and Activities

There are four watersheds with active citizen-based groups in Tehama County along with two Resource Conservation Districts (TCRCD undated). The watershed groups represent Battle Creek, Cottonwood Creek, Mill Creek, and Deer Creek. Tehama County and Vina are the two Resource Conservation Districts. A fifth watershed group may be active for Thomes Creek but no information is available. This section presents an overview of each group and district including the organization, mission, and activities. Table 6-2 includes the contact information for these organizations, as listed on the website for the Tehama County Flood Control and Water Conservation District.

Table 6-2
Watershed Groups and Resource Conservation Districts

Organization	Address
Battle Creek Watershed Conservancy	P.O. Box 606 Manton, CA 96059
Cottonwood Creek Watershed Conservancy	P.O. Box 1198 Cottonwood, CA 96022
Deer Creek Watershed Conservancy	580 Paseo Comtenaros Chico, CA 95928
Mill Creek Conservancy	P.O. Box 188 Los Molinos, CA 96055
Tehama County RCD	2 Sutter Street, Suite D Red Bluff, CA 96080
Vina RCD	P.O. Box 274 Vina, CA 96092

The Tehama County Flood Control and Water Conservation District and the Tehama County Resource Conservation District (TCRCD) were responsible for coordinating a joint meeting with Cottonwood Creek Watershed Group, and Battle Creek, Mill Creek, and Deer Creek Watershed Conservancies as part of the interview process. Only Battle Creek Watershed Conservancy and the TCRCD were available to participate. Information regarding watershed groups not a part of the interview process is taken from websites as referenced below.

There is also number of organizations dedicated to the preservation of the Sacramento River in terms of water supply, water quality, biodiversity, salmon and steelhead habitat, and riparian areas. These organizations include:

- Sacramento River Watershed Program (www.sacriver.org)
- Upper Sacramento River Exchange (www.riverexchange.org)
- Sacramento River Riparian Habitat Program (www.sacramentoriver.ca.gov)
- Sacramento River Preservation Trust (916 345-1865) (www.sacrivertrust.org)
- Sacramento River Discovery Center (530 527-1196) (www.srdc.tehama.k12.ca.us)
- Sacramento River Conservation Area Forum (530-528-7411) (www.sacramentoriver.ca.gov)

6.3.1 Battle Creek Watershed Conservancy (BCWC)

The Battle Creek Watershed Conservancy (BCWC) was organized in 1997 to provide representation for landowners, stakeholders, and residents of the watershed as planning moved forward for the restoration of Battle Creek. Information presented in this section was taken directly from their web site at www.battle-creek.net.

The overall goal of the BCWC is:

> *"To preserve the environmental and economic resources of the Battle Creek watershed through responsible stewardship, liaison, cooperation, and education."*

The BCWC considers both creek and land uses of the watershed, their impact on natural processes, and the long-term health of the entire watershed.

BCWC is actively involved in the Battle Creek Salmon and Steelhead Restoration Project being implemented by Reclamation. Recent activities have included reviewing and contributing to the Environmental Impact Statement and Environmental Impact Report. The BCWC Board has also been actively involved in the Coleman National Fish Hatchery reevaluation.

The BCWC is looking beyond the Battle Creek Salmon and Steelhead Restoration Project to long-term protection of this investment through watershed stewardship. BCWC received several grants to implement a number of tasks in two phases. Phase I included direct ecosystem restoration (noxious weed abatement), protection against future ecosystem degradation (fuels management, conservation easements), improvement of degraded habitats, and public education and outreach. Phase II is designed to enhance BCWC's linkage between the local communities and the resource agencies currently implementing CALFED's Battle Creek Salmon and Steelhead Restoration Project, to gather field data on land-use factors that affect the watershed and its fishery for a watershed assessment document, and to develop an electronic watershed information integration tool based on the KRIS.

6.3.2 Cottonwood Creek Watershed Group (CCWG)

The CCWG was formed in 1998 in answer to a growing concern about land and water management issues (Cottonwood Creek Watershed Group 2003). It is made up of landowners in the watershed who are working with a number of government agencies and private groups. The mission of the CCWB is to preserve the environment, private property and water rights, and economic resources of Cottonwood Creek watershed through responsible stewardship, liaison, cooperation and education.

CCWG is a broad-based, very active group that works in a collaborative fashion with its technical advisory team. The team is comprised of federal, state and local agency representatives that provide natural resource expertise to the watershed group. Recent activities have included the hiring of a watershed coordinator, mapping the watershed, and completing a comprehensive watershed assessment (TRCD 2001 and 2002). CCWG has participated cooperatively with the efforts of other parties on various watershed activities. This includes fuels management planning by Shasta

County, Tehama County, U.S. Forest Service, and the California Department of Forestry and Fire Protection; and planting projects on the Cottonwood Creek Wildlife Area, which is owned and managed by DFG. It is also providing environmental education via monthly stakeholder meetings; a quarterly newsletter to all residents in the watershed and other interested parties; and, in cooperation with the public school system, a comprehensive environmental education program for all schools in the watershed (Swearinger 2003). A website for the public school cooperative program is http://www.eusd.tehama.k12.ca.us/Watershed.html.

6.3.3 Mill Creek Watershed Conservancy

The Mill Creek Conservancy (P.O. Box 188, Los Molinos, CA 96055) is a non-profit corporation formed by landowners and concerned citizens whose primary goal is to protect the resources of the Mill Creek Watershed (American Rivers undated). Their mission is to ensure Mill Creek retains its historical pristine condition by promoting resource protection and compatible land uses that help to sustain the outstanding natural environment. The Conservancy was formed in 1994 in response to the possibility that segments of Mill Creek would be added to the California Wild and Scenic Rivers System. The members feared the new designation would bring unnecessary government regulations and increased public access to remote pristine habitat.

The Conservancy is involved with the restoration of native vegetation along the lower eight miles of Mill Creek. The project was begun in 1996. Several pilot projects have been performed on small parcels to test various restoration methods.

The Conservancy has also developed a Mill Creek Watershed Management Strategy and a Mill Creek Watershed GIS program. They are working with: the USFS to remove feral cattle from the watershed; several government and private entities to monitor anadromous fish; The Nature Conservancy to purchase conservation easements; and other government agencies to acquire land exchanges (TRCD 2001 and 2002).

6.3.4 Deer Creek Watershed Conservancy (DCWC)

Deer Creek Watershed Conservancy was formed as a non-profit organization made up entirely of watershed landowners. Information presented in this section was taken directly from their web site at http://deercreekconservancy.com.

The landowners joined together in 1994 with resource managers in response to a proposal to include Deer Creek in the Wild and Scenic Rivers Act. Fearing a threat to private property rights and government regulations, the landowners within the watershed felt that a wild and scenic designation for Deer Creek was an unacceptable substitute for responsible past, present and future landowner stewardship.

The Conservancy is focusing its attention on preserving the natural resources of Deer Creek through sensitive stewardship practices. The Conservancy also serves as a forum for communication and group action within the Deer Creek watershed. The goals of the DCWC include:

1. Optimize use of public and private resources to develop, adopt and implement a management strategy for the Deer Creek watershed that will provide clear guidance for resource conservation and land-use for present and future generations.

2. Foster conservation, restoration and sound resource management in the Deer Creek watershed. Achieve long-term sustainability of watershed processes, natural resources, and economic viability and preserve the cultural heritage and resources within the watershed.

3. Respect and protect private property rights and public resources.

4. Apply an ecosystem and multi-species approach to maintaining biodiversity and the conservation of native habitats in the Deer Creek watershed. Base management decisions on sustaining ecosystem functions in response to long-term changes and/or unexpected occurrences.

5. Protect and enhance the long-term productivity of the Deer Creek aquatic ecosystem with special consideration for spring-run Chinook salmon, fall-run Chinook salmon and steelhead populations and the quality of their habitat.

6. Manage watershed lands so as to minimize unnatural rates of erosion and sedimentation.

7. Encourage good land stewardship practices through education, research and public outreach.

8. Eliminate duplication of effort by agencies/organizations through improved communication and cooperation.

9. Develop a long-term monitoring program that provides continuous evaluation of key watershed conditions.

To achieve maximum resource protection and provide a “functional equivalent” for wild and scenic, the Conservancy initiated and drafted legislation to preclude any future dams, diversions, reservoirs or impoundments on Deer Creek. AB1413 passed unanimously in both houses of the legislature.

Deer Creek Watershed Conservancy then took the lead in developing a watershed management plan for Deer Creek. The Deer Creek Watershed Management Plan consists of Part I - the Watershed Management Strategy and its support document Part II - the Existing Conditions Report. Other background reports being prepared under the direction of DCWC address: 1) the history of man’s activities in the Deer

Creek Watershed; 2) governmental and non-governmental institutions involved in the management of the watershed; 3) Federal, State, and County laws and policies protecting the natural, cultural, and socio-economic resources; 4) plans and programs affecting the management of Deer Creek and the Deer Creek Watershed; and 5) economic conditions in the watershed (DCWC 2001).

Current activities being performed by DCWC include: assisting the DWR with the Deer Creek Water Exchange Project; working with private landowners to grant DFG permission to cross their lands to maintain fish ladders and screens; seeking funds to allow water quality monitoring to continue; developing the *Deer Creek Canyon Contingency Spill Plan and Assessment*; implementing the Deer Creek Sediment Control and Erosion Project along logging roads; removing exotic species from the creek and replacing them with native vegetation; instituting the *Deer Creek Spring-Run Chinook Salmon Protection Program*; developing funding to initiate and proceed with the *Deer Creek Flood Plan*; sponsoring a Rangeland Water Quality Ranch Course and providing assistance to ranchers to implement management practices identified in the course; developing the *Deer Creek Fire Management Framework*; developing a watershed education curriculum for grades K-12 called "Creeksiders"; and publishing newsletters and an annual report.

6.3.5 Tehama County Resource Conservation District

The Tehama County Resource Conservation District encompasses all of Tehama County except the incorporated areas (the cities of Red Bluff, Corning and Los Molinos) and the Vina Resource Conservation District, located in the southeastern corner of the County. The District contains approximately 1.7 million acres (92% of the Tehama County) and 28,000 people (62% of the County's total population). Tehama County itself is 1,904,000 acres (TCRCD undated). Tehama County Resource Conservation District maintains an informational website at http://tehamacountyrcd.org.

Resource Conservation Districts have been in Tehama County since the mid 1940's. In 1987, TCRCD was formed by consolidation of the Corning District, Cottonwood District, and the Lassen View District. According to their *Long-Range Plan*, the TCRCD "envisions a balance of uses of the county's natural resources, where all land use decisions are socially acceptable, environmentally sound and economically feasible." Their stated mission is to assist people to manage, conserve and improve the natural resources of Tehama County, and to improve the quality of life for all county residents and visitors through an enhanced environment.

In order to achieve the long-term vision, the TCRCD concentrates its activities on budget and administration, education and outreach, and watershed management. According to a TCRCD publication, completed and current activities include:

- Host workshops on watershed health, geomorphology and agland protection;

- Conduct GIS mapping, workshops, local school outreach, restoration projects in the Reeds Creek and Red Bank Creek watersheds;
- Oversee elderberry mitigation, perform noxious weed surveys, and conduct a feasibility study for use of small diameter wood harvested from local forests;
- Provide a watershed coordinator for public education and outreach, invasive species control, and acquiring funding;
- Organize a citizens monitoring program in the Reeds Creek and Red Bank Creek watersheds;
- Produce a booklet entitled, "Beneficial Plants of Tehama County" to assist landowners in identifying native and non-native plants; and
- Provide free irrigation system evaluations to local farmers.

6.3.6 Vina Resource Conservation District (VRCD)

The Vina Resource Conservation District (VRCD) is located in the southeast corner of Tehama County, covering roughly the same area as the Deer Creek watershed. The VRCD works closely with the Deer Creek Watershed Conservancy to preserve natural resources, private property rights, and responsible land stewardship. They have received a number of grants that has allowed the VRCD to contribute funds to many of the activities listed earlier under the section on the DCWC (TCRCD undated).

6.4 Fish Enhancement Activities

The Anadromous Fish Restoration Program developed under the CVPIA identified several streams in Tehama County as having exceptionally high restoration potential for native salmon and steelhead fisheries. The Restoration Program also listed several factors commonly found in most streams that limit restoration and enhancement. These factors involve low instream flows, restricted passage, impacts on land use and riparian areas, suitable spawning gravel, and degraded habitat.

In response to the Program, several stream-specific programs and one statewide program have implemented within Tehama County to enhance fisheries. This section summarizes the programs for:

- Deer Creek
- Mill Creek
- Battle Creek
- Sacramento River at the Red Bluff Diversion Dam
- Environmental Water Acquisition Program

6.4.1 Deer Creek Water Exchange Pilot Program

In 1986, four additional pumps were installed at the Banks Pumping Plant in the Delta Region to increase the plant's capacity to pump and divert water. The DWR was required to mitigate for additional fish loss anticipated by the increased pumping by funding restoration programs targeted at striped bass, steelhead trout, and Chinook salmon populations. DWR and DFG signed the Delta Pumping Plant Fish Protection Agreement in 1986, which is commonly known as the 4-Pumps Agreement. The agreement established an annual mitigation program for improving salmon habitat in the Sacramento River and San Joaquin tributaries, along with a $15 million fund to pay for such projects. The agreement has also created a law enforcement unit to combat poaching, as well as a program to expand and modernize the Merced River Fish Hatchery. A recently funded project included the exchange of groundwater for surface water diversions in Deer Creek (DWR 2000).

DCID and DWR have developed a water exchange pilot program that would evaluate the feasibility of the district using groundwater to supply a portion of its water needs instead of surface flow from Deer Creek (DCID 2003). The excess surface water would be allowed to bypass stream diversion points and would provide adequate flows for anadromous fish during low-flow periods throughout the year. DCID and DWR have coordinated with DFG to determine when the additional instream flows would be most beneficial. Since Deer Creek represents one of the State's largest undammed watersheds, it provides valuable habitat for spring run, fall run and late fall run Chinook salmon, and steelhead trout. The water exchange pilot program represents an opportunity to improve fish habitat and passage on Deer Creek

The pilot program is a one-year study. One test-production well was installed in January 2003. The well will be operated for a minimum of 60 days and a maximum of 90 days during the critical period of April to October 2003 when salmon and steelhead require sufficient flows to migrate into or out of Deer Creek and to hold over. The total volume of groundwater pumped will not exceed 750 acre-feet and all of it will be pumped into the District's distribution system. A like amount of surface water will be allowed to bypass the District's diversion structure on Deer Creek and continue downstream (DCID 2003).

Pumping will be conducted in accordance to guidelines set forth in DCID's *Groundwater Management Objectives*. The overall management goals are to "maintain the groundwater surface elevation at a level that will assure an adequate and affordable irrigation water supply, and to assure a sustainable supply of good quality groundwater for agricultural and domestic use." The performance of the aquifer test, identifying the changes in groundwater levels associated with pumping from this new source, and the associated monitoring and reporting requirements will all be used to assess the feasibility of an expanded surface water/groundwater exchange program. If the pilot study finds groundwater can be exchanged for surface water, an expanded program may be developed. Before the program could begin pumping water, Tehama County's Ordinance 1617 required the program to obtain a groundwater export permit.

6.4.2 Mill Creek Fish Passage Program

The goal of the Mill Creek Fish Passage Program is to provide enhanced fish passage conditions for the migration of both adult and juvenile Chinook salmon and steelhead trout that are native to the Mill Creek watershed. The two main problems being addressed by this program are the damaged and obsolete fish passage structures at Clough Dam and the inadequate flows in the lower portion of Mill Creek. Removing these two barriers will help to advance ecosystem and endangered species recovery on Mill Creek.

The Clough Dam was scheduled for removal as the result of being damaged during flood flows in 1997. Instead of repairing the dam and its fish passage structures, the dam was replaced with an inverted siphon to allow unimpeded fish passage while maintaining water deliveries. Water was diverted through the Los Molinos Mutual Water Company diversion ditch, siphoned under Mill Creek, and discharged into the Clough ditch (DWR 2000). Funding for the project was awarded through CALFED in 1999 and the project was completed in the fall of 2002.

Enhancing in-stream flows will require securing an adequate supply of water for environmental purposes in the lower portion of Mill Creek. A proposed plan for addressing this issue and the associated background information are presented in the document, *Draft Environmental Assessment/Initial Study for Mill Creek Anadromous Fish Adaptive Management Enhancement Plan* (Reclamation 2000). Ultimately, a long-term water supply program will be developed to enhance the in-stream flows during below average and dry water years. At present, the proposed program consists of three components:

1. The purchase of Mill Creek water right entitlement to provide environmental water that will be dedicated to in-stream uses in Mill Creek.

2. Providing readily available funds to accomplish other fish passage needs.

3. Conducting studies to develop the most efficient and economical long-term solution to the fish passage problem.

Environmental water would come from a Mill Creek water right entitlement purchased by the Orange Cove Irrigation District (OCID) of the San Joaquin Valley. According to the Draft Plan, OCID has secured the right to purchase certain water rights on Mill Creek. This water would be dedicated to in-stream use from October 16th through June 30th in exchange for some form of credit towards OCID's CVPIA restoration fees. From July through October 15th, this water would be made available to the LMMWC. During the period when the surface water is left in Mill Creek, groundwater pumping will be used to meet the required irrigation needs. The environmental water supply will remain in the Sacramento River and Bay/Delta system for further environmental enhancement and will not be exported south from the delta (Reclamation 2002d and 2002e).

Additional coordination between the OCID and LMMWC will be developed to allow spring-run pulse flows to occur. These pulse flows are important for triggering fish migration in Mill Creek. California Department of Fish and Game has been coordinating with project participants and LMMWC has provided pulse flows at their direction.

The OCID recognizes the plan may be modified or expanded once in-stream target flows are established. Preliminary flow requirements have been proposed as starting points, but further studies and adaptive management will be needed to fine tune the program to assure the required in-stream flow in dry water years are available without causing economic harm to the other water users.

The program would also establish a fund to be used for fish passage monitoring, riffle modification, and to study water distribution conservation opportunities, conjunctive use opportunities, fishery in-stream flow needs, and fishery biology. The OCID plans to act as a coordinator between local, state, and federal agencies and to prepare reports on the programs progress. To date, the project has yet to be implemented pending resolution of funding and decisions pertaining to long-term project participation and maintenance.

6.4.3 Battle Creek Fish Passage Activities

Activities to enhance fish passage and habitat on Battle Creek are presented in two documents, *Battle Creek Salmon and Steelhead Restoration Plan* (Kier Associates 1999) and *Maximizing Compatibility Between Coleman National Fish Hatchery Operations, Management of Lower Battle Creek, and Salmon and Steelhead Restoration* (Kier Associates 1999b). The Salmon and Steelhead Restoration Plan focuses on 42 miles of Battle Creek above the Coleman National Fish Hatchery (CNFH) that includes the main stem along with both the north and south branches (Keir Associates 1999). These reaches are affected by the Battle Creek Hydroelectric project, which is own and operated by PG&E (Keir Associates 1999b). The CNFH compatibility document addresses operations of the CNFH and the lower portion of Battle Creek from the CNFH barrier dam to the confluence with the Sacramento River to promote fishery enhancement throughout the Battle Creek watershed.

The primary objectives of the Battle Creek restoration effort is to open up over 42 miles to spring-run and winter-run Chinook salmon and steelhead trout by correcting problems associated with ineffective fish ladders, unscreened diversions, and inadequate stream flows. PG&E is open to working cooperatively towards improving fish passage by modifying and removing its various hydroelectric facilities on Battle Creek. The major tasks include:

- Installing fish ladders and fish screens at the North Battle Creek Feeder Diversion Dam on the North Fork and Inskip and Eagle Canyon Diversion Dams on the South Fork;

- Removing Wildcat, Coleman, Soap Creek, Lower Ripley, and South Diversion Dams and associated facilities; and

- Installing pipeline connections between powerhouses and diversion-canal intakes to prevent trans-basin water diversions from causing false attraction of salmonids at the Inskip and South hydroelectric facilities.

Operations at the CNFH must be compatible with the fish passage enhancement program proposed for the portion of Battle Creek upstream the hatchery. Although located on Battle Creek, the primary purpose of the CNFH is to mitigate salmonid native to the Sacramento River that was impacted by the construction of Shasta Dam. Specific fish passage issues raised in the Kier report (Keir Associates 1999b) that need to be addressed include:

- The hatchery diverts flow from Battle Creek and uses water intakes that do not include fish screens; and

- The fish ladder at the CNFH barrier dam is closed for up to eight months, denying a majority of the returning salmon access to upstream reaches.

The Kier report proposed installing fish screens at all three intakes and diverting water at an individual intake only when the fish screen is known to be operating correctly. The schedule when the fish ladder at the CNFH barrier dam is open could be modified to open the upstream reaches to more fish. Modifications or upgrades to the existing barrier dam and ladder were also proposed to improve fish management such as separating hatchery-produced fish from wild stock. Other proposals include isolating the hatchery from Battle Creek or moving it to a new location on the Sacramento River to separate Sacramento fish stocks from Battle Creek wild fish stocks, and to open up the Battle Creek watershed to all its native wild salmonid.

6.4.4 Fish Passage Improvements at Red Bluff Diversion Dam

The Red Bluff Diversion Dam is operated to provide water for agricultural uses. Adjustments to its operations have been made throughout the years to reduce its negative effects on both upstream and downstream fish migration. Fish ladders have been installed and, currently, its gates are closed for only four months during the summer, which limits fish passage, and are open for the remaining eight months, which allows unrestricted passage.

Further modifications are being considered to improve both fish passage and the reliability of the agricultural water supply. Six alternatives have been proposed. These alternatives are defined in the Federal Register (Reclamation 2002).

1. No action and the current operating conditions remain the same.
2. Addition of a new fish-friendly channel around the dam to be operated when the dam is closed for four months. Sufficient flows would be provided in the channel to attract and transport fish moving either upstream or downstream. A new pumping station with 1700 cfs capacity would be constructed to provide a reliable water supply.
3. Increase the flows through the existing fish ladders when the dam is closed for four months. Increased flows would attract and transport more fish. A new pumping station with 1700 cfs capacity would be constructed to provide a reliable water supply.
4. Reduce the time the dam is closed to two months. Increase the flows through the existing fish ladders when the dam is closed. Construct a new pumping station with a larger capacity (2000 cfs) to offset the reduction in available water caused by the shorter dam closure.
5. Reduce the time the dam is closed to two months. Construct a new pumping station with a larger capacity (2000 cfs) to offset the reduction in available water caused by the shorter dam closure. No changes in the operations of the existing fish ladders.
6. Keep the gates open year round and provide unrestricted fish passage. Construct a new pumping station with a capacity (2500 cfs) that could supply the entire agricultural water demand on a year round basis.

Federal and state agencies, as well as the Tehama-Colusa Canal Authority, have selected the alternative that keeps the dam open year round (Alternative #6 above) as the preferred alternative. However, some local groups and the City of Red Bluff oppose this alternative because Lake Red Bluff will no longer be created every summer. Local groups do not want to lose this recreational resource. Governing agencies have said they will consider impacts on other interests and find a solution such as creating the lake for a two-week period in July to accommodate an annual powerboat racing event (DFG 2002).

The draft EIS/EIR was released in September 2002 for comments. In August 2003, Reclamation tentatively proposed to leave Red Bluff Diversion Dam operations as they stand. The decision, however, is tentative and a Record of Decision on the Fish Passage Improvement Project at the Red Bluff Diversion Dam is expected later in 2003.

6.4.5 U.S. Department of the Interior Water Acquisition Program

A major feature of the CVPIA is the requirement for water acquisitions in order to protect, restore, and enhance fish and wildlife populations. Water is required for

Level 4 refuge supplies and instream flows. To meet the needs, the U. S. Department of the Interior developed the Water Acquisition Program (WAP). Both the Bureau of Reclamation and the U.S. Fish and Wildlife Service have been charged with implementing WAP since 1993 (Reclamation 2000b and 2000c)

The WAP's goals are to: acquire water on a long-term basis; provide certainty in water supplies for instream flows and refuge supplies; and reduce the cost involved in conducting these acquisitions on an annual basis (Reclamation 2002b). Strategies and criteria for obtaining long-term contracts are being developed.

The acquisition process starts by locating owners willing to transfer their water rights to the U.S. Department of the Interior. The potential acquisition is then evaluated in terms of source, quantity, delivery schedule, availability schedule, existing conveyance facilities, known environmental impacts of the transfer, and other impacted or interested parties. Environmental considerations are addressed through the National Environmental Policy Act (NEPA), California Environmental Quality Act, Endangered Species Act, and other applicable environmental regulations and laws. The acquisition process is complete when the environmental documentation is finalized and the agreement/contract identifying the purchase price and conditions of the sale is approved.

In Tehama County the only WAP projects to date have involved instream flows on Battle Creek. Since 1995, through a partnering arrangement, the Bureau of Reclamation has partially compensated PG&E for reducing hydropower generation at PG&E's Battle Creek Hydroelectric Unit in order to maintain a minimum year-round flow rate (Reclamation 2002b). None of the 12 national wildlife refuges or wildlife areas that have been identified to receive Level 4 water supplies is located in Tehama County.

The WAP program is coordinating with other water acquisition programs such as CALFED Environmental Water Program and Environmental Water Account, and the drought-planning program proposed by the State of California. This coordination is needed to avoid competition and confusion among the water owners, and to increase efficiency when acquiring water rights.

References

American Rivers. Undated. *Mill Creek Conservancy*. Available at: http://www.americanrivers.org/groups/millcreekconservancy.htm. Accessed on March 18, 2003.

Battle Creek Watershed Conservancy (BCWC). Website, available at: http://www.battle-creek.net. Accessed on March 14, 2003.

California Biodiversity Council and University of California Davis. Undated. *Natural Resources Projects Inventory for Tehama County*. Available at: http://endeavor.des.ucdavis.edu/nrpi. Accessed in March 2003.

California Department of Fish and Game (DFG). 1999. *Natural Diversity Database: Special Status Plants, Animals, and Natural Communities of Tehama County*. Issued April 6, 1999.

California Department of Fish and Game (DFG). 2002. *Fish Passage Improvement Project at the Red Bluff Diversion Dam*. Presentation. August 27, 2002.

California Department of Fish and Game (DFG). Undated. *Mill Creek watershed riparian restoration demonstration*. Available at: http://www.delta.dfg.ca.gov/afrp/template_frame.asp?code=96%20L-7. Accessed on March 14, 2003.

California Department of Water Resources (DWR). Undated. *Mill Creek.* Northern District Engineering Studies Section - Projects. Available at: http://wwwdpla.water.ca.gov/nd/Engineering/projects.html. Accessed during March 2003.

California Department of Water Resources (DWR). 2000. *The SWP's 4 Pumps Program.* Available at: http://www.news.water.ca.gov/2000.sedition/tablsedtn.html. Accessed during March 2003.

California Department of Water Resources (DWR). 2003. *Groundwater Quality in the Antelope Area of Red Bluff*. Available at: http://wwwdpla.water.ca.gov/nd/NewsRelease/AntelopeText.htm. Accessed on August 5, 2003.

California Regional Water Quality Control Board Central Valley Region (CVWQB). 1998. *Fourth Edition of the Water Quality Control Plan (Basin) for the Sacramento River and San Joaquin River Basins*. Report issued Sept 15, 1998.

California Resource Conservation District (CRCD). Undated. *Tehama County Resource Conservation District*. Prepared for Watershed Information Sharing Project. Available at: http://www.carcd.org/wisp/tehama. Accessed during March 2003.

California State Water Resources Control Board (SWRCB). 2003. *2002 CWA Section 303 (d) List of Water Quality Limited Segment*. Approved Feb 4, 2003.

Cottonwood Creek Watershed Group. Website, available at: http://www.cottonwoodcofc.org/ccwg/ccwg.htm. Accessed on March 17, 2003.

Deer Creek Irrigation District (DCID). 2003. *Deer Creek Water Exchange Pilot Program Tehama County Permit Application to Extract Groundwater for Off Parcel Use*. February 2003. Available at http://wdl10.water.ca.gov/gw/projects/deer_creek/

Deer Creek Watershed Conservancy (DCWC). Website, available at: http://www.deercreekconservancy.com. Accessed on March 14, 2003.

Deer Creek Watershed Conservancy (DCWC). 2001. *Annual Report 2001*. Available at http://deercreekconservancy.com/annualreport1/contents.htm. Accessed on March 14, 2003.

Jones & Stokes. 2001. *Environmental Water Program Steering Committee Briefing Paper No. 9 EWP Pilot Water Acquisition Program Preliminary Evaluation Factors*. Prepared for the CALFED Bay-Delta Program. August 2001.

Jones & Stokes. 2001b. *Environmental Water Program Briefing Paper No. 2 Coordination with Other Programs and initiatives*. Prepared for the CALFED Bay-Delta Program. August 2001.

Kier Associates. 1999. *Battle Creek Salmon and Steelhead Restoration Plan*. Prepared for the Battle Creek Working Group. January 1999.

Kier Associates. 1999b. *Maximizing Compatibility Between Coleman National Fish Hatchery Operations, Management of Lower Battle Creek, and Salmon and Steelhead Restoration*. Prepared for the Battle Creek Working Group. April 1999.

Lis, Richard, et. al. Undated. *Conservation and management of vernal pools through grazing and burning: Updating the Vernal Pool Project*. Available at: http://www.dfg.ca.gov/coned/ocal/daleslake.pdf. Accessed in March 2003.

Mercer, Lee. (Director, Tehama County Department of Environmental Health.) March 13, 2003. Personal communication with R. Vince of CDM Sacramento.

Mountain Lion Foundation. Undated. Habitat conservation fund project updates for Tehama County. Available at http://www.mountainlion.org/Habitat/prop117T-Y.htm. Accessed on March 13, 2003.

Ohlin, Ernie. (Director, Tehama County Flood Control and Water Conservation District.) February 18, 2003. Fax communication with R. Vince of CDM Sacramento.

Patricia, et. al. 1997. F*ish and Wildlife Service Ads Eight Plants to Endangered List; Seven are Already Protected by State of California.* U.S. Fish and Wildlife Service. Available at: http://pacific.fws.gov/news/1997/9726nr.htm. Accessed in March 2003. March 26, 1997.

Sacramento River Advisory Council. 1998. *Draft Sacramento River Conservation Area Handbook*. Prepared for the Resource Agency State of California. May 1998.

Snow, Richard. 1998. *Tehama County Vernal Pool Inventory, Project Map*. Available at: http://phobos.lab.csuchico.edu/projects/veg_mapping/vernal/. Accessed March 13, 2003. July 1998.

Swearinger, V. 2003. Personal communication (e-mail). March 19, 2003.

Tehama County Resource Conservation District (TCRCD). 2001. *Watershed Events in Tehama County*. October 2001.

Tehama County Resource Conservation District (TCRCD). 2002. *Watershed Events in Tehama County*. June 2002.

Tehama County Resource Conservation District (TCRCD). Undated. *Untitled brochure.*

Tehama County Resource Conservation District (TCRCD). Undated. *The Watersheds of Tehama County* (brochure).

The Nature Conservancy of California (TNC). Undated. *Gray Davis Dye Creek Preserve*. Available at: http://www.tnccalifornia.org/our_proj/lassen/dye_creek.asp. Accessed March 13, 2003.

The Nature Conservancy of California (TNC). Undated. *Vina Plains Preserve*. Available at: http://www.calcattlemen.org/GrazingforChange/Vina.htm. Accessed March 13, 2003.

The Nature Conservancy of California (TNC). Undated. *Vina Plains Preserve*. Available at: http://www.tnccalifornia.org/our_proj/lassen/vina/vina.asp. Accessed March 13, 2003.

The Nature Conservancy of California (TNC). Undated. *Visit Dye Creek Preserve*. Available at: http://www.tnccalifornia.org/our_proj/lassen/dye_creek/dye_visit.asp. Accessed March 13, 2003.

U.S. Bureau of Reclamation (Reclamation) et. al. 2000. *Draft Environmental Assessment/Initial Study for Mill Creek Anadromous Fish Adaptive Management Enhancement Plan*. March 2000.

U.S. Bureau of Reclamation (Reclamation) and U.S. Fish and Wildlife Service (USFWS). 2001. *Central Valley Project Improvement Act Accomplishment Report Fiscal Year 2000.* Available at http://www.mp.usbr.gov/cvpia/accomplishments/2000FINAL.pdf. Accessed in March 2003.

U.S. Bureau of Reclamation (Reclamation). 2002. *Anadromous Fish Restoration Program Fact Sheet*. Available at: http://www.mp.usbr.gov/cvpia/wap/docs/AFRP.html. Accessed March 24, 2003. April 2002.

U.S. Bureau of Reclamation (Reclamation) and U.S. Fish and Wildlife Service (USFWS). 2002b. *U.S. Department of the Interior Water Acquisition Program Background Information Sheet and Water Acquisition Summary for Fiscal Years 1993 to 2001.* April 2002.

U.S. Bureau of Reclamation (Reclamation). 2002c. *Water Acquisition Program – Frequently Asked Questions.* Available at: http://www.mp.usbr.gov/cvpia/wap/docs/faq.html. Accessed on March 24, 2003. April 2002.

U.S. Bureau of Reclamation (Reclamation). 2002d. *Finding of No Significant Impact Environmental Assessment for the Temporary Forbearance of a Water Right Entitlement Held by the Orange Cove Irrigation District on Mill Creek, Tehama County, California*. Available at: http://www.mp.usbr.gov/cvpia/wap/EA/Fonsi-MillCreek09-24-02.pdf. Accessed during March 2003. September 2002.

U.S. Bureau of Reclamation (Reclamation). 2002. *Fish Passage Improvement Project at the Red Bluff Diversion Dam, Tehama County, California*. Federal Register, Volume 66, No. 172. September 5, 2002. Available at: http://frwebgate.access.gpo.gov/cgibin/getdoc.cgi?dbname=2002_register&docid=02-22636-filed.

U.S. Bureau of Reclamation (Reclamation). 2002e. News Release: *Reclamation Releases Final Environmental Assessment and Finding of No Significant Impact for the Instream Transfer and Forbearance of Water Rights on Mill Creek*. October 3, 2002.

U.S. Bureau of Reclamation (Reclamation). Undated. *Tracking Ecosystem Restoration Activities (TERA) – Projects & Activities – Battle Creek*. Available at: http://www.tera.mp.usbr.gov/budget/bay_delta_act/project_details.cfm?ProjectID=9. Accessed on March 24, 2003.

U.S. Environmental Protection Agency. 2000. *Battle Creek Salmon and Steelhead Restoration Project, Tehama and Shasta Counties, CA.* Federal Register Environmental

Documents. Available at http://www.epa.gov/fedrgstr/EPA-IMPACT/2000/January/Day-12/i686.htm. Accessed on March 13, 2003. January 12, 2000.

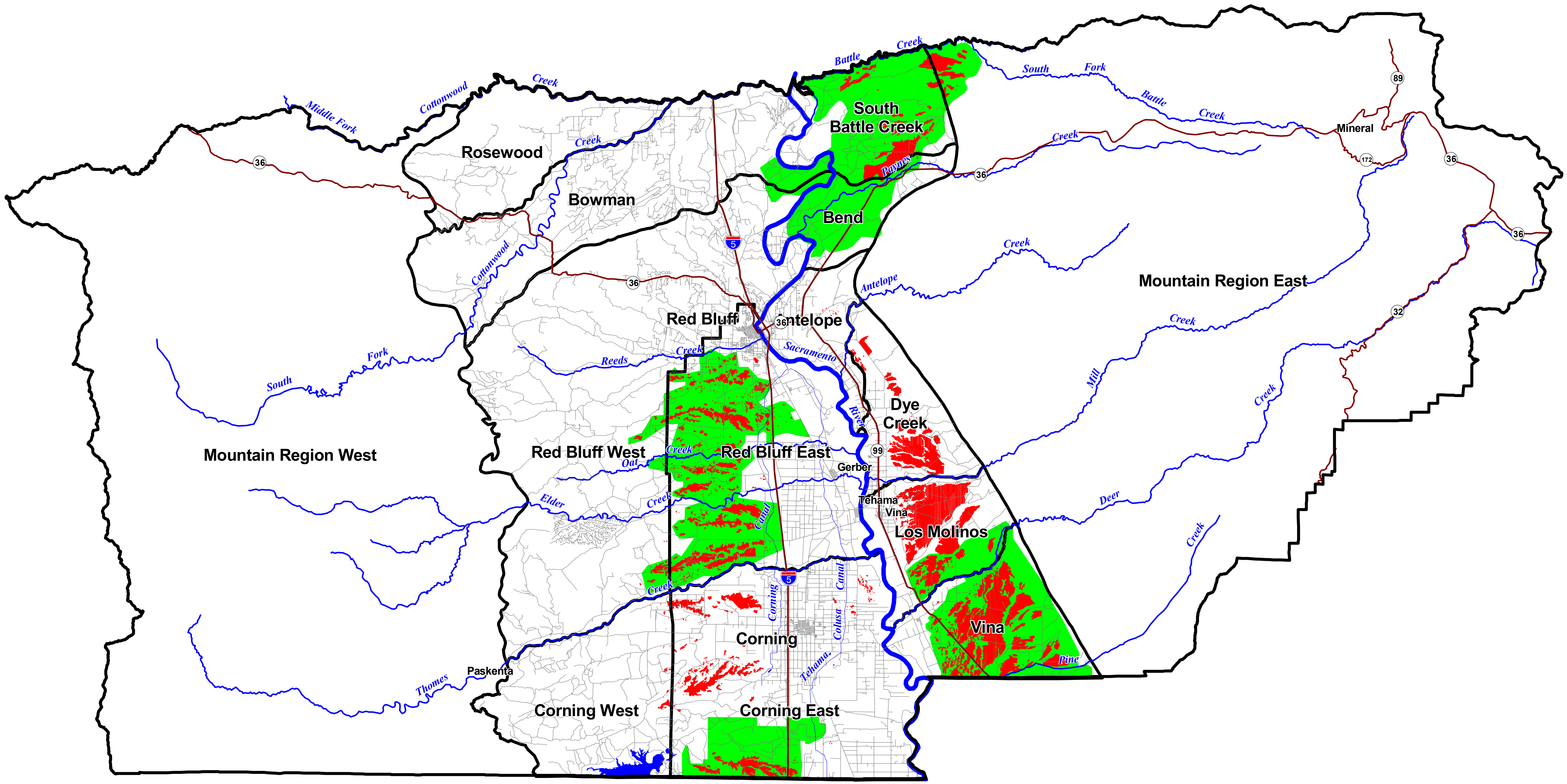
U.S. Environmental Protection Agency. 2003. *Surf Your Watershed (Tehama County, CA).* Available at http://cfpub.epa.gov/sur/county.cfm?fips_code=06103. Accessed on March 13, 2003.

U.S. Fish and Wildlife Service. 2001. Final Restoration Plan for the Anadromous Fish Restoration Program. Available at http://www.delta.dfg.ca.gov/afrp/restplan_final.asp. Accessed on August 7, 2003.

U.S. Fish and Wildlife Service. 2002. News Release: *Service Proposes Critical Habitat for Threatened and Endangered Vernal Pool Species*. Available at: http://news.fws.gov/newsreleases/r1/03B04EE8-E865-4B3E-8DDD6C63EB5491DF.html. Accessed in March 2003. September 24, 2002.

Vendlinski, Tim. 2000. *California's Vernal Pools: Accomplishments and Conservation Strategies*. Fremontia, Volume 27:4 and Volume 28:1. January 2000.

Water Education Foundation. 2002. *Environmental Water Acquisition: A Briefing*. ISBN# 1-893246-90-6.



Data Source: US Fish and Wildlife Services

August 2003

DFG Vernal Pool Inventory

USFWS Proposed Critical Habitat for Vernal Pool Areas

N

5 0 5 Miles

1:411,840

Figure 6-1
Vernal Pool Areas

FILE REFERENCE: c:\gis\22010_tehamacounty\36522_inventoryanalysis\inventory_analysis_draft.apr
LAYOUT: (LAYOUT) Figure 6-1 Vernal Pool Areas
DATE: Aug 18, 2003 4:24 PM

Section 7
Conclusions and Recommendations

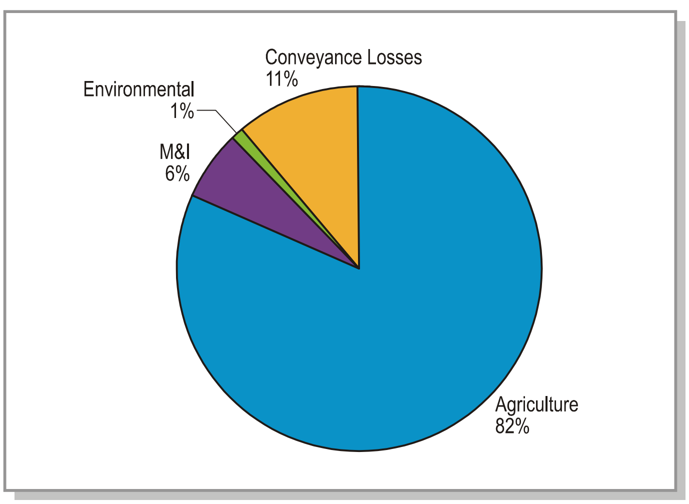
The following conclusions and recommendations are based on results of 1) interviews with local water resource stakeholders, 2) water supply and use calculations under average, dry and wet hydrologic conditions and 3) analysis of groundwater level trends at individual monitoring wells, groundwater contours, spring to summer groundwater level change contours, changes in groundwater in storage, and existing groundwater extraction well infrastructure.

7.1 Conclusions

Completion of the Tehama County Water Inventory and Analysis report furthers implementation of the County's AB 3030 Coordinated Groundwater Management Plan. Information contained in the document will be utilized for future water resource management planning.

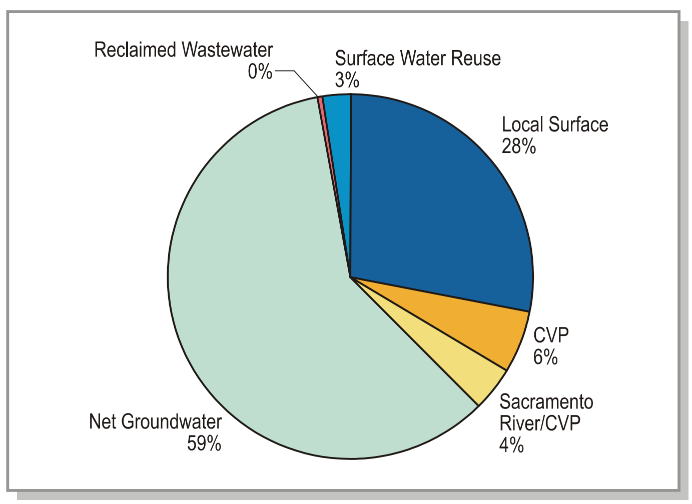
7.1.1 Average Year Hydrologic Scenario Conclusions

Figures 7-1 and 7-2 illustrate the average year water demand and water supply, respectively. Agriculture is the largest user of water in the County, and the largest agricultural demands are in Corning East and Red Bluff East Inventory Units. Conveyance losses are included in demand because they increase the amount of water needed within districts that have these losses. Dye Creek, Los Molinos, and Vina Inventory Units have agencies with older water distribution systems with unlined canals; therefore, these units have relatively high conveyance losses.



Source: DWR 2003

Figure 7-1
Average Year Water Demand



Source: DWR 2003

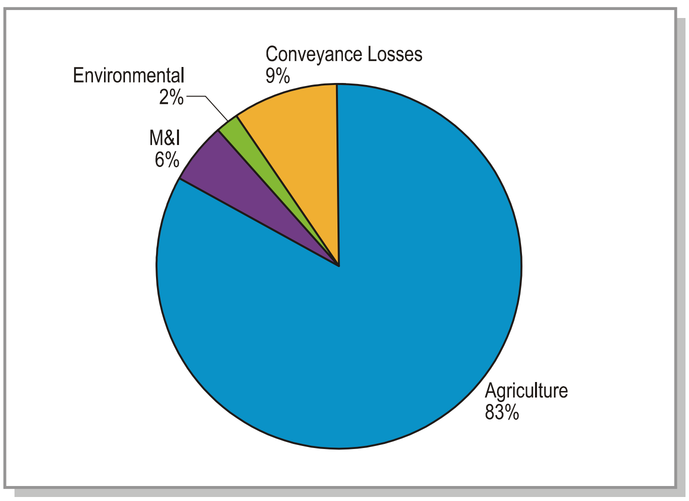
Figure 7-2
Average Year Water Supplies

The Sacramento Valley groundwater basin has the most demand and supply for water because most of the agricultural and M&I development is in this area. Groundwater sources represent the majority of supply, followed by local surface water.

During an average water year, Tehama County would not experience any water shortages. The water supply is generally larger than the water demand. All inventory units in the County have enough water supplies to meet their needs.

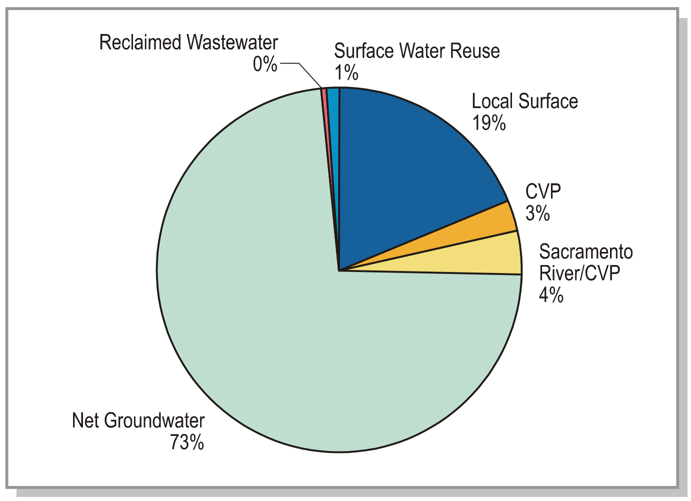
7.1.2 Dry Year Hydrologic Scenario Conclusions

Figures 7-3 and 7-4 illustrate the dry year water demands and supplies, respectively. Relative to an average water year, water demand in a dry year from all sectors increases by 64,100 acre-feet (17 percent). Agricultural water demand and M&I demands increase during a dry year because of higher demand for irrigation of crops and landscape during summer months. Environmental water demand doubles in Dye Creek and Los Molinos Inventory Units, mainly because these areas participate in dry year programs to benefit the environment. Conveyance losses decrease during a dry year because of the smaller surface water supply and less potential for percolation, evaporation and spillage.



Source: DWR 2003

Figure 7-3
Dry Year Water Demands



Source: DWR 2003

Figure 7-4
Dry Year Water Supplies

The composition of water supplies also changes during a dry year. Local surface water supplies decrease by 26 percent and CVP supplies decrease by 42 percent, relative to an average year, because of lower precipitation and snowmelt in local streams and creeks. Groundwater supplies increase by approximately 32 percent to compensate for increased water needs and smaller surface water supplies.

Sacramento River Settlement Contractors and riparian water right holders supplies also increase in a dry year relative to an average year because of increased demands and strong water rights.

Supply shortages total approximately 31,000 acre-feet under the dry-year scenario. Increased groundwater use mitigates a portion of the scenario's surface water shortage; however, the county does not have adequate groundwater infrastructure to cover all water shortages. In general, inventory units with greater reliance on surface water supplies and relatively higher conveyance losses experience the larger shortages. Without the infrastructure, the cutbacks in CVP supply during a dry year create water shortages in Red Bluff East and Corning East Inventory Units. Dye Creek, Los Molinos, and Vina Inventory Units face larger water shortages than most other units because of decreased water availability in local streams. Dry year conditions and high conveyance losses cause shortages by depleting these units' stream diversions by 32%. They also do not have the groundwater facilities to extract more water to cover the shortages.

7.1.3 Wet Year Hydrologic Scenario Conclusions

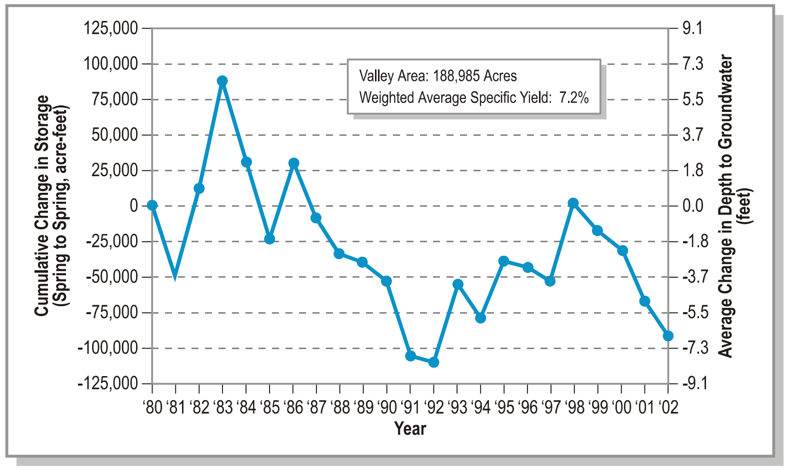
Wet year demands would be equal to or less than average year demands because increased soil moisture at the beginning of the irrigation season would decrease the need for applied water. In an average year, adequate supplies are available to meet demands. All creeks and streams in the County see increased flows during wet years; this increase indicates that additional supplies may be available in those years. Because these supplies are not diverted, however, does not indicate that they are not being used. Although this water is not required to meet immediate water demands, it provides other benefits. Additional water would percolate to the aquifers, recharging groundwater levels for future use. It would also provide environmental benefits to fisheries and riparian vegetation by providing the pulse flows necessary for some species.

7.1.4 Groundwater Levels and Water Quality Conclusions

Isolated areas with organic contaminants exist at several locations in the County. Elevated nitrate concentrations in shallow groundwater in the Antelope area continue to be focal point for the Tehama County Environmental Health Department.

Groundwater levels decrease during the summer with larger seasonal variations in areas that use groundwater. Areas that use groundwater as the primary supply typically show increased seasonal drawdown. These areas include the Aaction Tree Farm Sub-unit and El Camino Irrigation District. Areas that use more surface water supplies, such as Kirkwood Water District and the east side of the Sacramento River, show relatively small seasonal variation.

The Inventory and Analysis includes an assessment of groundwater in storage from 1980 to the present. Figure 7-5 shows the groundwater in storage for the entire County as a comparison to the year 1980. This figure shows that overall groundwater in storage has a decreasing trend, especially over the past five years. This trend is found on the figures for most of the Inventory Units as well. The decrease over the past five years does not appear to be tied to a dry weather pattern because the past years have been close to normal rainfall. Therefore, this decrease appears to be tied to changes in land use (increased development) or water use (conversion from surface water to groundwater supply).



Source: DWR 2003

Figure 7-5
Estimated Cumulative Change in Spring-to-Spring Storage
Sum of Valley Inventory Units

7.2 Recommendations

The Tehama County Flood Control and Water Conservation District makes the following recommendations based on information contained in the Water Inventory and Analysis report and information from other ongoing efforts:

- The FCWCD will continue to implement the County's AB 3030 Groundwater Management Plan as developed in an effort to promote groundwater management activities that will result in an adequate supply of high quality water into the future.

- The FCWCD will continue to encourage active participation by local stakeholders in both groundwater planning and groundwater monitoring efforts. The District will encourage groundwater monitoring partnerships with local groundwater users.

- The FCWCD will promote cooperative planning and groundwater management with other local neighboring plans and will participate in coordinated regional and statewide groundwater monitoring and planning efforts.

- The FCWCD will continue investigation into locally-led development of groundwater trigger levels as a method for groundwater management as required under SB 1938 and as discussed in "Trigger Levels to Define Management Involvement" in the AB 3030 Plan.

- The FCWCD will pursue the installation and monitoring of additional groundwater monitoring wells in areas of data gaps and in areas where increasing groundwater demand is anticipated in the future. Adequate groundwater level information is not available at some locations in the County, resulting in an incomplete understanding of groundwater levels, movement, and response to extraction. These areas include 1) east-southeast of the City of Corning where a groundwater depression is indicated in an area with little extraction, 2) east of the Aaction Tree Farm where little data exists and increased groundwater demand is anticipated, 3) the eastern portion of the Bowman inventory unit where gaps in monitoring locations exist, and 4) near the boundary between El Camino Irrigation District and Elder Creek Irrigation District where seasonal groundwater drawdown is experienced.

- The FCWCD will support additional studies focused on furthering the understanding of the potential for groundwater recharge. Groundwater recharge, to supplement current groundwater supplies, may be feasible in areas where surface water bodies are located proximal to outcrops of major fresh groundwater-bearing units, including the Tuscan Formation, Tehama Formation, Riverbank Formation and Modesto Formation.

- The FCWCD will support efforts to better understand surface water flow and temperature requirements associated with transport flows for fishery recovery.

- The FCWCD will pursue a more coordinated effort with Tehama County Planning Department with respect to development and water supply.

- The FCWCD will coordinate review of the AB 3030 Plan for compliance with SB 1938.

- The FCWCD will assist in the study of fish passage programs to understand the effects of decreased stream diversions and increased groundwater pumping on the environment and local water users.

- The FCWCD will assist the Tehama County Department of Environmental Health to cooperatively develop plans to improve water quality in the Antelope area.

Appendix A
Change in Groundwater Storage

The following discussion and data regarding change in groundwater storage is taken from the pre-publication draft report *Tehama County Groundwater Inventory,* DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California.

Change in groundwater in storage is dependent on many factors, including climatic conditions, the annual rate of groundwater extraction, and the annual rate of groundwater recharge. Groundwater storage commonly fluctuates within a given year and from year to year. Groundwater in storage will typically decline during periods of drought and rebound during periods of above-normal precipitation. Within the same year, groundwater in storage will decline through the summer months as it is extracted for municipal and agricultural uses, then recover as extraction slows and seasonal precipitation increases recharge. In basins where the amount of annual groundwater extraction is at or below the amount of normal-year recharge, the long-term change in groundwater in storage will remain the same. In basins where the annual amount of groundwater extraction exceeds the amount of normal-year recharge, the long-term change in groundwater in storage will decline. Depletion of groundwater in storage is typically exhibited by a decline in groundwater levels during periods of normal precipitation.

The annual spring-to-spring changes in groundwater in storage for the Sacramento Valley portion of Tehama County were calculated over a 20-year period from 1980 to 2000. The spring-to-spring changes in groundwater storage were calculated using groundwater contour maps developed from spring groundwater level measurements in the upper portion of the aquifer. Digital three-dimensional groundwater elevation surfaces were constructed using the spring groundwater level data, and the volume differences between consecutive spring-to-spring groundwater elevation surfaces were calculated. Changes in groundwater in storage calculated from groundwater elevation contour maps are a good approximation of the actual changes in the volumes of groundwater in storage over time. However, the accuracy of groundwater elevation contours varies with respect to the groundwater gradient, the data density, and proximity to the basin boundary. Overall, the calculated volumes of groundwater in storage are considered accurate within plus or minus 10%.

The spring-to-spring changes in groundwater in storage are graphically illustrated in the cumulative spring-to-spring changes in groundwater in storage graphs in this appendix. The spring-to-spring graphs start with a baseline of zero for the spring of 1980. Similar to the 1997 water year, basin-wide groundwater levels during the spring of 1980 closely characterize groundwater conditions associated with a normal water year. Changes in spring-to-spring storage in subsequent years are shown as cumulative changes and are calculated based on the difference between groundwater levels during the 1980 base year and the spring of any given year. Changes in groundwater in storage data are summarized in Table A-1.

Table A-1
Spring-to-Spring Changes in Groundwater in Storage, Valley Portions of Tehama County, 1980 to 2002
Tehama County Groundwater Inventory Change in Spring-to-Spring Groundwater Storage
Spring 1980 to Spring 2002

DRAFT

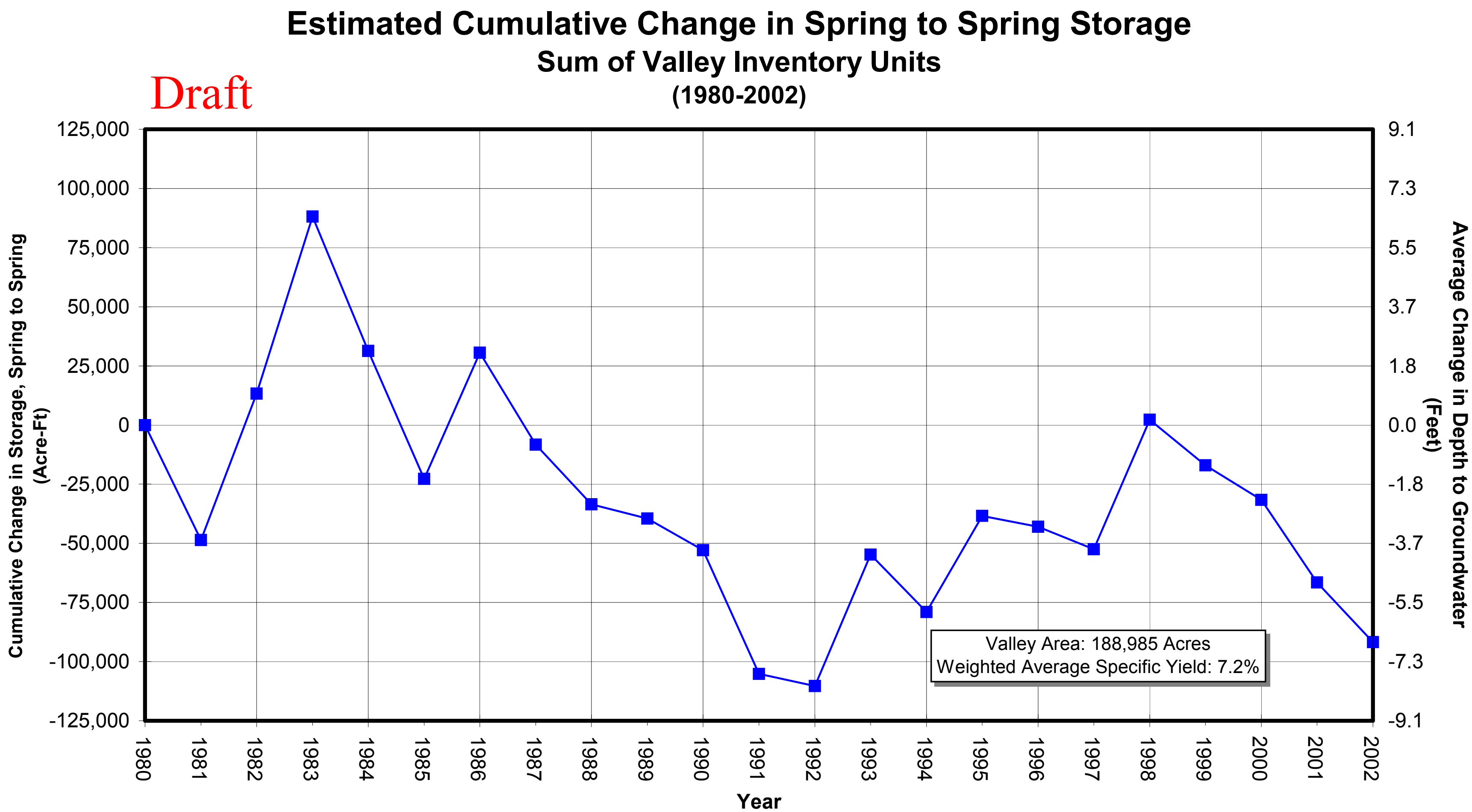
INVENTORY UNIT	AREA (acres)	SY (%)	ESTIMATED ANNUAL CHANGE IN STORAGE (acre-feet)																					
			1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
Antelope	13,581	7.3%	-3,164	4,069	5,998	-6,111	-4,213	5,479	-2,708	-4,803	1,438	-860	-1,718	979	3,678	-2,748	5,130	-594	-1,091	5,140	-4,648	-727	-3,121	-2,662
Dye Creek	9,222	7.3%	-900	1,558	2,081	-2,919	-2,549	4,590	-2,223	-1,053	2	1,039	-1,047	-945	2,217	-1,042	1,586	13	-393	1,462	-1,096	-561	-416	-2,103
Los Molinos	12,697	6.8%	-3,592	2,406	4,832	-3,329	-354	1,750	-4,011	-1,046	1,400	697	-3,850	1,161	1,014	-2,028	1,642	-127	-774	2,914	-435	-372	-1,550	-2,292
Vina	9,966	6.6%	-2,647	2,050	2,603	-643	-3,805	280	-860	-309	-1,135	47	-1,146	-245	2,534	-1,849	3,090	-803	709	2,803	-1,702	405	-1,902	-958
Corning East	68,850	7.2%	-10,117	18,799	28,045	-15,703	-25,762	21,234	-18,017	-2,359	-12,589	-1,674	-27,818	-3,818	30,136	-8,386	9,202	1,442	-8,564	22,968	-7,914	-7,044	-14,668	-12,498
Red Bluff East	63,505	7.5%	-27,709	32,751	27,029	-24,847	-15,801	19,085	-10,049	-15,070	3,415	-9,972	-15,362	-2,463	14,538	-6,923	16,202	-2,245	2,182	18,267	-4,005	-5,160	-10,002	-9,706
Rose-bowman area	11,164	7.0%	-440	183	4,235	-3,203	-1,568	956	-1,017	-640	1,410	-2,608	-1,312	199	1,380	-1,236	3,718	-2,232	-1,594	1,177	547	-1,139	-3,198	4,993
Total	**188,985**	**7.2%**	**-48,570**	**61,817**	**74,823**	**-56,756**	**-54,052**	**53,375**	**-38,885**	**-25,280**	**-6,058**	**-13,331**	**-52,254**	**-5,132**	**55,496**	**-24,211**	**40,570**	**-4,546**	**-9,524**	**54,730**	**-19,253**	**-14,598**	**-34,855**	**-25,226**

INVENTORY UNIT	AREA (acres)	SY (%)	ESTIMATED ANNUAL CHANGE IN STORAGE (acre-feet)																					
			1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
Antelope	13,581	7.3%	-3,164	905	6,903	792	-3,421	2,058	-650	-5,453	-4,015	-4,874	-6,592	-5,614	-1,935	-4,684	446	-148	-1,239	3,901	-746	-1,473	-4,594	-7,256
Dye Creek	9,222	7.3%	-900	658	2,739	-180	-2,728	1,862	-361	-1,414	-1,412	-373	-1,420	-2,364	-148	-1,190	396	409	16	1,478	382	-178	-595	-2,698
Los Molinos	12,697	6.8%	-3,592	-1,186	3,646	317	-38	1,713	-2,299	-3,345	-1,945	-1,248	-5,098	-3,938	-2,924	-4,951	-3,310	-3,437	-4,211	-1,296	-1,732	-2,103	-3,653	-5,945
Vina	9,966	6.6%	-2,647	-597	2,006	1,363	-2,442	-2,162	-3,022	-3,331	-4,466	-4,419	-5,565	-5,811	-3,277	-5,125	-2,035	-2,838	-2,130	673	-1,029	-624	-2,526	-3,483
Corning East	68,850	7.2%	-10,117	8,682	36,727	21,024	-4,738	16,496	-1,521	-3,880	-16,469	-18,143	-45,961	-49,778	-19,642	-28,028	-18,826	-17,383	-25,948	-2,980	-10,894	-17,938	-32,605	-45,104
Red Bluff East	63,505	7.5%	-27,709	5,042	32,071	7,224	-8,577	10,508	459	-14,611	-11,196	-21,168	-36,530	-38,993	-24,455	-31,378	-15,176	-17,421	-15,239	3,027	-978	-6,138	-16,139	-25,845
Rose-bowman area	11,164	7.0%	-440	-257	3,977	774	-794	163	-855	-1,495	-84	-2,693	-4,005	-3,806	-2,426	-3,661	57	-2,175	-3,769	-2,592	-2,045	-3,184	-6,382	-1,389
Total	**188,985**	**7.2%**	**-48,570**	**13,247**	**88,070**	**31,314**	**-22,738**	**30,637**	**-8,248**	**-33,528**	**-39,587**	**-52,917**	**-105,171**	**-110,304**	**-54,807**	**-79,018**	**-38,448**	**-42,994**	**-52,518**	**2,212**	**-17,041**	**-31,639**	**-66,494**	**-91,720**

INVENTORY UNIT	AREA (acres)	SY (%)	ESTIMATED ANNUAL CHANGE IN STORAGE (acre-feet)																					
			1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
Antelope	13,581	7.3%	-3.2	4.1	6.1	-6.2	-4.2	5.5	-2.7	-4.8	1.5	-0.9	-1.7	1.0	3.7	-2.8	5.2	-0.6	-1.1	5.2	-4.7	-0.7	-3.1	-2.7
Dye Creek	9,222	7.3%	-1.3	2.3	3.1	-4.4	-3.8	6.9	-3.3	-1.6	0.0	1.6	-1.6	-1.4	3.3	-1.6	2.4	0.0	-0.6	2.2	-1.6	-0.8	-0.6	-3.1
Los Molinos	12,697	6.8%	-4.2	2.8	5.6	-3.9	-0.4	2.0	-4.6	-1.2	1.6	0.8	-4.5	1.3	1.2	-2.3	1.9	-0.1	-0.9	3.4	-0.5	-0.4	-1.8	-2.7
Vina	9,966	6.6%	-4.0	3.1	4.0	-1.0	-5.8	0.4	-1.3	-0.5	-1.7	0.1	-1.7	-0.4	3.9	-2.8	4.7	-1.2	1.1	4.3	-2.6	0.6	-2.9	-1.5
Corning East	68,850	7.2%	-2.0	3.8	5.7	-3.2	-5.2	4.3	-3.6	-0.5	-2.6	-0.3	-5.6	-0.8	6.1	-1.7	1.9	0.3	-1.7	4.7	-1.6	-1.4	-3.0	-2.5
Red Bluff East	63,505	7.5%	-5.8	6.9	5.7	-5.2	-3.3	4.0	-2.1	-3.2	0.7	-2.1	-3.2	-0.5	3.1	-1.5	3.4	-0.5	0.5	3.8	-0.8	-1.1	-2.1	-2.0
Rose-bowman area	11,164	7.0%	-0.6	0.2	5.4	-4.1	-2.0	1.2	-1.3	-0.8	1.8	-3.3	-1.7	0.3	1.8	-1.6	4.8	-2.9	-2.0	1.5	0.7	-1.5	-4.1	6.4
Total	**188,985**	**7.2%**	**-3.6**	**4.5**	**5.5**	**-4.2**	**-4.0**	**3.9**	**-2.8**	**-1.9**	**-0.4**	**-1.0**	**-3.8**	**-0.4**	**4.1**	**-1.8**	**3.0**	**-0.3**	**-0.7**	**4.0**	**-1.4**	**-1.1**	**-2.6**	**-1.8**

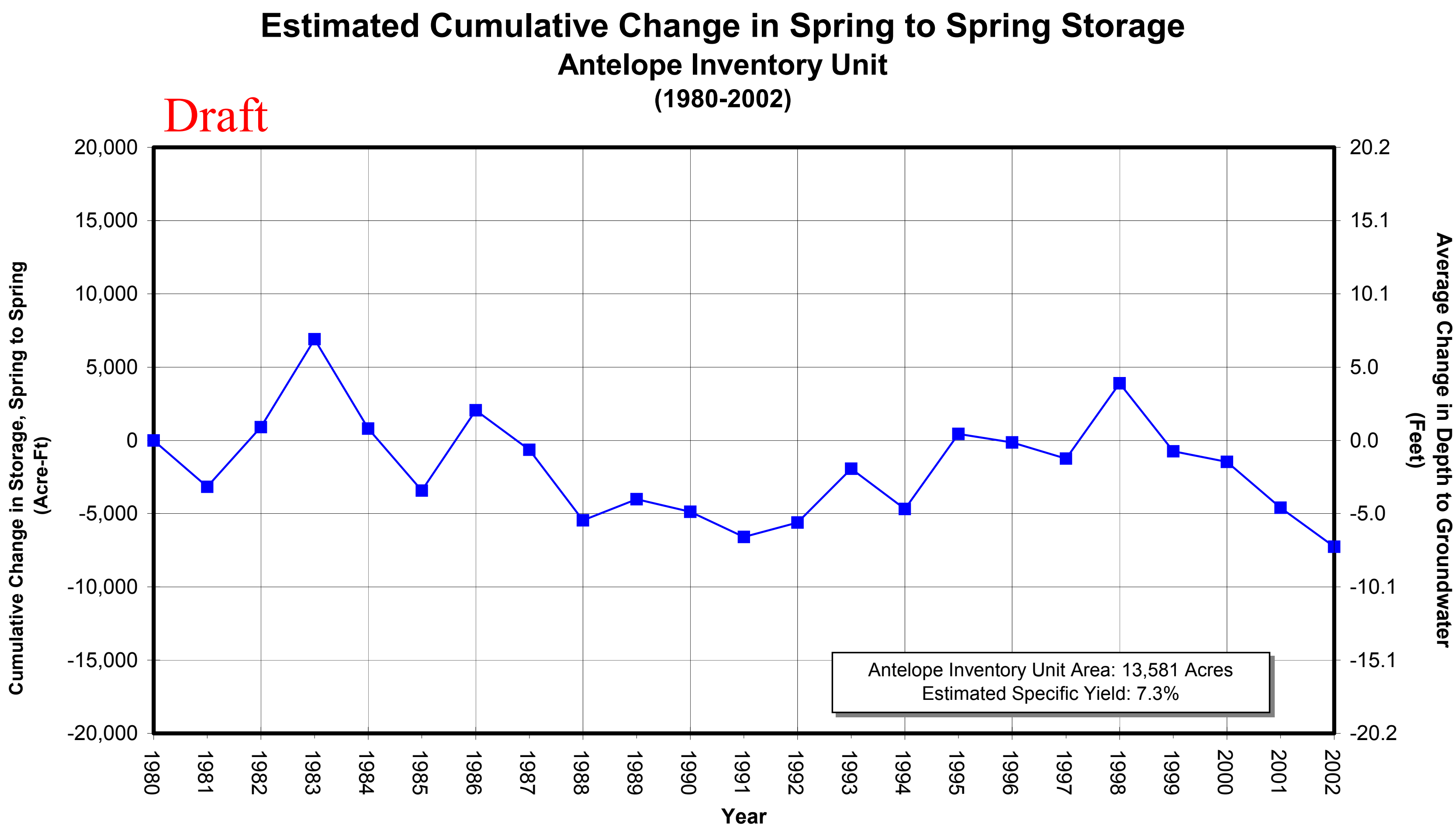
INVENTORY UNIT	AREA (acres)	SY (%)	ESTIMATED ANNUAL CHANGE IN STORAGE (acre-feet)																					
			1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
Antelope	13,581	7.3%	-3.2	0.9	7.0	0.8	-3.5	2.1	-0.7	-5.5	-4.0	-4.9	-6.6	-5.7	-2.0	-4.7	0.4	-0.1	-1.2	3.9	-0.8	-1.5	-4.6	-7.3
Dye Creek	9,222	7.3%	-1.3	1.0	4.1	-0.3	-4.1	2.8	-0.5	-2.1	-2.1	-0.6	-2.1	-3.5	-0.2	-1.8	0.6	0.6	0.0	2.2	0.6	-0.3	-0.9	-4.0
Los Molinos	12,697	6.8%	-4.2	-1.4	4.2	0.4	0.0	2.0	-2.7	-3.9	-2.3	-1.4	-5.9	-4.6	-3.4	-5.7	-3.8	-4.0	-4.9	-1.5	-2.0	-2.4	-4.2	-6.9
Vina	9,966	6.6%	-4.0	-0.9	3.0	2.1	-3.7	-3.3	-4.6	-5.1	-6.8	-6.7	-8.5	-8.8	-5.0	-7.8	-3.1	-4.3	-3.2	1.0	-1.6	-0.9	-3.8	-5.3
Corning East	68,850	7.2%	-2.0	1.8	7.4	4.3	-1.0	3.3	-0.3	-0.8	-3.3	-3.7	-9.3	-10.1	-4.0	-5.7	-3.8	-3.5	-5.3	-0.6	-2.2	-3.6	-6.6	-9.1
Red Bluff East	63,505	7.5%	-5.8	1.1	6.7	1.5	-1.8	2.2	0.1	-3.1	-2.4	-4.4	-7.7	-8.2	-5.1	-6.6	-3.2	-3.7	-3.2	0.6	-0.2	-1.3	-3.4	-5.4
Rose-bowman area	11,164	7.0%	-0.6	-0.3	5.1	1.0	-1.0	0.2	-1.1	-1.9	-0.1	-3.4	-5.1	-4.9	-3.1	-4.7	0.1	-2.8	-4.8	-3.3	-2.6	-4.1	-8.2	-1.8
Weighted Average	**188,985**	**7.2%**	**-3.6**	**1.0**	**6.4**	**2.3**	**-1.7**	**2.2**	**-0.6**	**-2.5**	**-2.9**	**-3.9**	**-7.7**	**-8.1**	**-4.0**	**-5.8**	**-2.8**	**-3.1**	**-3.8**	**0.2**	**-1.2**	**-2.3**	**-4.9**	**-6.7**

Source: California Department of Water Resources, Northern District

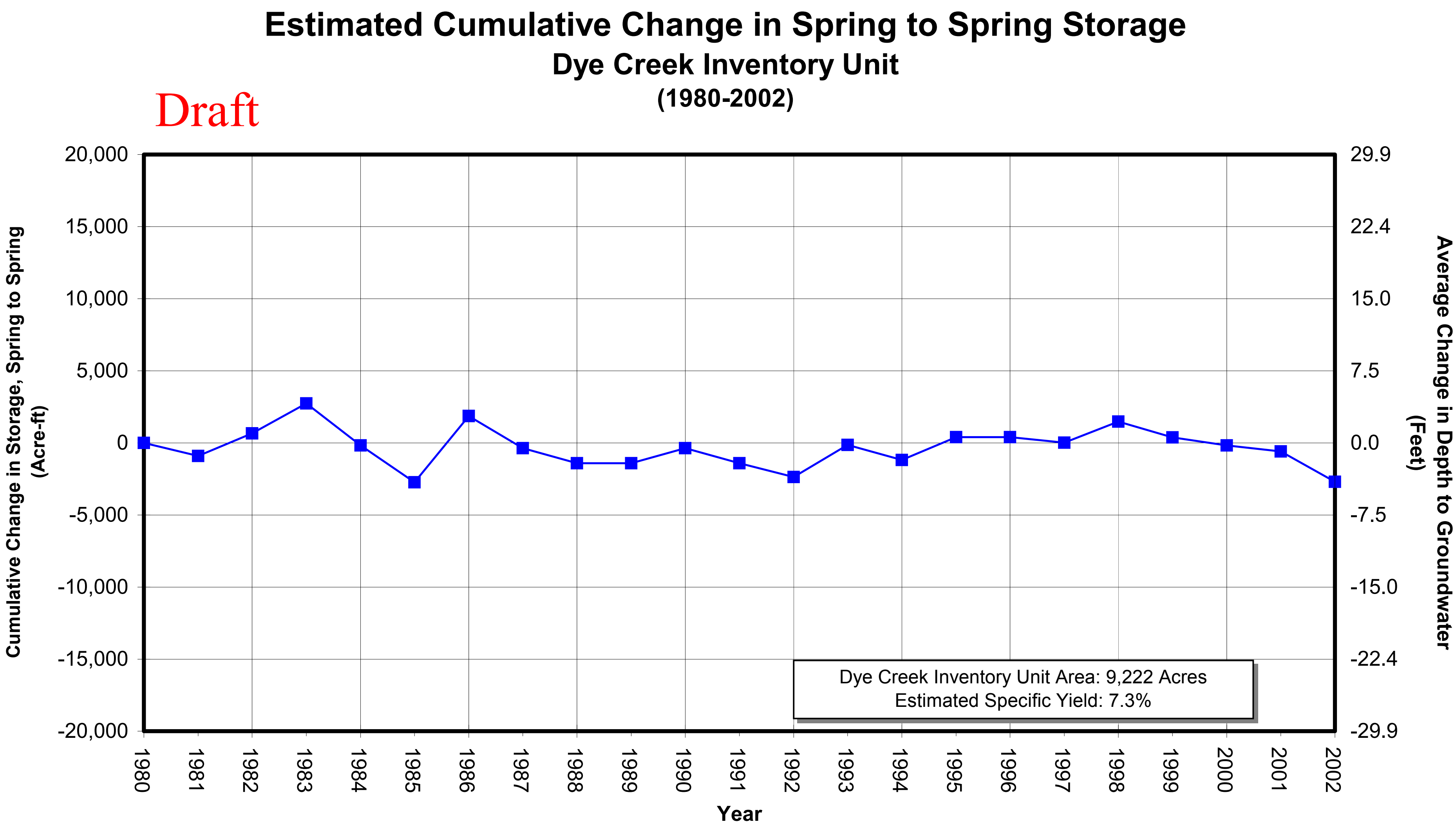


Source: California Department of Water Resources, Northern District.

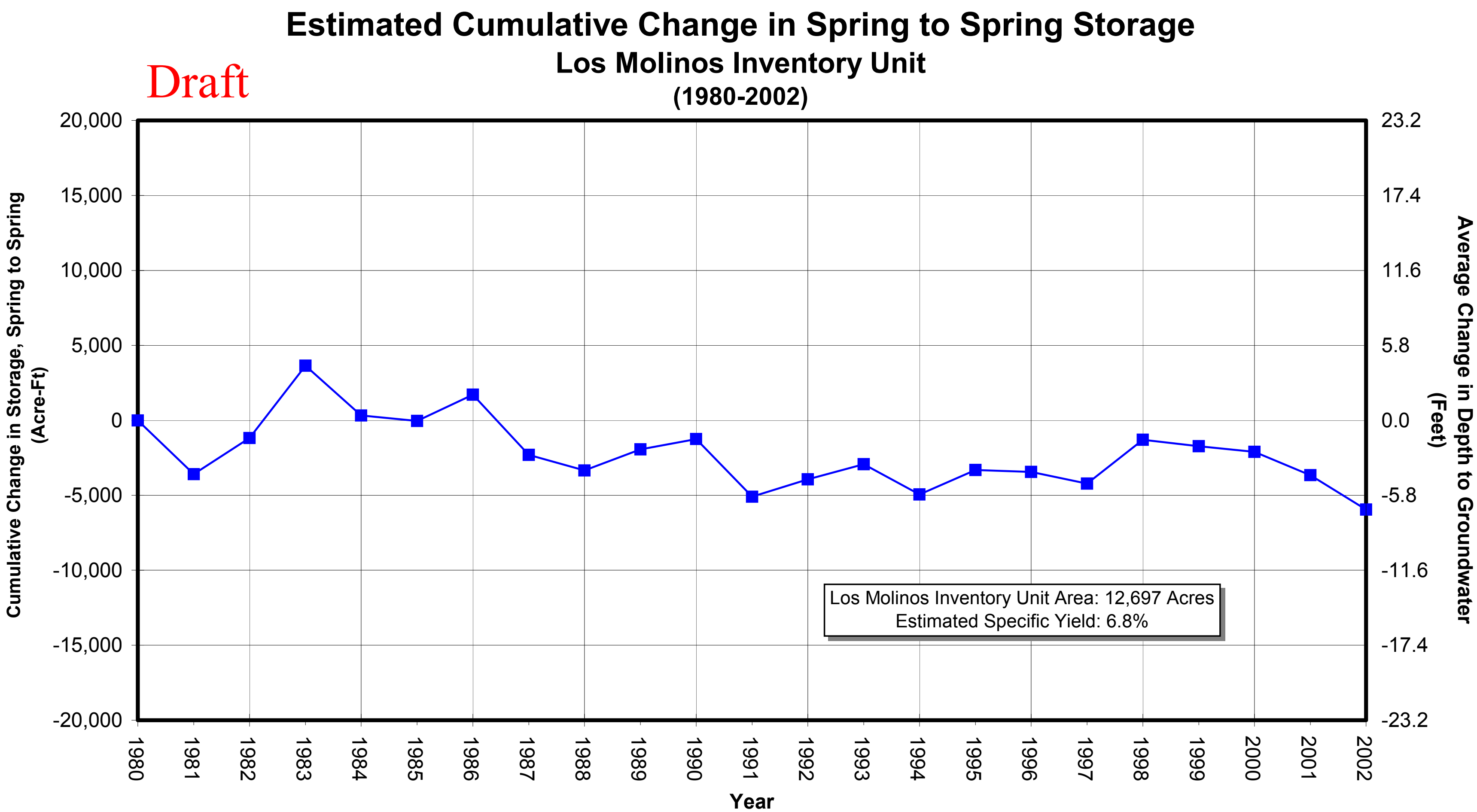
CDM



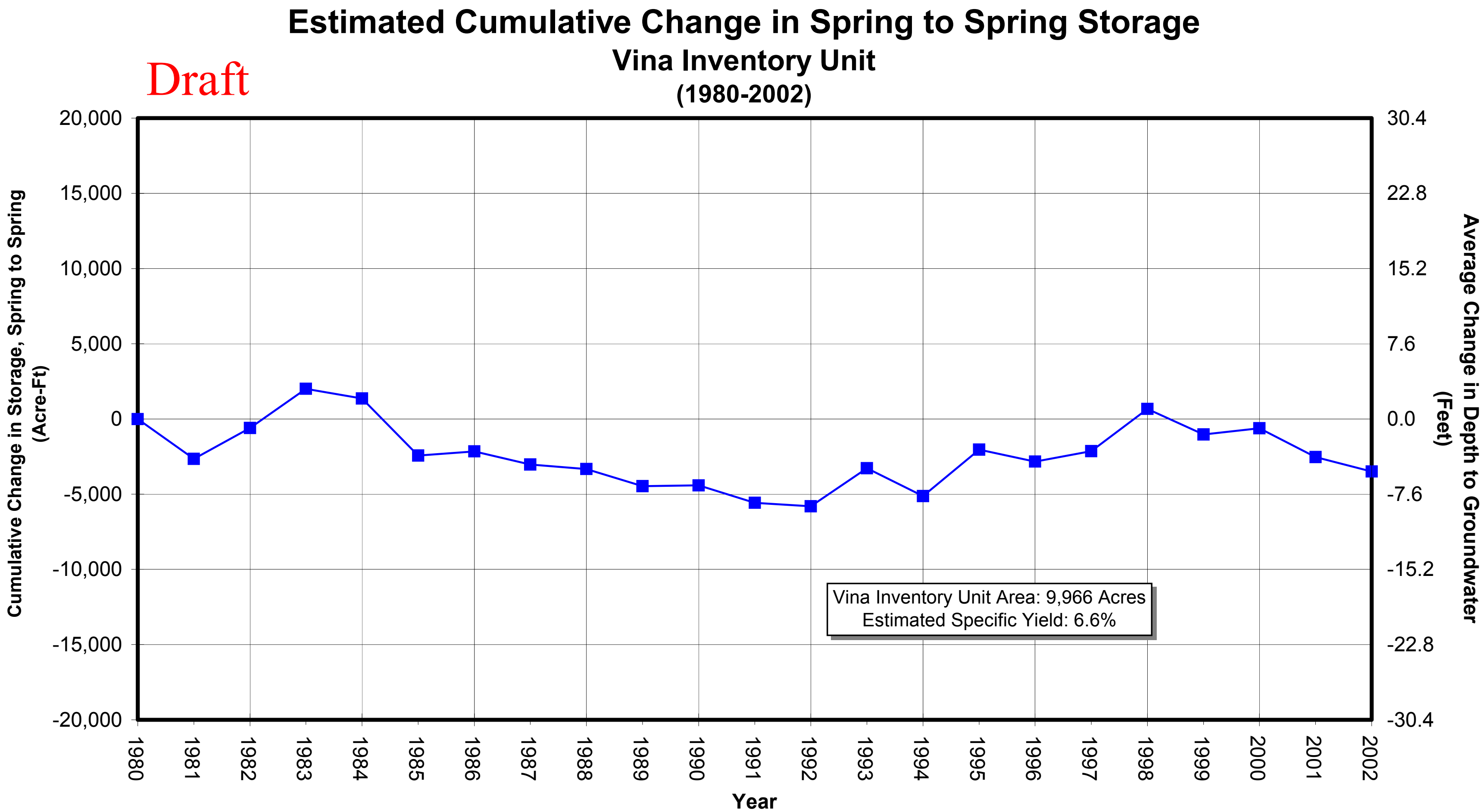
Source: California Department of Water Resources, Northern District.



Source: California Department of Water Resources, Northern District.



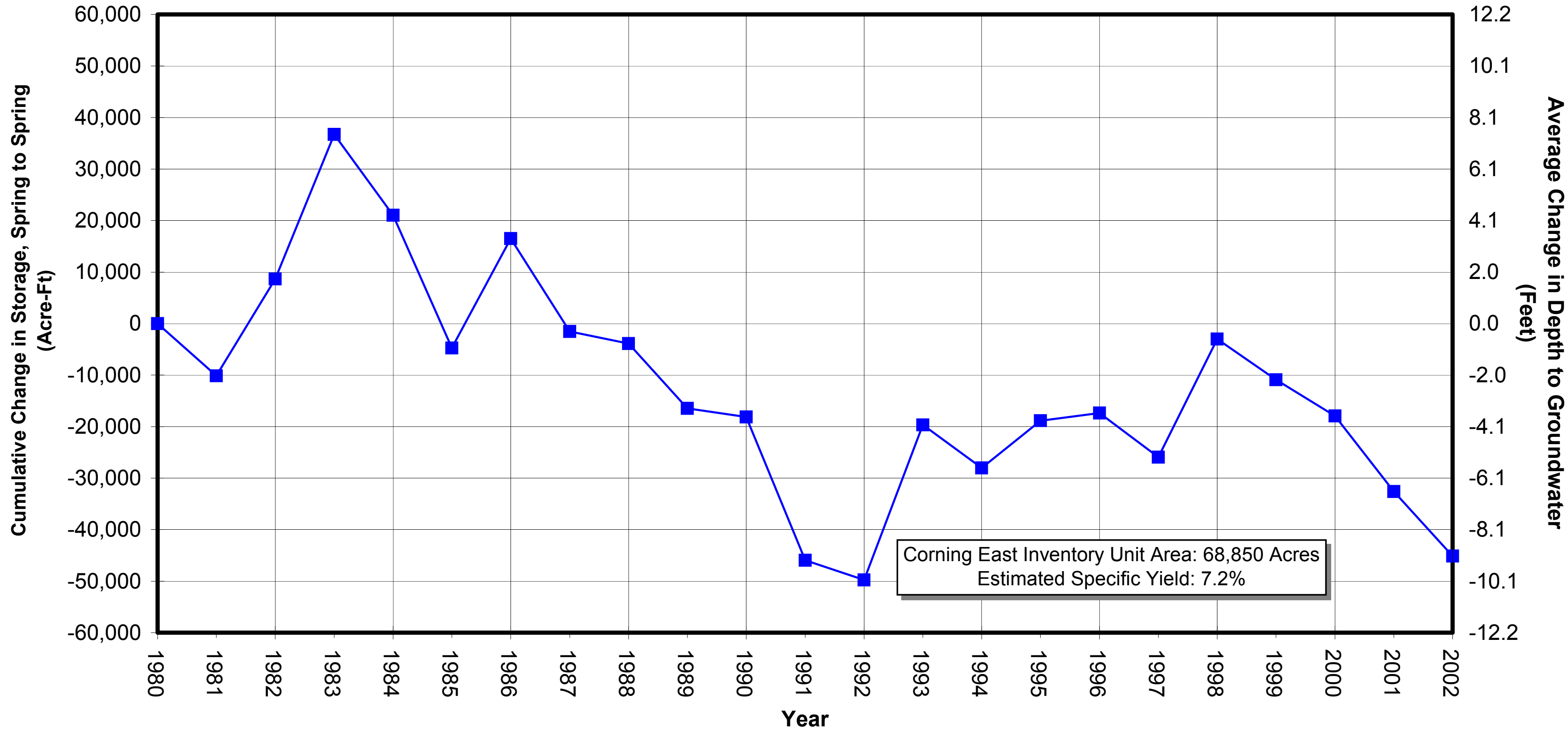
Source: California Department of Water Resources, Northern District.



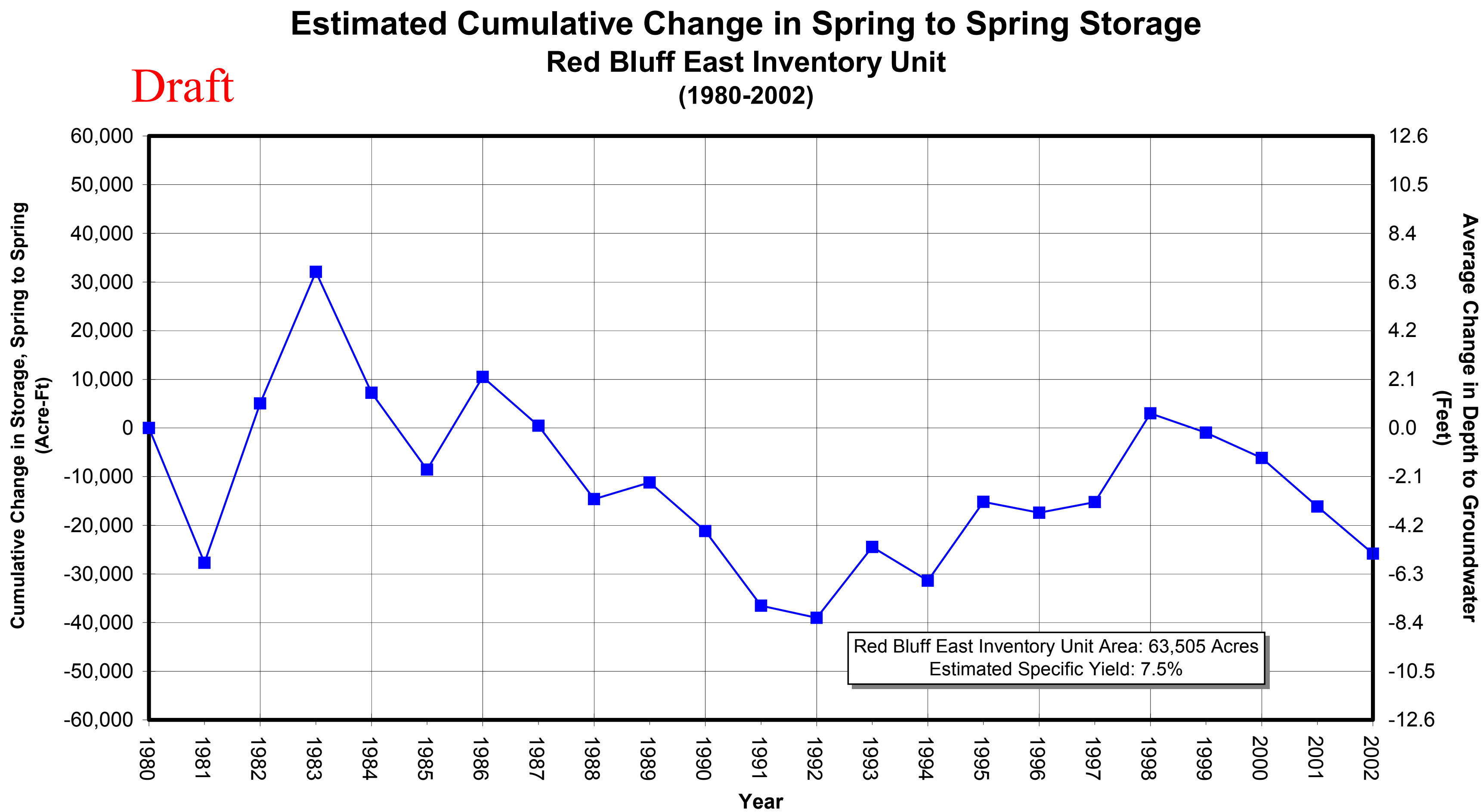
Source: California Department of Water Resources, Northern District.

Estimated Cumulative Change in Spring to Spring Storage
Corning East Inventory Unit
(1980-2002)

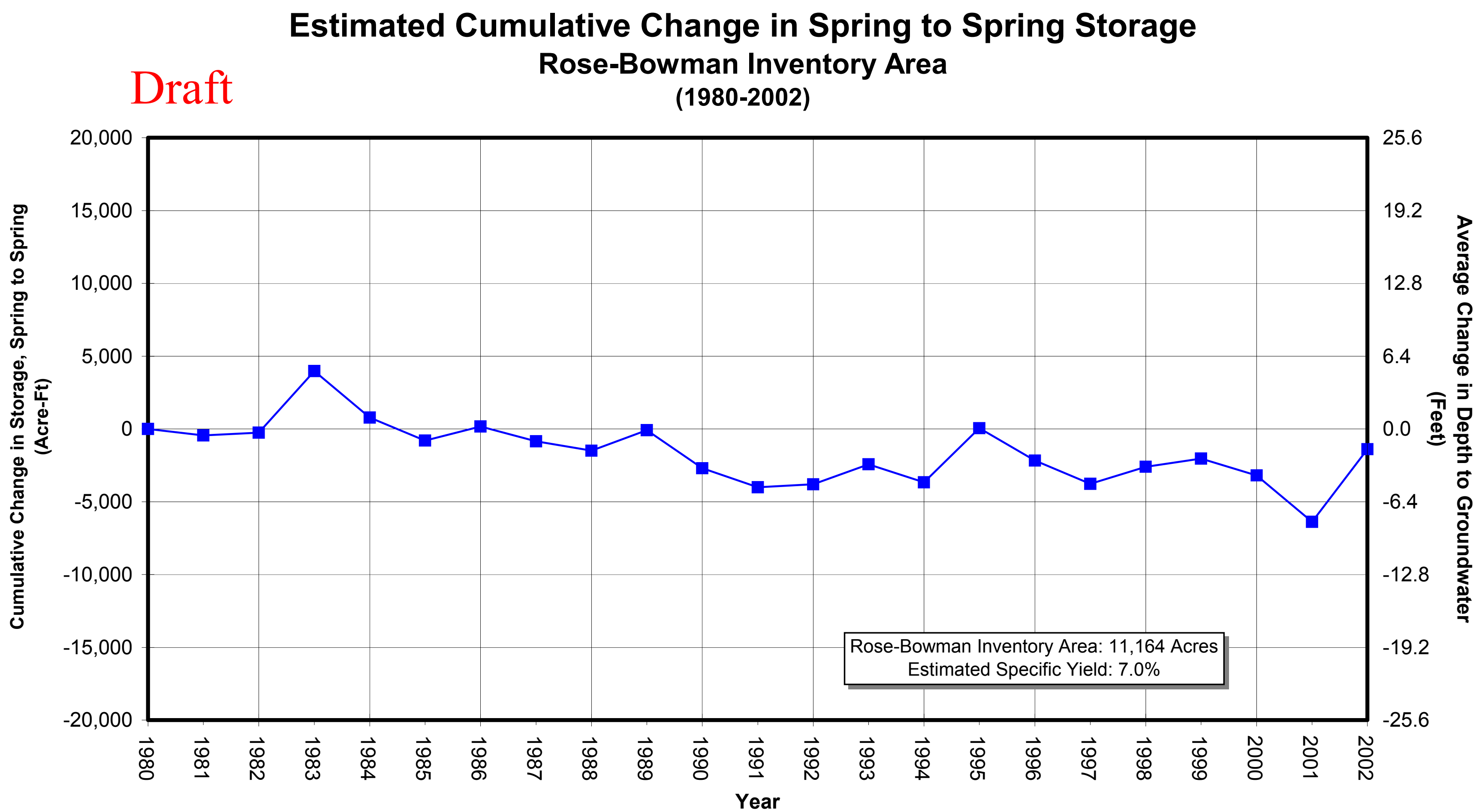
Draft



Source: California Department of Water Resources, Northern District.



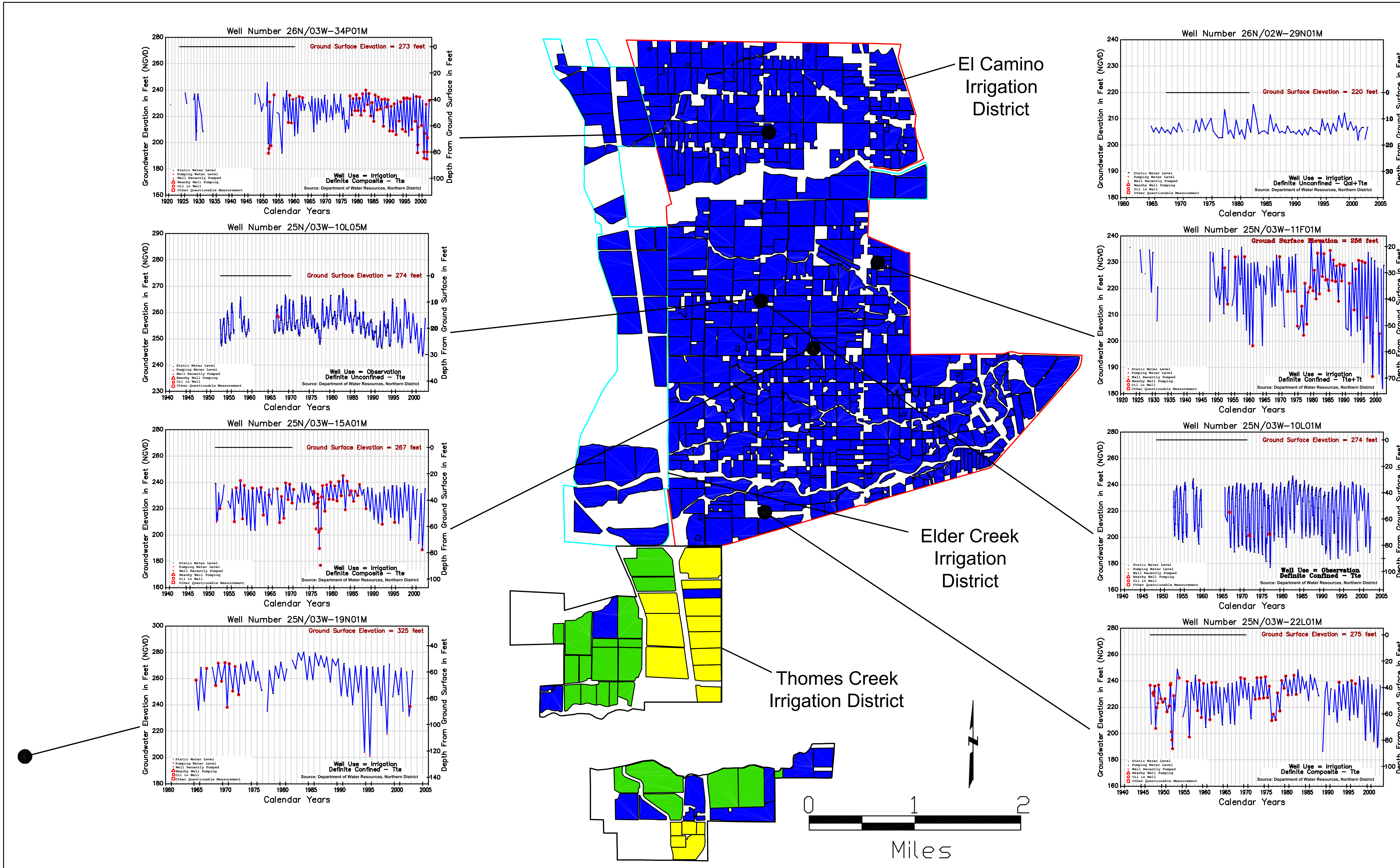
Source: California Department of Water Resources, Northern District.



Source: California Department of Water Resources, Northern District.

Appendix B
Irrigation District Maps with Hydrographs

The following maps illustrating irrigation districts, water source information, monitoring well locations and hydrographs is taken from the pre-publication draft report *Tehama County Groundwater Inventory,* DWR Northern District, May, 2003. The information presented from this report is still in draft form and may be subject to changes. For further information or questions regarding the source or qualification of this material, please contact Toccoy Dudley, Chief of the Groundwater Section, Northern District Department of Water Resources, Red Bluff, California. This information supplements Section 3, the physical setting.



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-1

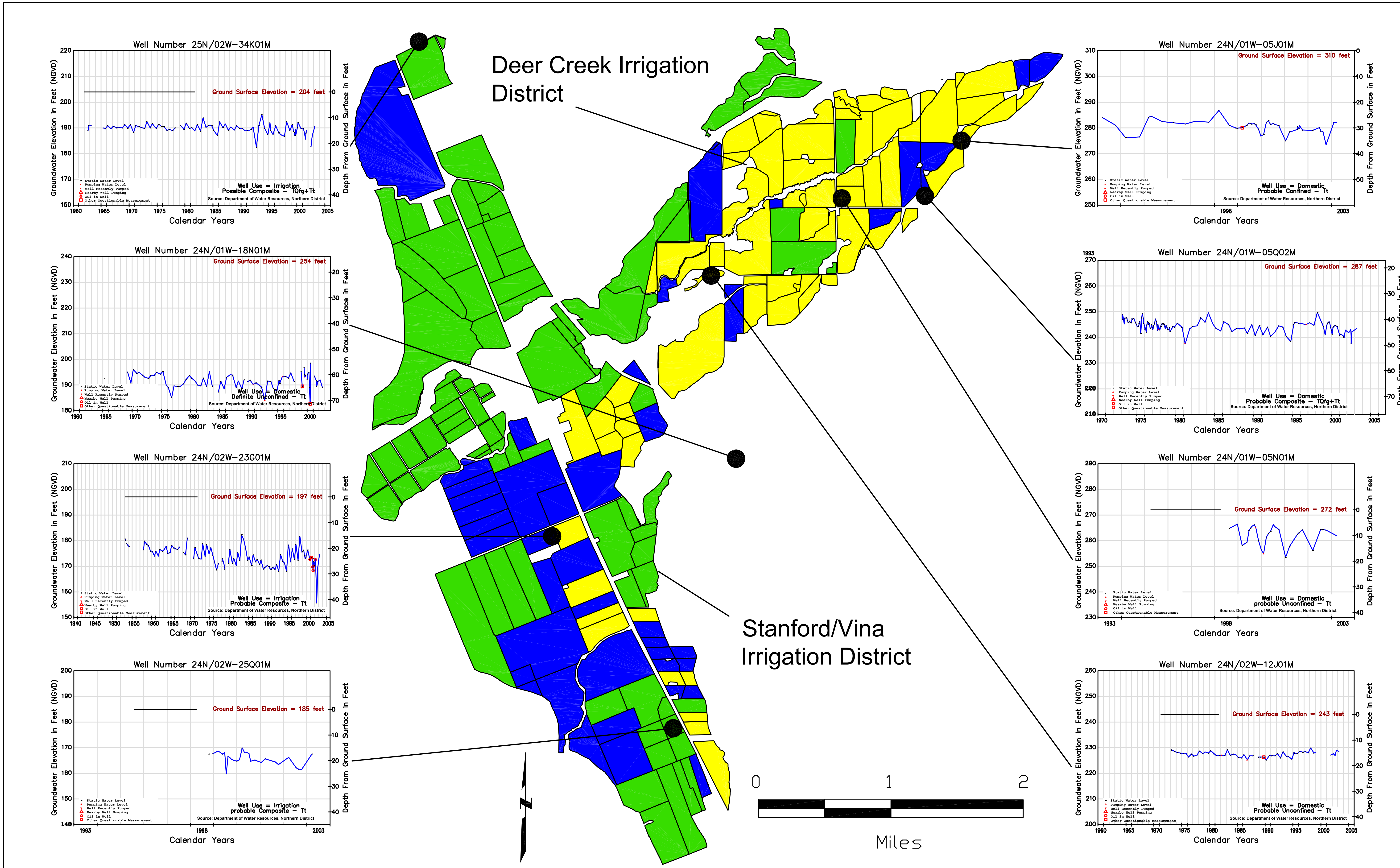
El Camino, Elder Creek and Thomes Creek Irrigation Districts and Surrounding Area

- Surface Water
- Ground Water
- Mixed Surface & Ground Water
- Irrigation District Boundry

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
04/16/03

DRAWING NUMBER



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-2

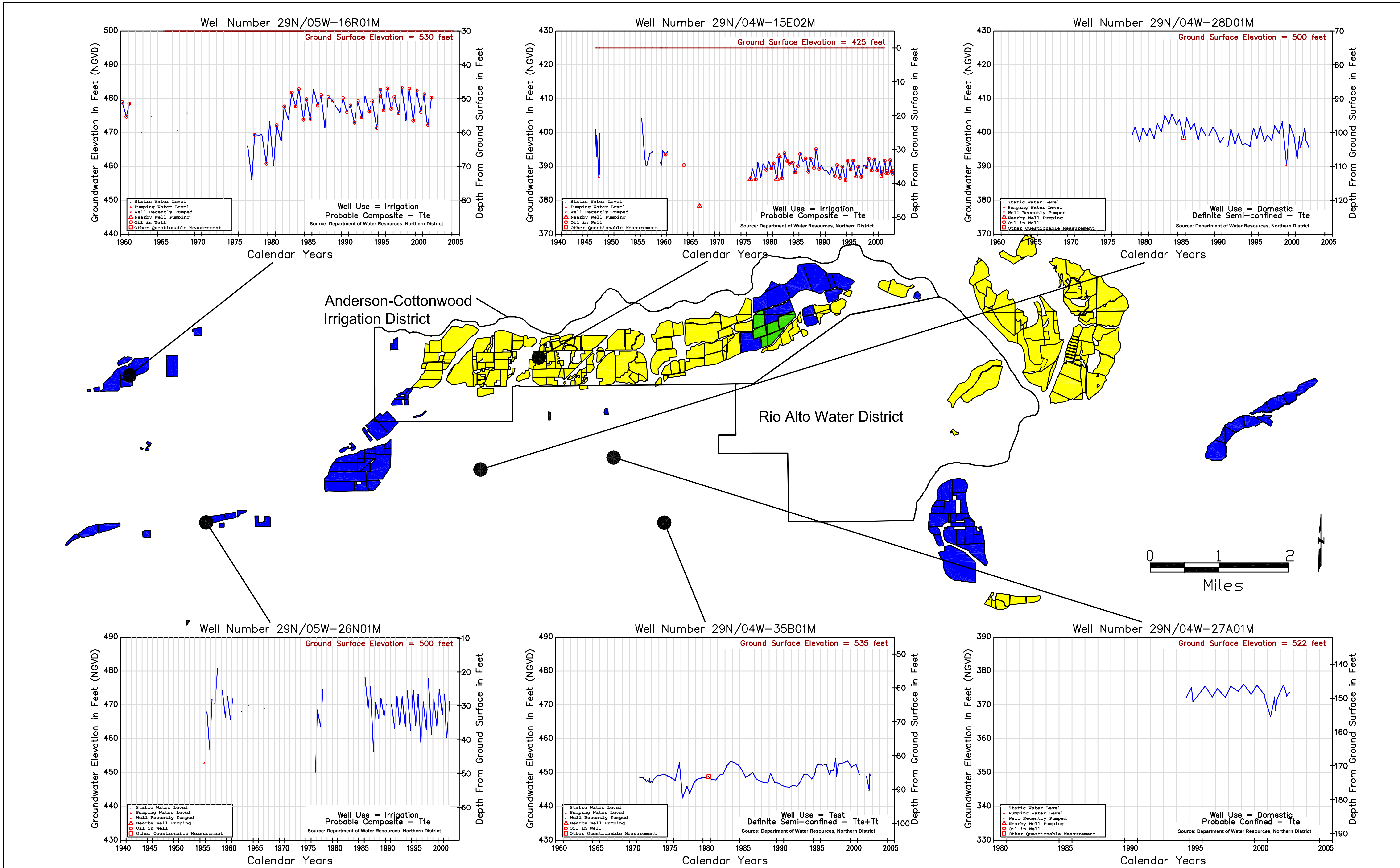
STANFORD/VINA AND DEERCREEK IRRIGATION DISTRICTS

- Surface Water
- Ground Water
- Mixed Surface & Ground Water
- Irrigation District Boundry

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
03/08/03

DRAWING NUMBER



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-3

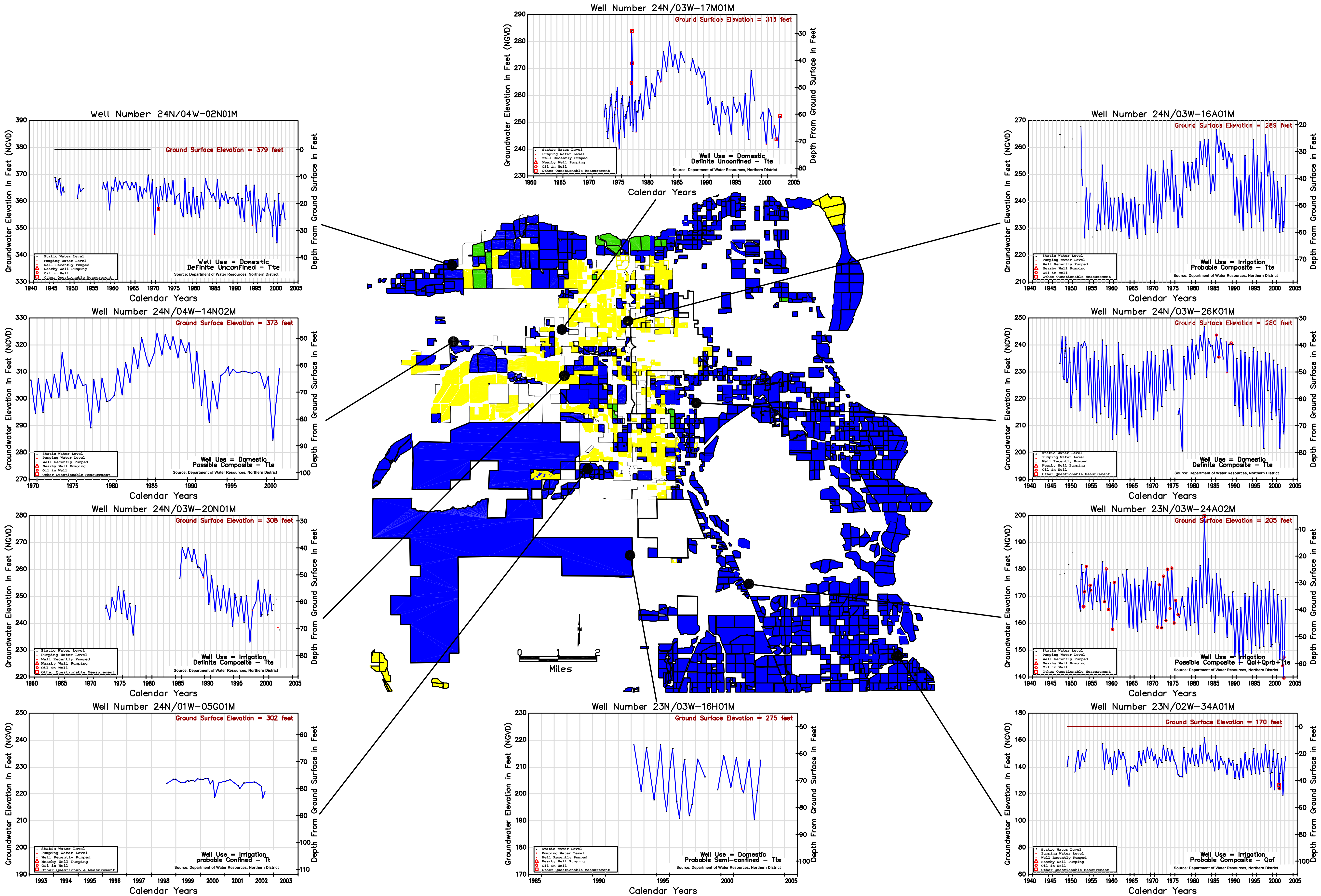
Anderson-Cottonwood Irrigation District, Rio Alto Water District and Surrounding Area

Surface Water
Ground Water
Mixed Surface & Ground Water
Irrigation District Boundry

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
04/16/03

DRAWING NUMBER



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-4

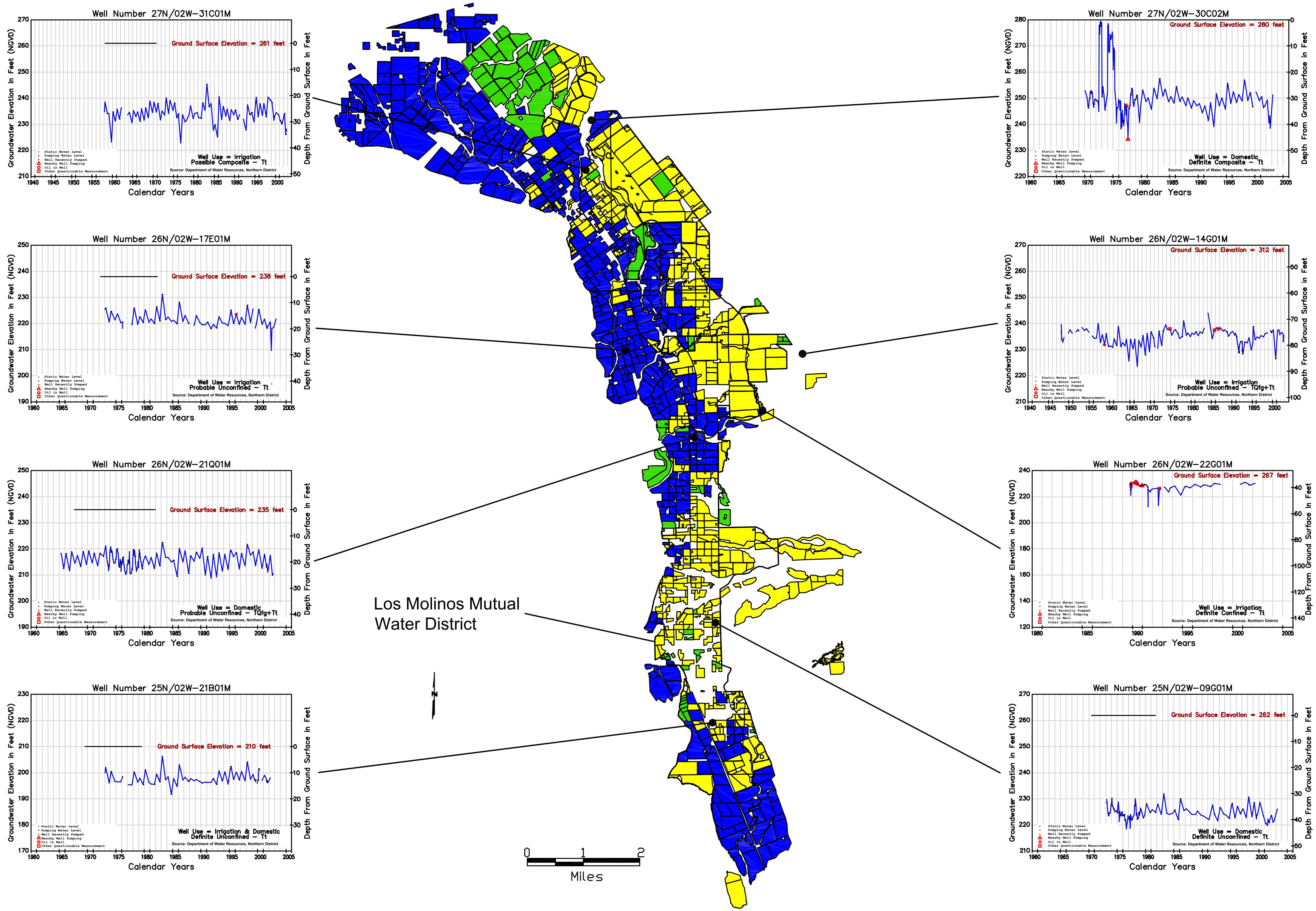
Corning Water District and Aaction Tree Farm

Surface Water
Ground Water
Mixed Surface & Ground Water
Irrigation District Boundry

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
04/16/03

DRAWING NUMBER



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

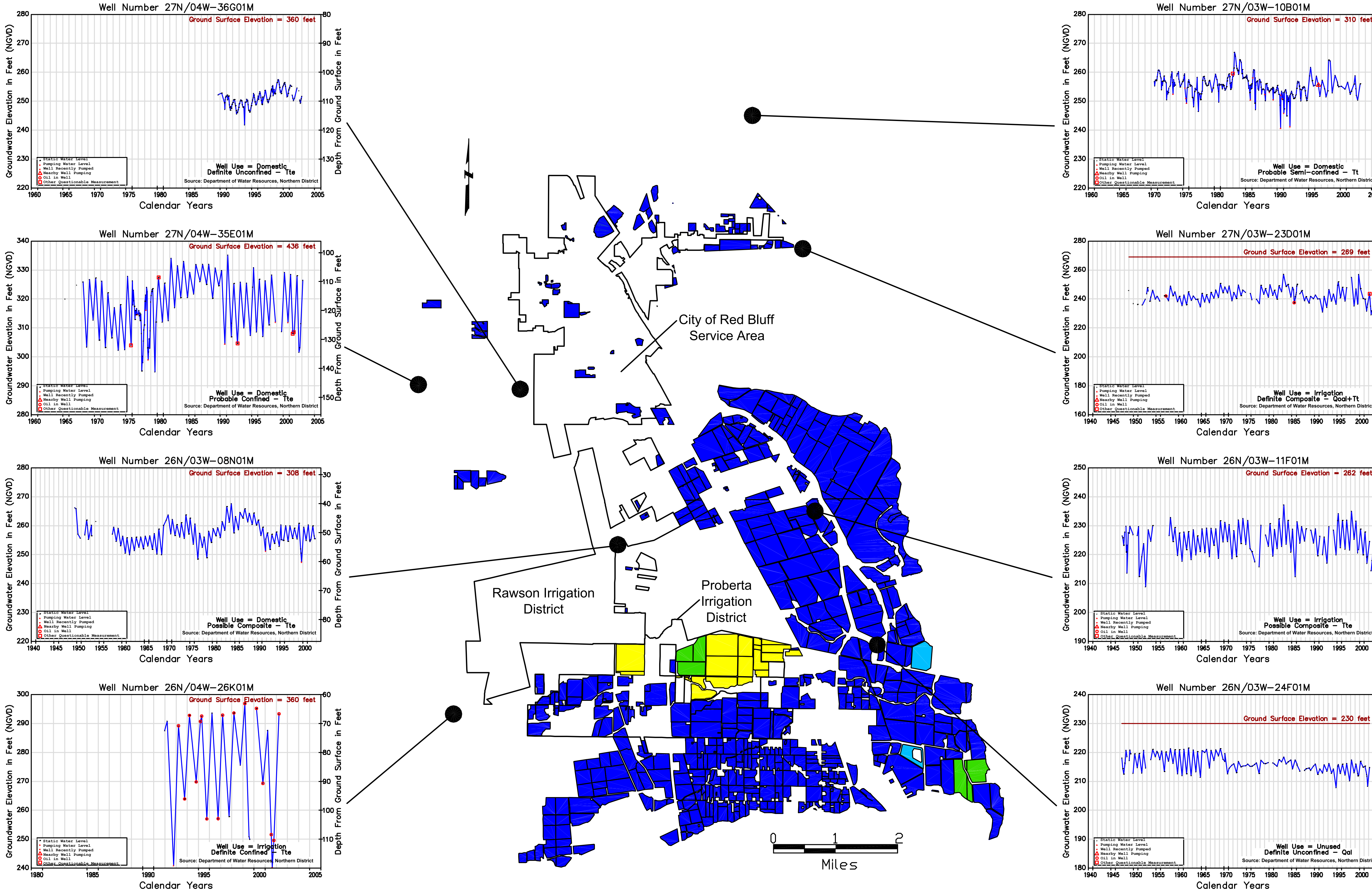
Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-5
Los Molinos Mutual Water District and Surrounding Area

- Surface Water
- Ground Water
- Mixed Surface & Ground Water
- Irrigation District Boundry

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
03/08/03
DRAWING NUMBER



STATE OF CALIFORNIA, THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF LOCAL ASSISTANCE, NORTHERN DISTRICT

2440 N. Main St.
Red Bluff, CA 96080
(530) 529-7300
FAX (530) 529-7322

Note: Hydrographs are available on the internet at http://www.wdl.water.ca.gov

Figure B-6

City of Red Bluff Service Area, Proberta and Rawson Irrigation Districts and Surrounding Area

- Surface Water
- Ground Water
- Mixed Surface & Ground Water
- Irrigation District Boundry
- Reclaimed Water

Note: Water source data is based on 1999 DWR Land & Water Use survey. Water source areas represent potential water source, rather than actual water type used during any given year

DATE
04/16/03

DRAWING NUMBER

Appendix C
Mill Creek Water Rights Adjudication

The Superior Court of Tehama County, by its Decree of August 16, 1920 adjudicated entitlements to all flows below 203 cfs in Mill Creek to serve 8,500 acres of agricultural lands based upon their riparian and appropriated water rights at that time. This appendix presents the distribution of water rights to Mill Creek to original and current owners. The data supplements water rights adjudication discussion in Section 4.

APPENDIX C

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811 (August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership	***Harvey & Mckay***	***Clough***		***Horst***	***Garber***	***Runyon***					***Cone & Ward***	***Los Molinos MWC***
Recent Ownership	***Droz***			***Jones***	***Redamonti***	***Kremer***	***Call***	***Fraga***	***Patrick*** (***Orange Cove ID***)	***Smith*** (***Orange Cove ID***)	***Owens***	
Decree Right	*Fixed*	*Fixed*		*7.00%*	*3.00%*	*1.00%*	*3.93%*	*2.50%*	*2.07%*	*3.50%*	*Fixed*	*Remainder*
Gross Flow			Net Flow									
203	3.0	11.0	189	13.23	5.67	1.89	7.43	4.73	3.91	6.62	6.0	139.53
202	3.0	10.0	189	13.23	5.67	1.89	7.43	4.73	3.91	6.62	6.0	139.53
201	3.0	9.0	189	13.23	5.67	1.89	7.43	4.73	3.91	6.62	6.0	139.53
200	3.0	8.0	189	13.23	5.67	1.89	7.43	4.73	3.91	6.62	6.0	139.53
199	3.0	7.0	189	13.23	5.67	1.89	7.43	4.73	3.91	6.62	5.0	140.53
198	3.0	7.0	188	13.16	5.64	1.88	7.39	4.70	3.89	6.58	5.0	139.76
197	3.0	7.0	187	13.09	5.61	1.87	7.35	4.68	3.87	6.55	5.0	138.99
196	3.0	7.0	186	13.02	5.58	1.86	7.31	4.65	3.85	6.51	5.0	138.22
195	3.0	7.0	185	12.95	5.55	1.85	7.27	4.63	3.83	6.48	5.0	137.45
194	3.0	7.0	184	12.88	5.52	1.84	7.23	4.60	3.81	6.44	5.0	136.68
193	3.0	7.0	183	12.81	5.49	1.83	7.19	4.58	3.79	6.41	5.0	135.91
192	3.0	7.0	182	12.74	5.46	1.82	7.15	4.55	3.77	6.37	5.0	135.14
191	3.0	7.0	181	12.67	5.43	1.81	7.11	4.53	3.75	6.34	5.0	134.37
190	3.0	7.0	180	12.60	5.40	1.80	7.07	4.50	3.73	6.30	5.0	133.60
189	3.0	7.0	179	12.53	5.37	1.79	7.03	4.48	3.71	6.27	5.0	132.83
188	3.0	7.0	178	12.46	5.34	1.78	7.00	4.45	3.68	6.23	5.0	132.06
187	3.0	7.0	177	12.39	5.31	1.77	6.96	4.43	3.66	6.20	5.0	131.29
186	3.0	7.0	176	12.32	5.28	1.76	6.92	4.40	3.64	6.16	5.0	130.52
185	3.0	7.0	175	12.25	5.25	1.75	6.88	4.38	3.62	6.13	5.0	129.75
184	3.0	7.0	174	12.18	5.22	1.74	6.84	4.35	3.60	6.09	5.0	128.98
183	3.0	7.0	173	12.11	5.19	1.73	6.80	4.33	3.58	6.06	5.0	128.21
182	3.0	7.0	172	12.04	5.16	1.72	6.76	4.30	3.56	6.02	5.0	127.44
181	3.0	7.0	171	11.97	5.13	1.71	6.72	4.28	3.54	5.99	5.0	126.67
180	3.0	7.0	170	11.90	5.10	1.70	6.68	4.25	3.52	5.95	5.0	125.90
179	3.0	6.0	170	11.90	5.10	1.70	6.68	4.25	3.52	5.95	5.0	125.90
178	3.0	6.0	169	11.83	5.07	1.69	6.64	4.23	3.50	5.92	5.0	125.13
177	3.0	6.0	168	11.76	5.04	1.68	6.60	4.20	3.48	5.88	5.0	124.36
176	3.0	6.0	167	11.69	5.01	1.67	6.56	4.18	3.46	5.85	5.0	123.59
175	3.0	6.0	166	11.62	4.98	1.66	6.52	4.15	3.44	5.81	5.0	122.82

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811
(August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership	***Harvey & Mckay***	***Clough***		***Horst***	***Garber***	***Runyon***					***Cone & Ward***	***Los Molinos MWC***
Recent Ownership	***Droz***			***Jones***	***Redamonti***	***Kremer***	***Call***	***Fraga***	***Patrick***	***Smith***	***Owens***	
									Orange Cove ID			
Decree Right	*Fixed*	*Fixed*		*7.00%*	*3.00%*	*1.00%*	*3.93%*	*2.50%*	*2.07%*	*3.50%*	*Fixed*	*Remainder*
Gross Flow			Net Flow									
174	3.0	6.0	165	11.55	4.95	1.65	6.48	4.13	3.42	5.78	5.0	122.05
173	3.0	6.0	164	11.48	4.92	1.64	6.45	4.10	3.39	5.74	5.0	121.28
172	3.0	6.0	163	11.41	4.89	1.63	6.41	4.08	3.37	5.71	5.0	120.51
171	3.0	6.0	162	11.34	4.86	1.62	6.37	4.05	3.35	5.67	5.0	119.74
170	3.0	6.0	161	11.27	4.83	1.61	6.33	4.03	3.33	5.64	5.0	118.97
169	3.0	6.0	160	11.20	4.80	1.60	6.29	4.00	3.31	5.60	5.0	118.20
168	3.0	6.0	159	11.13	4.77	1.59	6.25	3.98	3.29	5.57	5.0	117.43
167	3.0	6.0	158	11.06	4.74	1.58	6.21	3.95	3.27	5.53	5.0	116.66
166	3.0	6.0	157	10.99	4.71	1.57	6.17	3.93	3.25	5.50	5.0	115.89
165	3.0	6.0	156	10.92	4.68	1.56	6.13	3.90	3.23	5.46	5.0	115.12
164	3.0	6.0	155	10.85	4.65	1.55	6.09	3.88	3.21	5.43	5.0	114.35
163	3.0	6.0	154	10.78	4.62	1.54	6.05	3.85	3.19	5.39	5.0	113.58
162	3.0	6.0	153	10.71	4.59	1.53	6.01	3.83	3.17	5.36	5.0	112.81
161	3.0	6.0	152	10.64	4.56	1.52	5.97	3.80	3.15	5.32	5.0	112.04
160	3.0	6.0	151	10.57	4.53	1.51	5.93	3.78	3.13	5.29	5.0	111.27
159	3.0	6.0	150	10.50	4.50	1.50	5.90	3.75	3.11	5.25	5.0	110.50
158	3.0	6.0	149	10.43	4.47	1.49	5.86	3.73	3.08	5.22	5.0	109.73
157	3.0	6.0	148	10.36	4.44	1.48	5.82	3.70	3.06	5.18	5.0	108.96
156	3.0	6.0	147	10.29	4.41	1.47	5.78	3.68	3.04	5.15	5.0	108.19
155	3.0	6.0	146	10.22	4.38	1.46	5.74	3.65	3.02	5.11	5.0	107.42
154	3.0	6.0	145	10.15	4.35	1.45	5.70	3.63	3.00	5.08	5.0	106.65
153	3.0	6.0	144	10.08	4.32	1.44	5.66	3.60	2.98	5.04	5.0	105.88
152	3.0	6.0	143	10.01	4.29	1.43	5.62	3.58	2.96	5.01	5.0	105.11
151	3.0	6.0	142	9.94	4.26	1.42	5.58	3.55	2.94	4.97	5.0	104.34
150	3.0	6.0	141	9.87	4.23	1.41	5.54	3.53	2.92	4.94	5.0	103.57
149	3.0	5.0	141	9.87	4.23	1.41	5.54	3.53	2.92	4.94	5.0	103.57
148	3.0	5.0	140	9.80	4.20	1.40	5.50	3.50	2.90	4.90	5.0	102.80
147	3.0	5.0	139	9.73	4.17	1.39	5.46	3.48	2.88	4.87	5.0	102.03
146	3.0	5.0	138	9.66	4.14	1.38	5.42	3.45	2.86	4.83	5.0	101.26
145	3.0	5.0	137	9.59	4.11	1.37	5.38	3.43	2.84	4.80	5.0	100.49
144	3.0	5.0	136	9.52	4.08	1.36	5.34	3.40	2.82	4.76	5.0	99.72

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811
(August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership	***Harvey & Mckay***	***Clough***		***Horst***	***Garber***	***Runyon***					***Cone & Ward***	***Los Molinos MWC***
Recent Ownership	***Droz***			***Jones***	***Redamonti***	***Kremer***	***Call***	***Fraga***	***Patrick***	***Smith***	***Owens***	
									Orange Cove ID			
Decree Right	*Fixed*	*Fixed*		*7.00%*	*3.00%*	*1.00%*	*3.93%*	*2.50%*	*2.07%*	*3.50%*	*Fixed*	*Remainder*
Gross Flow			Net Flow									
143	3.0	5.0	135	9.45	4.05	1.35	5.31	3.38	2.79	4.73	5.0	98.95
142	3.0	5.0	134	9.38	4.02	1.34	5.27	3.35	2.77	4.69	5.0	98.18
141	3.0	5.0	133	9.31	3.99	1.33	5.23	3.33	2.75	4.66	5.0	97.41
140	3.0	5.0	132	9.24	3.96	1.32	5.19	3.30	2.73	4.62	5.0	96.64
139	3.0	5.0	131	9.17	3.93	1.31	5.15	3.28	2.71	4.59	5.0	95.87
138	3.0	5.0	130	9.10	3.90	1.30	5.11	3.25	2.69	4.55	5.0	95.10
137	3.0	5.0	129	9.03	3.87	1.29	5.07	3.23	2.67	4.52	5.0	94.33
136	3.0	5.0	128	8.96	3.84	1.28	5.03	3.20	2.65	4.48	5.0	93.56
135	3.0	5.0	127	8.89	3.81	1.27	4.99	3.18	2.63	4.45	5.0	92.79
134	3.0	5.0	126	8.82	3.78	1.26	4.95	3.15	2.61	4.41	5.0	92.02
133	3.0	5.0	125	8.75	3.75	1.25	4.91	3.13	2.59	4.38	5.0	91.25
132	3.0	5.0	124	8.68	3.72	1.24	4.87	3.10	2.57	4.34	5.0	90.48
131	3.0	5.0	123	8.61	3.69	1.23	4.83	3.08	2.55	4.31	5.0	89.71
130	3.0	5.0	122	8.54	3.66	1.22	4.79	3.05	2.53	4.27	5.0	88.94
129	3.0	5.0	121	8.47	3.63	1.21	4.76	3.03	2.50	4.24	5.0	88.17
128	3.0	5.0	120	8.40	3.60	1.20	4.72	3.00	2.48	4.20	5.0	87.40
127	3.0	5.0	119	8.33	3.57	1.19	4.68	2.98	2.46	4.17	5.0	86.63
126	3.0	5.0	118	8.26	3.54	1.18	4.64	2.95	2.44	4.13	5.0	85.86
125	3.0	5.0	117	8.19	3.51	1.17	4.60	2.93	2.42	4.10	5.0	85.09
124	3.0	5.0	116	8.12	3.48	1.16	4.56	2.90	2.40	4.06	5.0	84.32
123	3.0	5.0	115	8.05	3.45	1.15	4.52	2.88	2.38	4.03	5.0	83.55
122	3.0	5.0	114	7.98	3.42	1.14	4.48	2.85	2.36	3.99	5.0	82.78
121	3.0	5.0	113	7.91	3.39	1.13	4.44	2.83	2.34	3.96	5.0	82.01
120	3.0	5.0	112	7.84	3.36	1.12	4.40	2.80	2.32	3.92	5.0	81.24
119	3.0	5.0	111	7.77	3.33	1.11	4.36	2.78	2.30	3.89	5.0	80.47
118	3.0	5.0	110	7.70	3.30	1.10	4.32	2.75	2.28	3.85	5.0	79.70
117	3.0	5.0	109	7.63	3.27	1.09	4.28	2.73	2.26	3.82	5.0	78.93
116	3.0	5.0	108	7.56	3.24	1.08	4.24	2.70	2.24	3.78	5.0	78.16
115	3.0	5.0	107	7.49	3.21	1.07	4.21	2.68	2.21	3.75	5.0	77.39
114	3.0	5.0	106	7.42	3.18	1.06	4.17	2.65	2.19	3.71	5.0	76.62
113	3.0	5.0	105	7.35	3.15	1.05	4.13	2.63	2.17	3.68	5.0	75.85

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811
(August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership	***Harvey & Mckay***	***Clough***		***Horst***	***Garber***	***Runyon***					***Cone & Ward***	***Los Molinos MWC***
Recent Ownership	***Droz***			***Jones***	***Redamonti***	***Kremer***	***Call***	***Fraga***	***Patrick*** (***Orange Cove ID***)	***Smith*** (***Orange Cove ID***)	***Owens***	
Decree Right	*Fixed*	*Fixed*		*7.00%*	*3.00%*	*1.00%*	*3.93%*	*2.50%*	*2.07%*	*3.50%*	*Fixed*	*Remainder*
Gross Flow			Net Flow									
112	3.0	5.0	104	7.28	3.12	1.04	4.09	2.60	2.15	3.64	5.0	75.08
111	3.0	5.0	103	7.21	3.09	1.03	4.05	2.58	2.13	3.61	5.0	74.31
110	3.0	5.0	102	7.14	3.06	1.02	4.01	2.55	2.11	3.57	5.0	73.54
109	3.0	5.0	101	7.07	3.03	1.01	3.97	2.53	2.09	3.54	5.0	72.77
108	3.0	5.0	100	7.00	3.00	1.00	3.93	2.50	2.07	3.50	5.0	72.00
107	3.0	5.0	99	6.93	2.97	0.99	3.89	2.48	2.05	3.47	5.0	71.23
106	3.0	5.0	98	6.86	2.94	0.98	3.85	2.45	2.03	3.43	5.0	70.46
105	3.0	5.0	97	6.79	2.91	0.97	3.81	2.43	2.01	3.40	5.0	69.69
104	3.0	5.0	96	6.72	2.88	0.96	3.77	2.40	1.99	3.36	5.0	68.92
103	3.0	5.0	95	6.65	2.85	0.95	3.73	2.38	1.97	3.33	5.0	68.15
102	3.0	5.0	94	6.58	2.82	0.94	3.69	2.35	1.95	3.29	5.0	67.38
101	3.0	5.0	93	6.51	2.79	0.93	3.65	2.33	1.93	3.26	5.0	66.61
100	3.0	5.0	92	6.44	2.76	0.92	3.62	2.30	1.90	3.22	5.0	65.84
99	3.0	5.0	91	6.37	2.73	0.91	3.58	2.28	1.88	3.19	5.0	65.07
98	3.0	5.0	90	6.30	2.70	0.90	3.54	2.25	1.86	3.15	5.0	64.30
97	3.0	5.0	89	6.23	2.67	0.89	3.50	2.23	1.84	3.12	5.0	63.53
96	3.0	5.0	88	6.16	2.64	0.88	3.46	2.20	1.82	3.08	5.0	62.76
95	3.0	5.0	87	6.09	2.61	0.87	3.42	2.18	1.80	3.05	5.0	61.99
94	3.0	5.0	86	6.02	2.58	0.86	3.38	2.15	1.78	3.01	5.0	61.22
93	3.0	5.0	85	5.95	2.55	0.85	3.34	2.13	1.76	2.98	5.0	60.45
92	3.0	5.0	84	5.88	2.52	0.84	3.30	2.10	1.74	2.94	5.0	59.68
91	3.0	5.0	83	5.81	2.49	0.83	3.26	2.08	1.72	2.91	5.0	58.91
90	3.0	5.0	82	5.74	2.46	0.82	3.22	2.05	1.70	2.87	5.0	58.14
89	3.0	5.0	81	5.67	2.43	0.81	3.18	2.03	1.68	2.84	5.0	57.37
88	3.0	5.0	80	5.60	2.40	0.80	3.14	2.00	1.66	2.80	5.0	56.60
87	3.0	5.0	79	5.53	2.37	0.79	3.10	1.98	1.64	2.77	5.0	55.83
86	3.0	5.0	78	5.46	2.34	0.78	3.07	1.95	1.61	2.73	5.0	55.06
85	3.0	5.0	77	5.39	2.31	0.77	3.03	1.93	1.59	2.70	5.0	54.29
84	3.0	5.0	76	5.32	2.28	0.76	2.99	1.90	1.57	2.66	5.0	53.52
83	3.0	5.0	75	5.25	2.25	0.75	2.95	1.88	1.55	2.63	5.0	52.75
82	3.0	5.0	74	5.18	2.22	0.74	2.91	1.85	1.53	2.59	5.0	51.98

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811

(August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership / Recent Ownership / Decree Right (Gross Flow)	***Harvey & Mckay*** / ***Droz*** / *Fixed*	***Clough*** / *Fixed*	Net Flow	***Horst*** / ***Jones*** / *7.00%*	***Garber*** / ***Redamonti*** / *3.00%*	***Runyon*** / ***Kremer*** / *1.00%*	***Runyon*** / ***Call*** / *3.93%*	***Runyon*** / ***Fraga*** / *2.50%*	***Runyon*** / ***Patrick*** (***Orange Cove ID***) / *2.07%*	***Runyon*** / ***Smith*** (***Orange Cove ID***) / *3.50%*	***Cone & Ward*** / ***Owens*** / *Fixed*	***Los Molinos MWC*** / *Remainder*
81	3.0	5.0	73	5.11	2.19	0.73	2.87	1.83	1.51	2.56	5.0	51.21
80	3.0	5.0	72	5.04	2.16	0.72	2.83	1.80	1.49	2.52	5.0	50.44
79	3.0	5.0	71	4.97	2.13	0.71	2.79	1.78	1.47	2.49	5.0	49.67
78	3.0	5.0	70	4.90	2.10	0.70	2.75	1.75	1.45	2.45	5.0	48.90
77	3.0	5.0	69	4.83	2.07	0.69	2.71	1.73	1.43	2.42	5.0	48.13
76	3.0	5.0	68	4.76	2.04	0.68	2.67	1.70	1.41	2.38	5.0	47.36
75	3.0	5.0	67	4.69	2.01	0.67	2.63	1.68	1.39	2.35	5.0	46.59
74	3.0	5.0	66	4.62	1.98	0.66	2.59	1.65	1.37	2.31	5.0	45.82
73	3.0	5.0	65	4.55	1.95	0.65	2.55	1.63	1.35	2.28	5.0	45.05
72	3.0	5.0	64	4.48	1.92	0.64	2.52	1.60	1.32	2.24	5.0	44.28
71	3.0	5.0	63	4.41	1.89	0.63	2.48	1.58	1.30	2.21	5.0	43.51
70	3.0	5.0	62	4.34	1.86	0.62	2.44	1.55	1.28	2.17	5.0	42.74
69	3.0	5.0	61	4.27	1.83	0.61	2.40	1.53	1.26	2.14	5.0	41.97
68	3.0	5.0	60	4.20	1.80	0.60	2.36	1.50	1.24	2.10	5.0	41.20
67	3.0	5.0	59	4.13	1.77	0.59	2.32	1.48	1.22	2.07	5.0	40.43
66	3.0	5.0	58	4.06	1.74	0.58	2.28	1.45	1.20	2.03	5.0	39.66
65	3.0	5.0	57	3.99	1.71	0.57	2.24	1.43	1.18	2.00	5.0	38.89
64	3.0	5.0	56	3.92	1.68	0.56	2.20	1.40	1.16	1.96	5.0	38.12
63	3.0	5.0	55	3.85	1.65	0.55	2.16	1.38	1.14	1.93	5.0	37.35
62	3.0	5.0	54	3.78	1.62	0.54	2.12	1.35	1.12	1.89	5.0	36.58
61	3.0	5.0	53	3.71	1.59	0.53	2.08	1.33	1.10	1.86	5.0	35.81
60	3.0	5.0	52	3.64	1.56	0.52	2.04	1.30	1.08	1.82	5.0	35.04
59	3.0	5.0	51	3.57	1.53	0.51	2.00	1.28	1.06	1.79	5.0	34.27
58	3.0	5.0	50	3.50	1.50	0.50	1.97	1.25	1.04	1.75	5.0	33.50
57	3.0	5.0	49	3.43	1.47	0.49	1.93	1.23	1.01	1.72	5.0	32.73
56	3.0	5.0	48	3.36	1.44	0.48	1.89	1.20	0.99	1.68	5.0	31.96
55	3.0	5.0	47	3.29	1.41	0.47	1.85	1.18	0.97	1.65	5.0	31.19
54	3.0	5.0	46	3.22	1.38	0.46	1.81	1.15	0.95	1.61	5.0	30.42
53	3.0	5.0	45	3.15	1.35	0.45	1.77	1.13	0.93	1.58	5.0	29.65
52	3.0	5.0	44	3.08	1.32	0.44	1.73	1.10	0.91	1.54	5.0	28.88
51	3.0	5.0	43	3.01	1.29	0.43	1.69	1.08	0.89	1.51	5.0	28.11

DISTRIBUTION OF MILL CREEK WATER RIGHTS BASED ON COURT DECREE No. 3811
(August 16, 1920) and M.R. RUNYON ESTATE DISTRIBUTION (cfs)

Aug 16, 1920 Ownership	***Harvey & Mckay***	***Clough***		***Horst***	***Garber***	***Runyon***					***Cone & Ward***	***Los Molinos MWC***
Recent Ownership	***Droz***			***Jones***	***Redamonti***	***Kremer***	***Call***	***Fraga***	***Patrick***	***Smith***	***Owens***	
									Orange Cove ID			
Decree Right	*Fixed*	*Fixed*		*7.00%*	*3.00%*	*1.00%*	*3.93%*	*2.50%*	*2.07%*	*3.50%*	*Fixed*	*Remainder*
Gross Flow			Net Flow									
50	3.0	5.0	42	2.94	1.26	0.42	1.65	1.05	0.87	1.47	5.0	27.34
49	3.0	5.0	41	2.87	1.23	0.41	1.61	1.03	0.85	1.44	5.0	26.57
48	3.0	5.0	40	2.80	1.20	0.40	1.57	1.00	0.83	1.40	5.0	25.80
47	3.0	5.0	39	2.73	1.17	0.39	1.53	0.98	0.81	1.37	5.0	25.03
46	3.0	5.0	38	2.66	1.14	0.38	1.49	0.95	0.79	1.33	5.0	24.26
45	3.0	5.0	37	2.59	1.11	0.37	1.45	0.93	0.77	1.30	5.0	23.49
44	3.0	5.0	36	2.52	1.08	0.36	1.41	0.90	0.75	1.26	5.0	22.72
43	3.0	5.0	35	2.45	1.05	0.35	1.38	0.88	0.72	1.23	5.0	21.95
42	3.0	5.0	34	2.38	1.02	0.34	1.34	0.85	0.70	1.19	5.0	21.18
41	3.0	5.0	33	2.31	0.99	0.33	1.30	0.83	0.68	1.16	5.0	20.41
40	3.0	5.0	32	2.24	0.96	0.32	1.26	0.80	0.66	1.12	5.0	19.64
39	3.0	5.0	31	2.17	0.93	0.31	1.22	0.78	0.64	1.09	5.0	18.87
38	3.0	5.0	30	2.10	0.90	0.30	1.18	0.75	0.62	1.05	5.0	18.10
37	3.0	5.0	29	2.03	0.87	0.29	1.14	0.73	0.60	1.02	5.0	17.33

Appendix D
Tehama County Water Supply, Demand, and Land Use Data

DWR Northern District, Land and Water Use Section developed the data in this appendix. This appendix includes three scenarios: average year, drought year (75 percent CVP cutbacks), and drought year (100 percent CVP cutbacks). The data includes water supply and demand estimates for each Inventory Sub-unit in Tehama County. The data supplements the analysis in Section 5.

This appendix also contains land use data, including net irrigated acreage, ET of applied water and applied water for each Inventory Unit in Tehama County. The data supports the agricultural water demand discussions in Section 5.

State of California, Department of Water Resources, Northern District

DRAFT

Tehama County Applied Water Balance for 2000 Actual Year Scenario

(Acre-Feet)

	Red Bluff East							Red Bluff West			Corning East							Corning West	Bend	Antelope			
Applied Water	City of Red Bluff	Proberta WD	Elder Creek WD	El Camino ID	Thomes Creek WD	Independent	**Total**	Rancho Tehama Reserve	Independent	**Total**	City of Corning	Thomes Creek Wd	Corning WD	Kirkwood WD	Aaction Tree Farm	Inpedendent	**Total**			City of Red Bluff	Los Molinos MWC	Independent	**Total**
Agriculture	300	7,300	2,200	11,100	3,000	51,100	**75,000**	0	2,100	**2,100**	300	1,400	21,000	1,600	20,100	69,500	**113,900**	3,200	1,700	0	2,400	21,600	**24,000**
M & I	3,300	0	0	500	0	4,300	**8,100**	400	1,400	**1,800**	2,500	0	500	0	0	1,600	**4,600**	100	200	700	100	1,400	**2,200**
Environmental[1]	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	200	0	0	0	**0**
Conveyance Losses[2]	0	300	900	0	300	800	**2,300**	0	0	**0**	0	200	1,100	0	0	0	**1,300**	400	200	0	1,900	3,200	**5,100**
Total Applied Water	**3,600**	**7,600**	**3,100**	**11,600**	**3,300**	**56,200**	**85,400**	**400**	**3,500**	**3,900**	**2,800**	**1,600**	**22,600**	**1,600**	**20,100**	**71,100**	**119,800**	**3,700**	**2,300**	**700**	**4,400**	**26,200**	**31,300**
Supplies																							
1. Local Surface	0	0	0	0	0	0	**0**	0	200	**200**	0	0	200	0	0	2,000	**2,200**	2,400	1,600	0	4,300	9,000	**13,300**
3. CVP: Corning & Tehama-Colusa C	0	5,000	900	0	2,800	800	**9,500**	0	0	**0**	0	900	10,000	900	0	0	**11,800**	0	0	0	0	0	**0**
3. Sacramento River/CVP	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	600	**600**	0	200	0	0	0	**0**
4. Total Ground Water	3,600	1,100	2,200	11,600	100	55,300	**73,900**	400	3,300	**3,700**	2,900	500	9,800	500	20,100	69,700	**103,500**	1,000	400	700	100	17,200	**18,000**
5. Surface Water Deep Percolation	0	500	900	0	400	800	**2,600**	0	0	**0**	0	200	1,500	0	0	100	**1,800**	300	400	0	500	900	**1,400**
6. Ground Water Deep Percolation	300	300	600	2,700	0	10,600	**14,500**	200	900	**1,100**	300	100	1,500	100	1,900	12,600	**16,500**	200	100	100	0	2,600	**2,700**
7. Net Ground Water	3,300	300	700	8,900	0	43,900	**57,100**	200	2,400	**2,600**	2,600	200	6,800	400	18,200	57,000	**85,200**	500	0	600	0	13,700	**14,300**
8. Reclaimed Waste Water	100	0	0	0	0	100	**200**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
9. Dedicated Natural Flow	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
Prime Supplies (1,2,3,4,8,9,10)	**3,400**	**5,300**	**1,600**	**8,900**	**2,800**	**44,800**	**66,800**	**200**	**2,600**	**2,800**	**2,600**	**1,100**	**17,000**	**1,300**	**18,200**	**59,600**	**99,800**	**2,900**	**1,800**	**600**	**4,300**	**22,700**	**27,600**
Deep Percolation Reuse[3]	200	800	1,500	2,700	100	11,400	**16,700**	200	900	1,100	200	300	3,000	100	1,900	11,500	17,000	500	400	100	100	3,500	3,700
Surface Water Reuse[3]	0	1,500	0	0	400	0	**1,900**	0	0	0	0	200	2,600	200	0	0	3,000	300	100	0	0	0	0
Total Reuse[3]	**200**	**2,300**	**1,500**	**2,700**	**500**	**11,400**	**18,600**	**200**	**900**	**1,100**	**200**	**500**	**5,600**	**300**	**1,900**	**11,500**	**20,000**	**800**	**500**	**100**	**100**	**3,500**	**3,700**
Reuse, %[3]	**5.56%**	**30.26%**	**48.39%**	**23.28%**	**15.15%**	**20.28%**	**21.78%**	**50.00%**	**25.71%**	**28.21%**	**7.14%**	**31.25%**	**24.78%**	**18.75%**	**9.45%**	**16.17%**	**16.69%**	**21.62%**	**21.74%**	**14.29%**	**2.27%**	**13.36%**	**11.82%**
Total Supplies	**3,600**	**7,600**	**3,100**	**11,600**	**3,300**	**56,200**	**85,400**	**400**	**3,500**	**3,900**	**2,800**	**1,600**	**22,600**	**1,600**	**20,100**	**71,100**	**119,800**	**3,700**	**2,300**	**700**	**4,400**	**26,200**	**31,300**
Shortage																							
Prime Surface Supply Shortage	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surface Water Deep Perc. Reuse	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surface Water Reuse	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Applied Water Shortage	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows
[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies
[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

DRAFT

Tehama County Applied Water Balance for 2000 Actual Year Scenario

(Acre-Feet)

	Dye Creek			Los Molinos				Vina				Bowman				Rosewood			South Battle Creek	West Mountain	East Mountain			TEHAMA CO SUMMARY
Applied Water	Los Molinos MWC	Independent	Total	Los Molinos MWC	Stanford-Vina Ranch IC	Independent	Total	Stanford-Vina Ranch IC	Deer Creek ID	Independent	Total	Anderson-Cottonwood ID	Rio Alto WD	Independent	Total	Anderson-Cottonwood ID	Independent	Total			Mineral County WD	Independent	Total	
Agriculture	17,200	7,400	**24,600**	5,700	5,400	5,700	**16,800**	11,400	6,500	4,600	**22,500**	8,400	700	1,100	**10,200**	1,200	800	**2,000**	7,300	200	1,900	3,200	**5,100**	**308,600**
M & I	1,100	200	**1,300**	2,000	0	100	**2,100**	100	0	100	**200**	100	1,000	1,000	**2,100**	0	200	**200**	0	100	0	100	**100**	**23,100**
Environmental[1]	2,000	0	**2,000**	0	0	1,900	**1,900**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**4,100**
Conveyance Losses[2]	10,200	200	**10,400**	2,200	3,500	1,900	**7,600**	4,700	5,100	0	**9,800**	4,200	0	0	**4,200**	200	0	200	600	0	0	300	**300**	**42,400**
Total Applied Water	**30,500**	**7,800**	**38,300**	**9,900**	**8,900**	**9,600**	**28,400**	**16,200**	**11,600**	**4,700**	**32,500**	**12,700**	**1,700**	**2,100**	**16,500**	**1,400**	**1,000**	**2,400**	**7,900**	**300**	**1,900**	**3,600**	**5,500**	**378,200**
Supplies																								
1. Local Surface	28,600	2,500	**31,100**	7,100	7,600	6,500	**21,200**	13,000	11,100	800	**24,900**	0	0	0	**0**	0	0	**0**	4,400	0	1,600	3,400	**5,000**	**106,300**
3. CVP: Corning & Tehama-Colusa C	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**21,300**
3. Sacramento River/CVP	0	0	**0**	0	0	400	**400**	0	0	0	**0**	10,600	1,200	300	**12,100**	1,100	0	**1,100**	0	0	0	0	**0**	**14,400**
4. Total Ground Water	700	5,100	**5,800**	3,000	900	2,700	**6,600**	4,000	800	3,800	**8,600**	1,400	400	1,800	**3,600**	200	1,100	**1,300**	2,100	300	0	200	**200**	**229,000**
5. Surface Water Deep Percolation	6,600	200	**6,800**	1,500	2,000	1,000	**4,500**	3,500	3,000	100	**6,600**	1,800	400	100	**2,300**	200	0	**200**	200	0	0	300	**300**	**27,400**
6. Ground Water Deep Percolation	100	800	**900**	600	100	500	**1,200**	800	200	700	**1,700**	300	100	500	**900**	0	200	**200**	400	100	0	100	**100**	**40,600**
7. Net Ground Water	0	4,100	**4,100**	900	0	1,200	**2,100**	0	0	3,000	**3,000**	0	0	1,200	**1,200**	0	900	**900**	1,500	200	0	0	**0**	**172,700**
8. Reclaimed Waste Water	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**200**
9. Dedicated Natural Flow	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**0**
Prime Supplies (1,2,3,4,8,9,10)	**28,600**	**6,600**	**35,200**	**8,000**	**7,600**	**8,100**	**23,700**	**13,000**	**11,100**	**3,800**	**27,900**	**10,600**	**1,200**	**1,500**	**13,300**	**1,100**	**900**	**2,000**	**5,900**	**200**	**1,600**	**3,400**	**5,000**	**314,900**
Deep Percolation Reuse[3]	700	1,000	1,700	1,900	900	1,500	4,300	3,200	500	800	4,500	1,400	400	600	2,400	200	100	300	600	100	0	200	200	53,500
Surface Water Reuse[3]	1,200	200	1,400	0	400	0	400	0	0	100	100	700	100	0	800	100	0	100	1,400	0	300	0	300	9,800
Total Reuse [3]	**1,900**	**1,200**	**3,100**	**1,900**	**1,300**	**1,500**	**4,700**	**3,200**	**500**	**900**	**4,600**	**2,100**	**500**	**600**	**3,200**	**300**	**100**	**400**	**2,000**	**100**	**300**	**200**	**500**	**63,300**
Reuse, %[3]	**6.23%**	**15.38%**	**8.09%**	**19.19%**	**14.61%**	**15.63%**	**16.55%**	**19.75%**	**4.31%**	**19.15%**	**14.15%**	**16.54%**	**29.41%**	**28.57%**	**19.39%**	**21.43%**	**10.00%**	**16.67%**	**25.32%**	**33.33%**	**15.79%**	**5.56%**	**9.09%**	**16.74%**
Total Supplies	**30,500**	**7,800**	**38,300**	**9,900**	**8,900**	**9,600**	**28,400**	**16,200**	**11,600**	**4,700**	**32,500**	**12,700**	**1,700**	**2,100**	**16,500**	**1,400**	**1,000**	**2,400**	**7,900**	**300**	**1,900**	**3,600**	**5,500**	**378,200**
Shortage																								
Prime Surface Supply Shortage	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surface Water Deep Perc. Reuse	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surface Water Reuse	**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 Applied Water Shortage	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows
[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies
[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

Tehama County Applied Water Balance for 2000 Dry Year (75% CVP Canal Cutback) Scenario

(Acre-Feet)

	Red Bluff East							Red Bluff West			Corning East									Antelope			
Applied Water	City of Red Bluff	Proberta WD	Elder Creek WD	El Camino ID	Thomes Creek WD	Independent	**Total**	Rancho Tehama Reserve	Independent	**Total**	City of Corning	Thomes Creek Wd	Corning WD	Kirkwood WD	Aaction Tree Farm	Inpedendent	**Total**	**Corning West**	**Bend**	City of Red Bluff	Los Molinos MWC	Independent	**Total**
Agriculture	400	7,900	2,400	13,000	3,700	59,300	**86,700**	0	2,300	**2,300**	500	1,800	26,200	1,900	29,300	84,700	**144,400**	3,800	2,000	0	2,800	24,900	**27,700**
M & I	4,500	0	0	500	0	4,500	**9,500**	400	1,400	**1,800**	2,300	0	400	0	0	1,700	**4,400**	100	200	900	100	1,500	**2,500**
Environmental[1]	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	200	0	0	0	**0**
Conveyance Losses[2]	0	300	900	0	300	800	**2,300**	0	0	**0**	0	200	1,100	0	0	0	**1,300**	400	200	0	1,900	2,800	**4,700**
Total Applied Water	**4,900**	**8,200**	**3,300**	**13,500**	**4,000**	**64,600**	**98,500**	**400**	**3,700**	**4,100**	**2,800**	**2,000**	**27,700**	**1,900**	**29,300**	**86,400**	**150,100**	**4,300**	**2,600**	**900**	**4,800**	**29,200**	**34,900**
Supplies																							
1. Local Surface	0	0	0	0	0	0	**0**	0	100	**100**	0	0	200	0	0	600	**800**	1,300	1,800	0	4,300	6,100	**10,400**
3. CVP: Corning & Tehama-Colusa C	0	1,100	900	0	1,800	800	**4,600**	0	0	**0**	0	300	6,900	500	0	0	**7,700**	0	0	0	0	0	**0**
3. Sacramento River/CVP	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	500	**500**	0	300	0	0	0	**0**
4. Total Ground Water	4,900	4,600	2,400	13,500	1,800	64,000	**91,200**	400	3,500	**3,900**	2,800	1,700	12,300	600	29,300	84,800	**131,500**	1,100	400	900	400	23,300	**24,600**
5. Surface Water Deep Percolation	0	100	900	0	400	800	**2,200**	0	0	**0**	0	200	900	0	0	100	**1,200**	200	400	0	500	600	**1,100**
6. Ground Water Deep Percolation	500	1,100	600	3,100	400	11,500	**17,200**	200	1,000	**1,200**	300	300	2,000	100	3,300	15,400	**21,400**	200	100	100	100	4,200	**4,400**
7. Net Ground Water	4,400	3,400	900	10,400	1,000	51,700	**71,800**	200	2,500	**2,700**	2,500	1,200	9,400	500	26,000	69,300	**108,900**	700	0	800	0	18,500	**19,300**
8. Reclaimed Waste Water	100	0	0	0	0	100	**200**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
9. Dedicated Natural Flow	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
Prime Supplies (1,2,3,4,8,9,10)	**4,500**	**4,500**	**1,800**	**10,400**	**2,800**	**52,600**	**76,600**	**200**	**2,600**	**2,800**	**2,500**	**1,500**	**16,500**	**1,000**	**26,000**	**70,400**	**117,900**	**2,000**	**2,100**	**800**	**4,300**	**24,600**	**29,700**
Deep Percolation Reuse[3]	400	1,200	1,500	3,100	800	12,000	**19,000**	200	1,000	1,200	300	500	2,900	100	3,300	15,500	22,600	400	400	100	400	4,600	5,100
Surface Water Reuse[3]	0	200	0	0	200	0	**400**	0	0	0	0	0	900	100	0	0	1,000	100	100	0	100	0	100
Total Reuse[3]	**400**	**1,400**	**1,500**	**3,100**	**1,000**	**12,000**	**19,400**	**200**	**1,000**	**1,200**	**300**	**500**	**3,800**	**200**	**3,300**	**15,500**	**23,600**	**500**	**500**	**100**	**500**	**4,600**	**5,200**
Reuse, %[3]	**8.16%**	**24.39%**	**45.45%**	**22.96%**	**30.00%**	**18.58%**	**20.51%**	**50.00%**	**27.03%**	**29.27%**	**10.71%**	**25.00%**	**21.66%**	**15.79%**	**11.26%**	**18.06%**	**17.32%**	**18.60%**	**19.23%**	**11.11%**	**10.42%**	**15.75%**	**14.90%**
Total Supplies	**4,900**	**5,900**	**3,300**	**13,500**	**3,800**	**64,600**	**96,000**	**400**	**3,600**	**4,000**	**2,800**	**2,000**	**20,300**	**1,200**	**29,300**	**85,900**	**141,500**	**2,500**	**2,600**	**900**	**4,800**	**29,200**	**34,900**
Shortage																							
Prime Surface Supply Shortage	**0**	**1,700**	**0**	**0**	**0**	**0**	**1,700**	**0**	**100**	**100**	**0**	**0**	**5,200**	**600**	**0**	**400**	**6,200**	**1,500**	**0**	**0**	**0**	**0**	**0**
Surface Water Deep Perc. Reuse	**0**	**400**	**0**	**0**	**100**	**0**	**500**	**0**	**0**	**0**	**0**	**0**	**1,200**	**0**	**0**	**0**	**1,200**	**100**	**0**	**0**	**0**	**0**	**0**
Surface Water Reuse	**0**	**200**	**0**	**0**	**100**	**0**	**300**	**0**	**0**	**0**	**0**	**0**	**1,000**	**100**	**0**	**100**	**1,200**	**200**	**0**	**0**	**0**	**0**	**0**
Total Applied Water Shortage	**0**	**2,300**	**0**	**0**	**200**	**0**	**2,500**	**0**	**100**	**100**	**0**	**0**	**7,400**	**700**	**0**	**500**	**8,600**	**1,800**	**0**	**0**	**0**	**0**	**0**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows

[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies

[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

DRAFT

Tehama County Applied Water Balance for 2000 Dry Year (75% CVP Canal Cutback) Scenario

(Acre-Feet)

	Dye Creek			Los Molinos				Vina				Bowman				Rosewood			South Battle Creek	West Mountain	East Mountain			TEHAMA CO SUMMARY
Applied Water	Los Molinos MWC	Independent	Total	Los Molinos MWC	Stanford-Vina Ranch IC	Independent	Total	Stanford-Vina Ranch IC	Deer Creek ID	Independent	Total	Anderson-Cottonwood ID	Rio Alto WD	Independent	Total	Anderson-Cottonwood ID	Independent	Total			Mineral County WD	Independent	Total	
Agriculture	18,900	8,500	**27,400**	6,500	6,100	6,600	**19,200**	12,800	7,400	5,200	**25,400**	9,200	800	1,300	**11,300**	1,300	900	**2,200**	8,000	200	2,500	4,000	**6,500**	**367,100**
M & I	1,400	200	**1,600**	2,500	0	100	**2,600**	100	0	100	**200**	100	1,000	1,000	**2,100**	0	200	**200**	0	100	0	100	**100**	**25,400**
Environmental[1]	4,000	0	**4,000**	1,300	0	2,700	**4,000**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**8,200**
Conveyance Losses[2]	11,200	200	**11,400**	2,200	2,200	2,000	**6,400**	3,600	5,400	0	**9,000**	4,500	0	0	**4,500**	200	0	200	700	0	100	400	**500**	**41,600**
Total Applied Water	**35,500**	**8,900**	**44,400**	**12,500**	**8,300**	**11,400**	**32,200**	**16,500**	**12,800**	**5,300**	**34,600**	**13,800**	**1,800**	**2,300**	**17,900**	**1,500**	**1,100**	**2,600**	**8,700**	**300**	**2,600**	**4,500**	**7,100**	**442,300**
Supplies																								
1. Local Surface	23,100	1,300	**24,400**	4,300	3,500	5,000	**12,800**	6,400	8,600	600	**15,600**	0	0	0	**0**	0	0	**0**	4,800	0	2,100	4,100	**6,200**	**78,200**
3. CVP: Corning & Tehama-Colusa C	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**12,300**
3. Sacramento River/CVP	0	0	**0**	0	0	400	**400**	0	0	0	**0**	11,500	800	400	**12,700**	1,200	0	**1,200**	0	0	0	0	**0**	**15,100**
4. Total Ground Water	2,700	6,800	**9,500**	6,100	4,700	3,700	**14,500**	10,900	1,500	4,400	**16,800**	1,500	400	2,000	**3,900**	200	1,200	**1,400**	2,400	300	0	200	**200**	**301,700**
5. Surface Water Deep Percolation	5,300	100	**5,400**	1,100	1,300	800	**3,200**	2,600	2,300	0	**4,900**	1,900	0	100	**2,000**	200	0	**200**	200	0	0	400	**400**	**21,400**
6. Ground Water Deep Percolation	200	1,100	**1,300**	700	700	700	**2,100**	1,500	300	900	**2,700**	300	100	600	**1,000**	0	200	**200**	500	100	0	100	**100**	**52,500**
7. Net Ground Water	0	5,600	**5,600**	4,300	2,700	2,200	**9,200**	6,800	0	3,500	**10,300**	0	300	1,300	**1,600**	0	1,000	**1,000**	1,700	200	0	0	**0**	**233,000**
8. Reclaimed Waste Water	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**200**
9. Dedicated Natural Flow	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**0**
Prime Supplies (1,2,3,4,8,9,10)	**23,100**	**6,900**	**30,000**	**8,600**	**6,200**	**7,600**	**22,400**	**13,200**	**8,600**	**4,100**	**25,900**	**11,500**	**1,100**	**1,700**	**14,300**	**1,200**	**1,000**	**2,200**	**6,500**	**200**	**2,100**	**4,100**	**6,200**	**338,800**
Deep Percolation Reuse[3]	2,700	1,200	3,900	1,800	2,000	1,500	5,300	3,300	1,100	900	5,300	1,500	100	600	2,200	200	100	300	700	100	0	200	200	66,700
Surface Water Reuse[3]	400	200	600	0	100	100	200	0	0	-100	-100	800	100	0	900	100	0	100	1,500	0	500	200	700	5,600
Total Reuse [3]	**3,100**	**1,400**	**4,500**	**1,800**	**2,100**	**1,600**	**5,500**	**3,300**	**1,100**	**800**	**5,200**	**2,300**	**200**	**600**	**3,100**	**300**	**100**	**400**	**2,200**	**100**	**500**	**400**	**900**	**72,300**
Reuse, %[3]	**11.27%**	**16.85%**	**12.39%**	**14.40%**	**25.30%**	**16.67%**	**18.01%**	**20.00%**	**8.59%**	**16.98%**	**15.32%**	**16.67%**	**11.11%**	**26.09%**	**17.32%**	**20.00%**	**9.09%**	**15.38%**	**25.29%**	**33.33%**	**19.23%**	**8.89%**	**12.68%**	**17.45%**
Total Supplies	**26,200**	**8,300**	**34,500**	**10,400**	**8,300**	**9,200**	**27,900**	**16,500**	**9,700**	**4,900**	**31,100**	**13,800**	**1,300**	**2,300**	**17,400**	**1,500**	**1,100**	**2,600**	**8,700**	**300**	**2,600**	**4,500**	**7,100**	**411,100**
Shortage																								
Prime Surface Supply Shortage	**8,400**	**500**	**8,900**	**2,100**	**0**	**1,900**	**4,000**	**0**	**3,100**	**300**	**3,400**	**0**	**500**	**0**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**26,300**
Surface Water Deep Perc. Reuse	**0**	**0**	**0**	**0**	**0**	**300**	**300**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,100**
Surface Water Reuse	**900**	**100**	**1,000**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,800**
Total Applied Water Shortage	**9,300**	**600**	**9,900**	**2,100**	**0**	**2,200**	**4,300**	**0**	**3,100**	**400**	**3,500**	**0**	**500**	**0**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31,200**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows

[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies

[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

Draft

Tehama County Applied Water Balance for 2000 Dry Year (100% CVP Canal Cutback) Scenario

(Acre-Feet)

	Red Bluff East							Red Bluff West			Corning East							Corning West	Bend	Antelope			
Applied Water	City of Red Bluff	Proberta WD	Elder Creek WD	El Camino ID	Thomes Creek WD	Independent	**Total**	Rancho Tehama Reserve	Independent	**Total**	City of Corning	Thomes Creek Wd	Corning WD	Kirkwood WD	Aaction Tree Farm	Inpedendent	**Total**			City of Red Bluff	Los Molinos MWC	Independent	**Total**
Agriculture	400	7,900	2,400	13,000	3,700	59,300	**86,700**	0	2,300	**2,300**	500	1,800	26,200	1,900	29,300	84,700	**144,400**	3,800	2,000	0	2,800	24,900	**27,700**
M & I	4,500	0	0	500	0	4,500	**9,500**	400	1,400	**1,800**	2,300	0	400	0	0	1,700	**4,400**	100	200	900	100	1,500	**2,500**
Environmental[1]	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	200	0	0	0	**0**
Conveyance Losses[2]	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	400	200	0	1,900	2,800	**4,700**
Total Applied Water	**4,900**	**7,900**	**2,400**	**13,500**	**3,700**	**63,800**	**96,200**	**400**	**3,700**	**4,100**	**2,800**	**1,800**	**26,600**	**1,900**	**29,300**	**86,400**	**148,800**	**4,300**	**2,600**	**900**	**4,800**	**29,200**	**34,900**
Supplies																							
1. Local Surface	0	0	0	0	0	0	**0**	0	100	**100**	0	0	200	0	0	600	**800**	1,300	1,800	0	4,300	6,100	**10,400**
3. CVP: Corning & Tehama-Colusa C	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
3. Sacramento River/CVP	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	500	**500**	0	300	0	0	0	**0**
4. Total Ground Water	4,900	4,600	2,400	13,500	1,800	63,900	**91,100**	400	3,500	**3,900**	2,800	1,700	12,300	600	29,300	84,800	**131,500**	1,100	400	900	400	23,300	**24,600**
5. Surface Water Deep Percolation	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	100	**100**	200	400	0	500	600	**1,100**
6. Ground Water Deep Percolation	500	1,100	600	3,100	400	11,500	**17,200**	200	1,000	**1,200**	300	300	2,000	100	3,300	15,400	**21,400**	200	100	100	100	4,200	**4,400**
7. Net Ground Water	4,400	3,500	1,800	10,400	1,400	52,400	**73,900**	200	2,500	**2,700**	2,500	1,400	10,300	500	26,000	69,300	**110,000**	700	0	800	0	18,500	**19,300**
8. Reclaimed Waste Water	100	0	0	0	0	100	**200**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
9. Dedicated Natural Flow	0	0	0	0	0	0	**0**	0	0	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
Prime Supplies (1,2,3,4,8,9,10)	**4,500**	**3,500**	**1,800**	**10,400**	**1,400**	**52,500**	**74,100**	**200**	**2,600**	**2,800**	**2,500**	**1,400**	**10,500**	**500**	**26,000**	**70,400**	**111,300**	**2,000**	**2,100**	**800**	**4,300**	**24,600**	**29,700**
Deep Percolation Reuse[3]	400	1,100	600	3,100	400	11,300	**16,900**	200	1,000	1,200	300	300	2,000	100	3,300	15,500	21,500	400	400	100	400	4,600	5,100
Surface Water Reuse[3]	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	100	100	0	100	0	100
Total Reuse [3]	**400**	**1,100**	**600**	**3,100**	**400**	**11,300**	**16,900**	**200**	**1,000**	**1,200**	**300**	**300**	**2,000**	**100**	**3,300**	**15,500**	**21,500**	**500**	**500**	**100**	**500**	**4,600**	**5,200**
Reuse, %[3]	**8.16%**	**22.78%**	**25.00%**	**22.96%**	**24.32%**	**17.71%**	**18.81%**	**50.00%**	**27.03%**	**29.27%**	**10.71%**	**16.67%**	**19.55%**	**15.79%**	**11.26%**	**18.06%**	**16.80%**	**18.60%**	**19.23%**	**11.11%**	**10.42%**	**15.75%**	**14.90%**
Total Supplies	**4,900**	**4,600**	**2,400**	**13,500**	**1,800**	**63,800**	**91,000**	**400**	**3,600**	**4,000**	**2,800**	**1,700**	**12,500**	**600**	**29,300**	**85,900**	**132,800**	**2,500**	**2,600**	**900**	**4,800**	**29,200**	**34,900**
Shortage																							
Prime Surface Supply Shortage	**0**	**2,600**	**0**	**0**	**1,400**	**0**	**4,000**	**0**	**100**	**100**	**0**	**100**	**10,900**	**1,100**	**0**	**400**	**12,500**	**1,500**	**0**	**0**	**0**	**0**	**0**
Surface Water Deep Perc. Reuse	**0**	**200**	**0**	**0**	**100**	**0**	**300**	**0**	**0**	**0**	**0**	**0**	**500**	**0**	**0**	**0**	**500**	**100**	**0**	**0**	**0**	**0**	**0**
Surface Water Reuse	**0**	**500**	**0**	**0**	**400**	**0**	**900**	**0**	**0**	**0**	**0**	**0**	**2,700**	**200**	**0**	**100**	**3,000**	**200**	**0**	**0**	**0**	**0**	**0**
Total Applied Water Shortage	**0**	**3,300**	**0**	**0**	**1,900**	**0**	**5,200**	**0**	**100**	**100**	**0**	**100**	**14,100**	**1,300**	**0**	**500**	**16,000**	**1,800**	**0**	**0**	**0**	**0**	**0**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows
[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies
[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

DRAFT

Tehama County Applied Water Balance for 2000 Dry Year (100% CVP Canal Cutback) Scenario

(Acre-Feet)

	Dye Creek			Los Molinos				Vina				Bowman				Rosewood			South Battle Creek	West Mountain	East Mountain			TEHAMA CO SUMMARY
Applied Water	Los Molinos MWC	Independent	Total	Los Molinos MWC	Stanford-Vina Ranch IC	Independent	Total	Stanford-Vina Ranch IC	Deer Creek ID	Independent	Total	Anderson-Cottonwood ID	Rio Alto WD	Independent	Total	Anderson-Cottonwood ID	Independent	Total			Mineral County WD	Independent	Total	
Agriculture	18,900	8,500	**27,400**	6,500	6,100	6,600	**19,200**	12,800	7,400	5,200	**25,400**	9,200	800	1,300	**11,300**	1,300	900	**2,200**	8,000	200	2,500	4,000	**6,500**	**367,100**
M & I	1,400	200	**1,600**	2,500	0	100	**2,600**	100	0	100	**200**	100	1,000	1,000	**2,100**	0	200	**200**	0	100	0	100	**100**	**25,400**
Environmental[1]	4,000	0	**4,000**	1,300	0	2,700	**4,000**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**8,200**
Conveyance Losses[2]	11,200	200	**11,400**	2,200	2,200	2,000	**6,400**	3,600	5,400	0	**9,000**	4,500	0	0	**4,500**	200	0	200	700	0	100	400	**500**	**38,000**
Total Applied Water	**35,500**	**8,900**	**44,400**	**12,500**	**8,300**	**11,400**	**32,200**	**16,500**	**12,800**	**5,300**	**34,600**	**13,800**	**1,800**	**2,300**	**17,900**	**1,500**	**1,100**	**2,600**	**8,700**	**300**	**2,600**	**4,500**	**7,100**	**438,700**
Supplies																								
1. Local Surface	23,100	1,300	**24,400**	4,300	3,500	5,000	**12,800**	6,400	8,600	600	**15,600**	0	0	0	**0**	0	0	**0**	4,800	0	2,100	4,100	**6,200**	**78,200**
3. CVP: Corning & Tehama-Colusa C	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**0**
3. Sacramento River/CVP	0	0	**0**	0	0	400	**400**	0	0	0	**0**	11,500	800	400	**12,700**	1,200	0	**1,200**	0	0	0	0	**0**	**15,100**
4. Total Ground Water	2,700	6,800	**9,500**	6,100	4,700	3,700	**14,500**	10,900	1,500	4,400	**16,800**	1,500	400	2,000	**3,900**	200	1,200	**1,400**	2,400	300	0	200	**200**	**301,600**
5. Surface Water Deep Percolation	5,300	100	**5,400**	1,100	1,300	800	**3,200**	2,600	2,300	0	**4,900**	1,900	0	100	**2,000**	200	0	**200**	200	0	0	400	**400**	**18,100**
6. Ground Water Deep Percolation	200	1,100	**1,300**	700	700	700	**2,100**	1,500	300	900	**2,700**	300	100	600	**1,000**	0	200	**200**	500	100	0	100	**100**	**52,500**
7. Net Ground Water	0	5,600	**5,600**	4,300	2,700	2,200	**9,200**	6,800	0	3,500	**10,300**	0	300	1,300	**1,600**	0	1,000	**1,000**	1,700	200	0	0	**0**	**236,200**
8. Reclaimed Waste Water	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**200**
9. Dedicated Natural Flow	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	0	0	**0**	**0**
Prime Supplies (1,2,3,4,8,9,10)	**23,100**	**6,900**	**30,000**	**8,600**	**6,200**	**7,600**	**22,400**	**13,200**	**8,600**	**4,100**	**25,900**	**11,500**	**1,100**	**1,700**	**14,300**	**1,200**	**1,000**	**2,200**	**6,500**	**200**	**2,100**	**4,100**	**6,200**	**329,700**
Deep Percolation Reuse[3]	2,700	1,200	3,900	1,800	2,000	1,500	5,300	3,300	1,100	900	5,300	1,500	100	600	2,200	200	100	300	700	100	0	200	200	63,500
Surface Water Reuse[3]	400	200	600	0	100	100	200	0	0	-100	-100	800	100	0	900	100	0	100	1,500	0	500	200	700	4,200
Total Reuse[3]	**3,100**	**1,400**	**4,500**	**1,800**	**2,100**	**1,600**	**5,500**	**3,300**	**1,100**	**800**	**5,200**	**2,300**	**200**	**600**	**3,100**	**300**	**100**	**400**	**2,200**	**100**	**500**	**400**	**900**	**67,700**
Reuse, %[3]	**11.27%**	**16.85%**	**12.39%**	**14.40%**	**25.30%**	**16.67%**	**18.01%**	**20.00%**	**8.59%**	**16.98%**	**15.32%**	**16.67%**	**11.11%**	**26.09%**	**17.32%**	**20.00%**	**9.09%**	**15.38%**	**25.29%**	**33.33%**	**19.23%**	**8.89%**	**12.68%**	**16.89%**
Total Supplies	**26,200**	**8,300**	**34,500**	**10,400**	**8,300**	**9,200**	**27,900**	**16,500**	**9,700**	**4,900**	**31,100**	**13,800**	**1,300**	**2,300**	**17,400**	**1,500**	**1,100**	**2,600**	**8,700**	**300**	**2,600**	**4,500**	**7,100**	**397,400**
Shortage																								
Prime Surface Supply Shortage	**8,400**	**500**	**8,900**	**2,100**	**0**	**1,900**	**4,000**	**0**	**3,100**	**300**	**3,400**	**0**	**500**	**0**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**34,900**
Surface Water Deep Perc. Reuse	**0**	**0**	**0**	**0**	**0**	**300**	**300**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,200**
Surface Water Reuse	**900**	**100**	**1,000**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5,200**
Total Applied Water Shortage	**9,300**	**600**	**9,900**	**2,100**	**0**	**2,200**	**4,300**	**0**	**3,100**	**400**	**3,500**	**0**	**500**	**0**	**500**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**41,300**
Reclaimed Water	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[1] Includes data for managed wetlands, rice straw decompostions, rice fields used as duck clubs, and instream flows

[2] Includes conveyance losses for agricultural, managed wetland and environmental supplies

[3] Reuse is for agriculture, municipal and industrial and managed wetland supplies only

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: WEST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.1		74% 4.2	0	40	40	0	124	124	0	168	168
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.3		82% 2.8	0	10	10	0	23	23	0	28	28
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**0**	**50**	**50**	**0**	**147**	**147**	**0**	**196**	**196**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**0**	**50**	**50**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: EAST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.1	70% 4.4		200	0	200	620	0	620	880	0	880
PASTURE - X	1.5	63% 2.4	71% 2.1	80	30	110	120	45	165	192	63	255
MEADOW PASTURE												
MEADOW PASTURE - X	1.1	65% 1.7		2,210	0	2,210	2,431	0	2,431	3,757	0	3,757
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS												
OTHER DECIDUOUS	2.2	73% 3.0		10	0	10	22	0	22	30	0	30
KIWI												
CITRUS - OLIVES												
GRAPES	1.6	73% 2.2		120	0	120	192	0	192	264	0	264
EUCALYPTUS												
Total Crop Acreage				**2,620**	**30**	**2,650**	**3,385**	**45**	**3,430**	**5,123**	**63**	**5,186**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,620**	**30**	**2,650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: SOUTH BATTEL CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3	75% 0.4		60	0	60	18	0	18	24	0	24
RICE												
CORN	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	2.9	73% 4.0	71% 4.1	10	30	40	29	87	116	40	123	163
PASTURE	3.1	65% 4.8	74% 4.2	740	200	940	2,294	620	2,914	3,552	840	4,392
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.2		76% 2.9	0	140	140	0	308	308	0	406	406
WALNUTS	2.3	72% 3.2	79% 2.9	480	260	740	1,104	598	1,702	1,536	754	2,290
OTHER DECIDUOUS												
KIWI	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,310**	**630**	**1,940**	**3,477**	**1,613**	**5,090**	**5,200**	**2,123**	**7,323**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,310**	**630**	**1,940**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: ROSEWOOD

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.2		67% 0.3	0	10	10	0	2	2	0	3	3
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	2.9	74% 3.8	78% 3.7	10	170	180	28	491	519	38	627	665
PASTURE	3.0	68% 4.4	72% 4.3	220	40	260	660	122	782	968	170	1,138
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.3		79% 2.9	0	50	50	0	115	115	0	145	145
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**230**	**270**	**500**	**688**	**730**	**1,418**	**1,006**	**945**	**1,951**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**230**	**270**	**500**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: BOWMAN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	2.9		78% 3.7	0	60	60	0	174	174	0	222	222
PASTURE	3.1	67% 4.6	71% 4.4	1,770	110	1,880	5,487	341	5,828	8,142	480	8,622
PASTURE - X	1.5	68% 2.2		10	0	10	15	0	15	22	0	22
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.7		78% 0.9	0	20	20	0	14	14	0	18	18
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.1		78% 2.7	0	270	270	0	580	580	0	742	742
WALNUTS	2.3		79% 2.9	0	240	240	0	552	552	0	696	696
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,780**	**700**	**2,480**	**5,502**	**1,661**	**7,163**	**8,164**	**2,158**	**10,322**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,780**	**700**	**2,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: VINA

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.4	67% 0.6		110	0	110	44	0	44	66	0	66
RICE												
CORN	1.7	65% 2.6		140	0	140	238	0	238	364	0	364
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.3	60% 5.5	73% 4.5	960	190	1,150	3,168	627	3,795	5,280	861	6,141
PASTURE - X	1.6	59% 2.7		120	0	120	192	0	192	324	0	324
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.9		69% 1.3	0	20	20	0	18	18	0	26	26
OTHER TRUCK	1.5	65% 2.3		20	0	20	30	0	30	46	0	46
ALMONDS	2.5	69% 3.6	78% 3.1	400	290	690	1,000	706	1,706	1,440	909	2,349
PISTACHIOS												
PRUNES	2.3	66% 3.5	72% 3.2	510	600	1,110	1,174	1,383	2,557	1,787	1,909	3,696
WALNUTS	2.5	69% 3.6	77% 3.3	1,290	1,470	2,760	3,225	3,675	6,900	4,644	4,785	9,429
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,550**	**2,570**	**6,120**	**9,071**	**6,409**	**15,480**	**13,951**	**8,490**	**22,441**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,550**	**2,570**	**6,120**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: LOS MOLINOS

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3	75% 0.4	75% 0.4	20	70	90	6	21	27	8	28	36
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.0	65% 4.6		450	0	450	1,350	0	1,350	2,070	0	2,070
PASTURE	3.2	60% 5.3		1,050	0	1,050	3,379	0	3,379	5,603	0	5,603
PASTURE - X	1.6	59% 2.7		50	0	50	80	0	80	135	0	135
MEADOW PASTURE	2.7	60% 4.4		50	0	50	133	0	133	221	0	221
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS	2.4	71% 3.4	77% 3.1	30	390	420	72	936	1,008	102	1,209	1,311
PISTACHIOS												
PRUNES	2.3	66% 3.5	79% 2.8	560	1,270	1,830	1,276	2,853	4,129	1,948	3,615	5,563
WALNUTS	2.4	65% 3.7	76% 3.2	210	330	540	504	792	1,296	777	1,044	1,821
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**2,420**	**2,060**	**4,480**	**6,800**	**4,602**	**11,402**	**10,864**	**5,896**	**16,760**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,420**	**2,060**	**4,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: DYE CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD	1.4	67% 2.1		30	0	30	42	0	42	63	0	63
ALFALFA												
PASTURE	3.3	61% 5.4	73% 4.4	2,900	90	2,990	9,536	288	9,824	15,746	396	16,142
PASTURE - X	1.6	61% 2.6	73% 2.2	210	20	230	336	32	368	553	44	597
MEADOW PASTURE	2.7	60% 4.5		10	0	10	27	0	27	45	0	45
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.2	66% 3.5	82% 2.7	400	890	1,290	918	1,970	2,888	1,398	2,415	3,813
WALNUTS	2.4	65% 3.7	78% 3.1	340	860	1,200	816	2,064	2,880	1,258	2,656	3,914
OTHER DECIDUOUS	2.3		79% 2.9	0	10	10	0	23	23	0	29	29
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,890**	**1,870**	**5,760**	**11,675**	**4,377**	**16,052**	**19,063**	**5,540**	**24,603**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,890**	**1,870**	**5,760**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: ANTELOPE

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3		75% 0.4	0	290	290	0	87	87	0	116	116
RICE												
CORN	1.6		73% 2.2	0	10	10	0	16	16	0	22	22
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	0.7		70% 1.0	0	60	60	0	42	42	0	60	60
OTHER FIELD												
ALFALFA	3.0	65% 4.6	77% 3.9	190	320	510	570	960	1,530	874	1,248	2,122
PASTURE	3.2	64% 5.0	73% 4.4	790	250	1,040	2,528	800	3,328	3,935	1,100	5,035
PASTURE - X	1.6		70% 2.3	0	10	10	0	16	16	0	23	23
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5	71% 2.1	71% 2.1	10	80	90	15	120	135	21	168	189
ALMONDS	2.4		80% 3.0	0	560	560	0	1,344	1,344	0	1,680	1,680
PISTACHIOS	2.5		81% 3.1	0	30	30	0	75	75	0	93	93
PRUNES	2.3	66% 3.5	79% 2.9	640	990	1,630	1,472	2,277	3,749	2,240	2,871	5,111
WALNUTS	2.4	65% 3.7	80% 3.0	320	2,780	3,100	768	6,672	7,440	1,184	8,340	9,524
OTHER DECIDUOUS	2.3	66% 3.5	77% 3.0	10	20	30	23	46	69	35	60	95
KIWI												
CITRUS - OLIVES	1.8		78% 2.3	0	10	10	0	18	18	0	23	23
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,960**	**5,410**	**7,370**	**5,376**	**12,473**	**17,849**	**8,289**	**15,804**	**24,093**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,960**	**5,410**	**7,370**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: BEND

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3	75% 0.4	75% 0.4	100	20	120	30	6	36	40	8	48
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	0.6	67% 0.9		20	0	20	12	0	12	18	0	18
OTHER FIELD	1.3		76% 1.7	0	10	10	0	13	13	0	17	17
ALFALFA												
PASTURE	3.2	67% 4.8		220	0	220	704	0	704	1,056	0	1,056
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X	1.1	65% 1.7		150	0	150	165	0	165	255	0	255
CUCURBITS												
OTHER TRUCK	1.6	73% 2.2	76% 2.1	60	20	80	96	32	128	132	42	174
ALMONDS												
PISTACHIOS	2.4		86% 2.8	0	10	10	0	24	24	0	28	28
PRUNES												
WALNUTS	2.4		83% 2.9	0	30	30	0	72	72	0	87	87
OTHER DECIDUOUS	2.2		79% 2.8	0	10	10	0	22	22	0	28	28
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**550**	**100**	**650**	**1,007**	**169**	**1,176**	**1,501**	**210**	**1,711**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**550**	**100**	**650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: CORNING WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.1	67% 4.6		60	0	60	186	0	186	276	0	276
PASTURE	3.3	67% 4.9	72% 4.6	240	70	310	792	231	1,023	1,176	322	1,498
PASTURE - X	1.6	64% 2.5		320	0	320	512	0	512	800	0	800
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS	2.5		83% 3.0	0	10	10	0	25	25	0	30	30
PISTACHIOS												
PRUNES	2.3		85% 2.7	0	170	170	0	391	391	0	459	459
WALNUTS	2.4		83% 2.9	0	30	30	0	72	72	0	87	87
OTHER DECIDUOUS	2.4	69% 3.5		10	0	10	24	0	24	35	0	35
KIWI												
CITRUS - OLIVES												
GRAPES	1.6		84% 1.9	0	10	10	0	16	16	0	19	19
EUCALYPTUS												
Total Crop Acreage				**630**	**290**	**920**	**1,514**	**735**	**2,249**	**2,287**	**917**	**3,204**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**630**	**290**	**920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: CORNING EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.4	67% 0.6	67% 0.6	190	1,270	1,460	76	508	584	114	762	876
RICE	2.9	55% 5.3	55% 5.3	510	70	580	1,479	204	1,683	2,703	373	3,076
CORN	1.6	67% 2.4	73% 2.2	110	990	1,100	176	1,584	1,760	261	2,182	2,443
SUNFLOWERS	1.2	67% 1.8	71% 1.7	40	180	220	48	216	264	72	306	378
DRY BEANS	1.2		71% 1.7	0	130	130	0	156	156	0	221	221
SAFFLOWER												
OTHER FIELD	1.4		74% 1.9	0	40	40	0	56	56	0	76	76
ALFALFA	3.1	70% 4.4	74% 4.2	130	1,730	1,860	403	5,363	5,766	572	7,266	7,838
PASTURE	3.3	68% 4.8	73% 4.5	770	6,240	7,010	2,541	20,592	23,133	3,718	28,080	31,798
PASTURE - X	1.6	68% 2.4	73% 2.2	150	130	280	240	208	448	354	286	640
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.9	69% 1.3	75% 1.2	170	210	380	153	189	342	221	252	473
OTHER TRUCK	1.5		75% 2.0	0	60	60	0	90	90	0	120	120
ALMONDS	2.4	79% 3.1	80% 3.0	510	3,150	3,660	1,224	7,560	8,784	1,556	9,422	10,978
PISTACHIOS	2.5	74% 3.4	78% 3.2	10	50	60	25	125	150	34	160	194
PRUNES	2.3	77% 3.0	82% 2.8	570	2,540	3,110	1,311	5,842	7,153	1,707	7,082	8,789
WALNUTS	2.5	78% 3.2	78% 3.2	110	2,210	2,320	275	5,525	5,800	352	7,072	7,424
OTHER DECIDUOUS	2.3	77% 3.1	84% 2.8	40	250	290	96	585	681	124	699	823
KIWI	1.7		85% 2.0	0	30	30	0	51	51	0	60	60
CITRUS - OLIVES	1.9	79% 2.4	83% 2.3	1,390	5,960	7,350	2,641	11,324	13,965	3,330	13,708	17,038
GRAPES												
EUCALYPTUS	1.9		86% 2.2	0	9,420	9,420	0	17,925	17,925	0	20,798	20,798
Total Crop Acreage				**4,700**	**34,660**	**39,360**	**10,688**	**78,103**	**88,791**	**15,118**	**98,925**	**114,043**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**4,700**	**34,660**	**39,360**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: RED BLUFF WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.0		79% 3.8	0	30	30	0	90	90	0	114	114
PASTURE	3.2		73% 4.4	0	340	340	0	1,088	1,088	0	1,496	1,496
PASTURE - X	1.6	64% 2.5		70	0	70	112	0	112	175	0	175
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5		71% 2.1	0	20	20	0	30	30	0	42	42
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.4		83% 2.9	0	80	80	0	192	192	0	232	232
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**70**	**470**	**540**	**112**	**1,400**	**1,512**	**175**	**1,884**	**2,059**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**70**	**470**	**540**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: RED BLUFF EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)				Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface		Ground		Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3	75%	0.4	75%	0.4	230	740	970	69	222	291	92	296	388
RICE	2.9	55%	5.5	55%	5.2	310	770	1,080	930	2,186	3,116	1,705	3,987	5,692
CORN	1.6	67%	2.4	73%	2.2	200	1,030	1,230	320	1,648	1,968	480	2,266	2,746
SUNFLOWERS	1.2	67%	1.8	75%	1.6	10	150	160	12	180	192	18	240	258
DRY BEANS	1.2			71%	1.7	0	190	190	0	228	228	0	323	323
SAFFLOWER	0.6			75%	0.8	0	120	120	0	72	72	0	96	96
OTHER FIELD	1.3			73%	1.8	0	120	120	0	159	159	0	219	219
ALFALFA	3.0	70%	4.3	73%	4.1	480	790	1,270	1,440	2,370	3,810	2,064	3,234	5,298
PASTURE	3.2	69%	4.6	73%	4.4	890	5,100	5,990	2,848	16,320	19,168	4,126	22,440	26,566
PASTURE - X	1.6			73%	2.2	0	440	440	0	704	704	0	968	968
MEADOW PASTURE														
MEADOW PASTURE - X														
CUCURBITS														
OTHER TRUCK	1.5			75%	2.0	0	10	10	0	15	15	0	20	20
ALMONDS	2.4	71%	3.4	80%	3.0	130	3,020	3,150	312	7,248	7,560	442	9,104	9,546
PISTACHIOS	2.5			86%	2.9	0	60	60	0	150	150	0	174	174
PRUNES	2.2			81%	2.7	0	2,660	2,660	0	5,852	5,852	0	7,202	7,202
WALNUTS	2.4			80%	3.0	0	4,080	4,080	0	9,792	9,792	0	12,253	12,253
OTHER DECIDUOUS	2.3			81%	2.8	0	50	50	0	115	115	0	142	142
KIWI														
CITRUS - OLIVES	1.8			79%	2.3	0	590	590	0	1,062	1,062	0	1,345	1,345
GRAPES														
EUCALYPTUS	1.8			86%	2.1	0	670	670	0	1,207	1,207	0	1,408	1,408
Total Crop Acreage						**2,250**	**20,590**	**22,840**	**5,931**	**49,530**	**55,461**	**8,927**	**65,717**	**74,644**
Double Crop Acreage						**0**	**0**	**0**						
Total Irrigated Land Area						**2,250**	**20,590**	**22,840**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: SACRAMENTO VALLEY GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.4	70% 0.5	70% 0.5	650	2,390	3,040	225	844	1,069	320	1,210	1,530
RICE	2.9	55% 5.4	55% 5.2	820	840	1,660	2,409	2,390	4,799	4,408	4,360	8,768
CORN	1.6	66% 2.5	73% 2.2	450	2,030	2,480	734	3,248	3,982	1,105	4,470	5,575
SUNFLOWERS	1.2	67% 1.8	73% 1.7	50	330	380	60	396	456	90	546	636
DRY BEANS	1.2		71% 1.7	0	320	320	0	384	384	0	544	544
SAFFLOWER	0.6	67% 0.9	73% 0.9	20	180	200	12	114	126	18	156	174
OTHER FIELD	1.4	67% 2.1	73% 1.8	30	170	200	42	228	270	63	312	375
ALFALFA	3.0	67% 4.5	74% 4.1	1,310	2,870	4,180	3,949	8,783	12,732	5,856	11,862	17,718
PASTURE	3.3	63% 5.2	73% 4.5	7,820	12,280	20,100	25,496	39,946	65,442	40,640	54,695	95,335
PASTURE - X	1.6	63% 2.5	73% 2.2	920	600	1,520	1,472	960	2,432	2,341	1,321	3,662
MEADOW PASTURE	2.7	60% 4.4		60	0	60	160	0	160	266	0	266
MEADOW PASTURE - X	1.1	65% 1.7		150	0	150	165	0	165	255	0	255
CUCURBITS	0.9	69% 1.3	74% 1.2	170	230	400	153	207	360	221	278	499
OTHER TRUCK	1.5	71% 2.2	73% 2.1	90	190	280	141	287	428	199	392	591
ALMONDS	2.4	74% 3.3	80% 3.0	1,070	7,420	8,490	2,608	17,819	20,427	3,540	22,354	25,894
PISTACHIOS	2.5	74% 3.4	82% 3.0	10	150	160	25	374	399	34	455	489
PRUNES	2.3	68% 3.4	80% 2.8	2,680	9,120	11,800	6,151	20,568	26,719	9,080	25,553	34,633
WALNUTS	2.4	68% 3.6	79% 3.1	2,270	11,870	14,140	5,588	28,856	34,444	8,215	36,556	44,771
OTHER DECIDUOUS	2.3	74% 3.2	83% 2.8	60	340	400	143	791	934	194	958	1,152
KIWI	1.7		85% 2.0	0	30	30	0	51	51	0	60	60
CITRUS - OLIVES	1.9	79% 2.4	82% 2.3	1,390	6,560	7,950	2,641	12,404	15,045	3,330	15,076	18,406
GRAPES	1.6		84% 1.9	0	10	10	0	16	16	0	19	19
EUCALYPTUS	1.9		86% 2.2	0	10,090	10,090	0	19,132	19,132	0	22,206	22,206
Total Crop Acreage				**20,020**	**68,020**	**88,040**	**52,174**	**157,798**	**209,972**	**80,175**	**203,383**	**283,558**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**20,020**	**68,020**	**88,040**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: REDDING GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.3	75% 0.4	67% 0.3	60	10	70	18	2	20	24	3	27
RICE												
CORN	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	2.9	73% 3.9	77% 3.7	20	260	280	57	752	809	78	972	1,050
PASTURE	3.1	67% 4.6	73% 4.3	2,730	350	3,080	8,441	1,083	9,524	12,662	1,490	14,152
PASTURE - X	1.5	68% 2.2		10	0	10	15	0	15	22	0	22
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.7		78% 0.9	0	20	20	0	14	14	0	18	18
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.2		77% 2.8	0	410	410	0	888	888	0	1,148	1,148
WALNUTS	2.3	72% 3.2	79% 2.9	480	550	1,030	1,104	1,265	2,369	1,536	1,595	3,131
OTHER DECIDUOUS												
KIWI	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,320**	**1,600**	**4,920**	**9,667**	**4,004**	**13,671**	**14,370**	**5,226**	**19,596**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,320**	**1,600**	**4,920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Average Year)

Inventory Unit: TEHAMA COUNTY

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.4	71% 0.5	70% 0.5	710	2,400	3,110	243	846	1,089	344	1,213	1,557
RICE	2.9	55% 5.4	55% 5.2	820	840	1,660	2,409	2,390	4,799	4,408	4,360	8,768
CORN	1.6	66% 2.5	73% 2.2	460	2,030	2,490	750	3,248	3,998	1,129	4,470	5,599
SUNFLOWERS	1.2	67% 1.8	73% 1.7	50	330	380	60	396	456	90	546	636
DRY BEANS	1.2		71% 1.7	0	320	320	0	384	384	0	544	544
SAFFLOWER	0.6	67% 0.9	73% 0.9	20	180	200	12	114	126	18	156	174
OTHER FIELD	1.4	67% 2.1	73% 1.8	30	170	200	42	228	270	63	312	375
ALFALFA	3.0	68% 4.5	74% 4.1	1,330	3,130	4,460	4,006	9,535	13,541	5,934	12,834	18,768
PASTURE	3.2	64% 5.0	73% 4.4	10,750	12,670	23,420	34,557	41,153	75,710	54,182	56,353	110,535
PASTURE - X	1.6	63% 2.5	73% 2.2	1,010	630	1,640	1,607	1,005	2,612	2,555	1,384	3,939
MEADOW PASTURE	2.7	60% 4.4		60	0	60	160	0	160	266	0	266
MEADOW PASTURE - X	1.1	65% 1.7		2,360	0	2,360	2,596	0	2,596	4,012	0	4,012
CUCURBITS	0.9	69% 1.3	75% 1.2	170	250	420	153	221	374	221	296	517
OTHER TRUCK	1.5	71% 2.2	73% 2.1	90	190	280	141	287	428	199	392	591
ALMONDS	2.4	74% 3.3	80% 3.0	1,070	7,420	8,490	2,608	17,819	20,427	3,540	22,354	25,894
PISTACHIOS	2.5	74% 3.4	82% 3.0	10	150	160	25	374	399	34	455	489
PRUNES	2.3	68% 3.4	80% 2.8	2,680	9,530	12,210	6,151	21,456	27,607	9,080	26,701	35,781
WALNUTS	2.4	69% 3.5	79% 3.1	2,750	12,430	15,180	6,692	30,144	36,836	9,751	38,179	47,930
OTHER DECIDUOUS	2.3	74% 3.2	83% 2.8	70	340	410	165	791	956	224	958	1,182
KIWI	1.7	67% 2.4	85% 2.0	10	30	40	16	51	67	24	60	84
CITRUS - OLIVES	1.9	79% 2.4	82% 2.3	1,390	6,560	7,950	2,641	12,404	15,045	3,330	15,076	18,406
GRAPES	1.6	73% 2.2	84% 1.9	120	10	130	192	16	208	264	19	283
EUCALYPTUS	1.9		86% 2.2	0	10,090	10,090	0	19,132	19,132	0	22,206	22,206
Total Crop Acreage				**25,960**	**69,700**	**95,660**	**65,226**	**161,994**	**227,220**	**99,668**	**208,868**	**308,536**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**25,960**	**69,700**	**95,660**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: WEST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.4		72% 4.7	0	40	40	0	136	136	0	188	188
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.5		83% 3.0	0	10	10	0	25	25	0	30	30
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**0**	**50**	**50**	**0**	**161**	**161**	**0**	**218**	**218**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**0**	**50**	**50**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: EAST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.4	69% 4.9		200	0	200	680	0	680	980	0	980
PASTURE - X	1.9	63% 3.0	73% 2.6	80	30	110	152	57	209	240	78	318
MEADOW PASTURE												
MEADOW PASTURE - X	1.4	64% 2.2		2,210	0	2,210	3,094	0	3,094	4,862	0	4,862
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS												
OTHER DECIDUOUS	2.6	72% 3.6		10	0	10	26	0	26	36	0	36
KIWI												
CITRUS - OLIVES												
GRAPES	1.6	73% 2.2		120	0	120	192	0	192	264	0	264
EUCALYPTUS												
Total Crop Acreage				**2,620**	**30**	**2,650**	**4,144**	**57**	**4,201**	**6,382**	**78**	**6,460**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,620**	**30**	**2,650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: SOUTH BATTEL CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)				Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface		Ground		Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71%	1.4			60	0	60	60	0	60	84	0	84
RICE														
CORN	1.7	68%	2.5			10	0	10	17	0	17	25	0	25
SUNFLOWERS														
DRY BEANS														
SAFFLOWER														
OTHER FIELD														
ALFALFA	3.3	73%	4.5	70%	4.7	10	30	40	33	99	132	45	141	186
PASTURE	3.4	65%	5.2	72%	4.7	740	200	940	2,516	680	3,196	3,848	940	4,788
PASTURE - X														
MEADOW PASTURE														
MEADOW PASTURE - X														
CUCURBITS														
OTHER TRUCK														
ALMONDS														
PISTACHIOS														
PRUNES	2.5			76%	3.3	0	140	140	0	350	350	0	462	462
WALNUTS	2.5	74%	3.4	78%	3.2	480	260	740	1,200	650	1,850	1,632	832	2,464
OTHER DECIDUOUS														
KIWI	1.6	67%	2.4			10	0	10	16	0	16	24	0	24
CITRUS - OLIVES														
GRAPES														
EUCALYPTUS														
Total Crop Acreage						**1,310**	**630**	**1,940**	**3,842**	**1,779**	**5,621**	**5,658**	**2,375**	**8,033**
Double Crop Acreage						**0**	**0**	**0**						
Total Irrigated Land Area						**1,310**	**630**	**1,940**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: ROSEWOOD

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.9		75% 1.2	0	10	10	0	9	9	0	12	12
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.3	74% 4.2	78% 4.2	10	170	180	31	557	588	42	710	752
PASTURE	3.3	67% 4.9	72% 4.7	220	40	260	726	134	860	1,078	186	1,264
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.5		78% 3.2	0	50	50	0	125	125	0	160	160
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**230**	**270**	**500**	**757**	**825**	**1,582**	**1,120**	**1,068**	**2,188**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**230**	**270**	**500**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: BOWMAN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.4		77% 4.4	0	60	60	0	204	204	0	264	264
PASTURE	3.4	68% 5.0	71% 4.8	1,770	110	1,880	6,018	374	6,392	8,850	524	9,374
PASTURE - X	1.9	68% 2.8		10	0	10	19	0	19	28	0	28
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.8		80% 1.0	0	20	20	0	16	16	0	20	20
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.4		78% 3.1	0	270	270	0	661	661	0	850	850
WALNUTS	2.4		77% 3.1	0	240	240	0	576	576	0	744	744
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,780**	**700**	**2,480**	**6,037**	**1,831**	**7,868**	**8,878**	**2,402**	**11,280**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,780**	**700**	**2,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: VINA

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6		110	0	110	126	0	126	181	0	181
RICE												
CORN	1.9	66% 2.9	70% 2.7	70	70	140	133	133	266	203	189	392
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.7	60% 6.2	72% 5.1	890	260	1,150	3,293	962	4,255	5,518	1,331	6,849
PASTURE - X	2.0	61% 3.3		120	0	120	240	0	240	396	0	396
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.9		69% 1.3	0	20	20	0	18	18	0	26	26
OTHER TRUCK	1.6	64% 2.5	70% 2.3	10	10	20	16	16	32	25	23	48
ALMONDS	3.0	70% 4.3	77% 3.9	290	400	690	870	1,200	2,070	1,247	1,560	2,807
PISTACHIOS												
PRUNES	2.8	65% 4.3	74% 3.8	370	740	1,110	1,036	2,070	3,106	1,591	2,796	4,387
WALNUTS	2.8	70% 4.0	76% 3.7	770	1,990	2,760	2,156	5,572	7,728	3,080	7,300	10,380
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**2,630**	**3,490**	**6,120**	**7,870**	**9,971**	**17,841**	**12,241**	**13,225**	**25,466**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,630**	**3,490**	**6,120**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: LOS MOLINOS

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)				Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface		Ground		Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	69%	1.6	69%	1.6	10	80	90	11	88	99	16	128	144
RICE														
CORN														
SUNFLOWERS														
DRY BEANS														
SAFFLOWER														
OTHER FIELD														
ALFALFA	3.5	65%	5.4	70%	5.0	220	220	440	770	770	1,540	1,188	1,100	2,288
PASTURE	3.6	60%	6.0	71%	5.1	930	120	1,050	3,348	432	3,780	5,580	612	6,192
PASTURE - X	1.9	60%	3.2			50	0	50	96	0	96	161	0	161
MEADOW PASTURE	2.9	60%	4.8	71%	4.1	20	40	60	58	116	174	96	164	260
MEADOW PASTURE - X														
CUCURBITS														
OTHER TRUCK														
ALMONDS	2.9	71%	4.1	77%	3.8	30	390	420	87	1,131	1,218	123	1,471	1,594
PISTACHIOS														
PRUNES	2.7	64%	4.1	78%	3.4	370	1,460	1,830	988	3,873	4,861	1,532	4,985	6,517
WALNUTS	2.7	64%	4.2	76%	3.6	170	370	540	459	999	1,458	714	1,320	2,034
OTHER DECIDUOUS														
KIWI														
CITRUS - OLIVES														
GRAPES														
EUCALYPTUS														
Total Crop Acreage						**1,800**	**2,680**	**4,480**	**5,817**	**7,409**	**13,226**	**9,410**	**9,780**	**19,190**
Double Crop Acreage						**0**	**0**	**0**						
Total Irrigated Land Area						**1,800**	**2,680**	**4,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: DYE CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD	1.4	67% 2.1		30	0	30	42	0	42	63	0	63
ALFALFA												
PASTURE	3.6	61% 5.9	71% 5.0	2,780	210	2,990	10,008	756	10,764	16,530	1,058	17,588
PASTURE - X	2.0	62% 3.2	73% 2.6	200	30	230	394	57	451	636	78	714
MEADOW PASTURE	2.9	60% 4.8		10	0	10	29	0	29	48	0	48
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.7	64% 4.2	82% 3.3	350	940	1,290	945	2,538	3,483	1,470	3,102	4,572
WALNUTS	2.7	64% 4.2	77% 3.5	170	1,030	1,200	459	2,781	3,240	714	3,595	4,309
OTHER DECIDUOUS	2.8		80% 3.5	0	10	10	0	28	28	0	35	35
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,540**	**2,220**	**5,760**	**11,877**	**6,160**	**18,037**	**19,461**	**7,868**	**27,329**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,540**	**2,220**	**5,760**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: ANTELOPE

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1		69% 1.6	0	290	290	0	319	319	0	464	464
RICE												
CORN	1.8		72% 2.5	0	10	10	0	18	18	0	25	25
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	1.5		71% 2.1	0	60	60	0	90	90	0	126	126
OTHER FIELD												
ALFALFA	3.5	65% 5.4	76% 4.6	70	440	510	245	1,540	1,785	378	2,024	2,402
PASTURE	3.6	64% 5.6	73% 4.9	640	400	1,040	2,304	1,440	3,744	3,600	1,960	5,560
PASTURE - X	2.0		69% 2.9	0	10	10	0	20	20	0	29	29
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.6	73% 2.2	73% 2.2	10	80	90	16	128	144	22	176	198
ALMONDS	2.9		78% 3.7	0	560	560	0	1,624	1,624	0	2,072	2,072
PISTACHIOS	2.7		79% 3.4	0	30	30	0	81	81	0	102	102
PRUNES	2.7	64% 4.2	77% 3.5	180	1,450	1,630	486	3,915	4,401	756	5,099	5,855
WALNUTS	2.7	64% 4.2	79% 3.4	160	2,940	3,100	432	7,938	8,370	672	10,000	10,672
OTHER DECIDUOUS	2.9	64% 4.5	76% 3.8	10	20	30	29	58	87	45	76	121
KIWI												
CITRUS - OLIVES	2.5		78% 3.2	0	10	10	0	25	25	0	32	32
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,070**	**6,300**	**7,370**	**3,512**	**17,196**	**20,708**	**5,473**	**22,185**	**27,658**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,070**	**6,300**	**7,370**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: BEND

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71% 1.4	77% 1.3	100	20	120	100	20	120	140	26	166
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	1.0	71% 1.4		20	0	20	20	0	20	28	0	28
OTHER FIELD	1.4		78% 1.8	0	10	10	0	14	14	0	18	18
ALFALFA												
PASTURE	3.5	66% 5.3		220	0	220	770	0	770	1,166	0	1,166
PASTURE - X												
MEADOW PASTURE												
MEADOW PASTURE - X	1.4	64% 2.2		150	0	150	210	0	210	330	0	330
CUCURBITS												
OTHER TRUCK	1.7	74% 2.3	77% 2.2	60	20	80	102	34	136	138	44	182
ALMONDS												
PISTACHIOS	2.6		84% 3.1	0	10	10	0	26	26	0	31	31
PRUNES												
WALNUTS	2.6		84% 3.1	0	30	30	0	78	78	0	93	93
OTHER DECIDUOUS	2.8		80% 3.5	0	10	10	0	28	28	0	35	35
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**550**	**100**	**650**	**1,202**	**200**	**1,402**	**1,802**	**247**	**2,049**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**550**	**100**	**650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: CORNING WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.6	68% 5.3		60	0	60	216	0	216	318	0	318
PASTURE	3.7	69% 5.4	71% 5.2	240	70	310	888	259	1,147	1,296	364	1,660
PASTURE - X	2.1	65% 3.2		320	0	320	672	0	672	1,030	0	1,030
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS	3.1		84% 3.7	0	10	10	0	31	31	0	37	37
PISTACHIOS												
PRUNES	2.8		85% 3.3	0	170	170	0	476	476	0	561	561
WALNUTS	2.8		82% 3.4	0	30	30	0	84	84	0	102	102
OTHER DECIDUOUS	3.0	68% 4.4		10	0	10	30	0	30	44	0	44
KIWI												
CITRUS - OLIVES												
GRAPES	1.8		86% 2.1	0	10	10	0	18	18	0	21	21
EUCALYPTUS												
Total Crop Acreage				**630**	**290**	**920**	**1,806**	**868**	**2,674**	**2,688**	**1,085**	**3,773**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**630**	**290**	**920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: CORNING EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.2	71% 1.7	71% 1.7	190	1,270	1,460	228	1,524	1,752	323	2,159	2,482
RICE	3.3	55% 6.0	55% 6.0	510	70	580	1,683	231	1,914	3,060	420	3,480
CORN	1.9	68% 2.8	73% 2.6	110	990	1,100	209	1,881	2,090	308	2,578	2,886
SUNFLOWERS	1.4	67% 2.1	74% 1.9	40	180	220	56	252	308	84	342	426
DRY BEANS	1.5		71% 2.1	0	130	130	0	195	195	0	273	273
SAFFLOWER												
OTHER FIELD	1.5		71% 2.1	0	40	40	0	60	60	0	84	84
ALFALFA	3.6	71% 5.1	73% 4.9	130	1,730	1,860	468	6,228	6,696	663	8,477	9,140
PASTURE	3.7	68% 5.4	73% 5.1	770	6,240	7,010	2,856	23,100	25,956	4,172	31,836	36,008
PASTURE - X	2.0	69% 2.9	71% 2.8	150	130	280	300	260	560	435	364	799
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.9	69% 1.3	75% 1.2	170	210	380	153	189	342	221	252	473
OTHER TRUCK	1.6		76% 2.1	0	60	60	0	96	96	0	126	126
ALMONDS	3.0	79% 3.8	81% 3.7	250	3,410	3,660	750	10,230	10,980	950	12,648	13,598
PISTACHIOS	2.8	74% 3.8	80% 3.5	10	50	60	28	140	168	38	175	213
PRUNES	2.8	78% 3.6	81% 3.5	570	2,540	3,110	1,611	7,112	8,723	2,064	8,818	10,882
WALNUTS	2.8	78% 3.6	80% 3.5	110	2,210	2,320	308	6,188	6,496	396	7,779	8,175
OTHER DECIDUOUS	3.0	77% 3.9	83% 3.6	40	250	290	120	750	870	156	903	1,059
KIWI	1.9		86% 2.2	0	30	30	0	57	57	0	66	66
CITRUS - OLIVES	2.7	79% 3.3	82% 3.3	1,390	5,960	7,350	3,614	15,917	19,531	4,581	19,493	24,074
GRAPES												
EUCALYPTUS	2.7		84% 3.2	0	9,420	9,420	0	25,417	25,417	0	30,167	30,167
Total Crop Acreage				**4,440**	**34,920**	**39,360**	**12,384**	**99,827**	**112,211**	**17,451**	**126,960**	**144,411**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**4,440**	**34,920**	**39,360**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: RED BLUFF WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.5		78% 4.5	0	30	30	0	105	105	0	135	135
PASTURE	3.6		73% 4.9	0	340	340	0	1,224	1,224	0	1,666	1,666
PASTURE - X	2.0	63% 3.2		70	0	70	140	0	140	224	0	224
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5		71% 2.1	0	20	20	0	30	30	0	42	42
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.7		82% 3.3	0	80	80	0	216	216	0	264	264
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**70**	**470**	**540**	**140**	**1,575**	**1,715**	**224**	**2,107**	**2,331**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**70**	**470**	**540**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: RED BLUFF EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	69% 1.6	71% 1.5	140	830	970	154	913	1,067	224	1,277	1,501
RICE	3.0	55% 5.8	55% 5.4	310	770	1,080	992	2,278	3,270	1,798	4,156	5,954
CORN	1.8	69% 2.6	72% 2.5	200	1,030	1,230	360	1,854	2,214	520	2,575	3,095
SUNFLOWERS	1.3	68% 1.9	72% 1.8	10	150	160	13	195	208	19	270	289
DRY BEANS	1.4		74% 1.9	0	190	190	0	266	266	0	361	361
SAFFLOWER	1.2		75% 1.6	0	120	120	0	144	144	0	192	192
OTHER FIELD	1.4		74% 1.9	0	120	120	0	168	168	0	228	228
ALFALFA	3.5	70% 5.0	73% 4.8	130	1,140	1,270	455	3,990	4,445	650	5,502	6,152
PASTURE	3.6	69% 5.2	73% 4.9	780	5,210	5,990	2,808	18,756	21,564	4,083	25,539	29,622
PASTURE - X	2.0		72% 2.8	0	440	440	0	880	880	0	1,229	1,229
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5		75% 2.0	0	10	10	0	15	15	0	20	20
ALMONDS	2.9	71% 4.1	80% 3.6	130	3,020	3,150	377	8,758	9,135	533	10,919	11,452
PISTACHIOS	2.7		84% 3.2	0	60	60	0	162	162	0	192	192
PRUNES	2.7		82% 3.3	0	2,660	2,660	0	7,182	7,182	0	8,808	8,808
WALNUTS	2.7		82% 3.3	0	4,080	4,080	0	11,016	11,016	0	13,490	13,490
OTHER DECIDUOUS	2.9		81% 3.6	0	50	50	0	145	145	0	179	179
KIWI												
CITRUS - OLIVES	2.5		80% 3.1	0	590	590	0	1,475	1,475	0	1,839	1,839
GRAPES												
EUCALYPTUS	2.5		86% 2.9	0	670	670	0	1,675	1,675	0	1,943	1,943
Total Crop Acreage				**1,700**	**21,140**	**22,840**	**5,159**	**59,872**	**65,031**	**7,827**	**78,719**	**86,546**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,700**	**21,140**	**22,840**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: SACRAMENTO VALLEY GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6	71% 1.6	550	2,490	3,040	619	2,864	3,483	884	4,054	4,938
RICE	3.1	55% 5.9	55% 5.4	820	840	1,660	2,675	2,509	5,184	4,858	4,576	9,434
CORN	1.9	68% 2.7	72% 2.6	380	2,100	2,480	702	3,886	4,588	1,031	5,367	6,398
SUNFLOWERS	1.4	67% 2.1	73% 1.9	50	330	380	69	447	516	103	612	715
DRY BEANS	1.4		73% 2.0	0	320	320	0	461	461	0	634	634
SAFFLOWER	1.3	71% 1.4	74% 1.8	20	180	200	20	234	254	28	318	346
OTHER FIELD	1.4	67% 2.1	73% 1.9	30	170	200	42	242	284	63	330	393
ALFALFA	3.5	67% 5.2	73% 4.8	610	3,560	4,170	2,154	12,633	14,787	3,197	17,238	20,435
PASTURE	3.6	63% 5.8	73% 5.0	7,250	12,850	20,100	26,275	46,929	73,204	41,945	64,366	106,311
PASTURE - X	2.0	64% 3.2	72% 2.8	910	610	1,520	1,842	1,217	3,059	2,882	1,700	4,582
MEADOW PASTURE	2.9	60% 4.8	71% 4.1	30	40	70	87	116	203	144	164	308
MEADOW PASTURE - X	1.4	64% 2.2		150	0	150	210	0	210	330	0	330
CUCURBITS	0.9	69% 1.3	74% 1.2	170	230	400	153	207	360	221	278	499
OTHER TRUCK	1.6	72% 2.3	74% 2.2	80	200	280	134	319	453	185	431	616
ALMONDS	3.0	73% 4.1	80% 3.7	700	7,790	8,490	2,084	22,974	25,058	2,853	28,707	31,560
PISTACHIOS	2.7	74% 3.8	82% 3.3	10	150	160	28	409	437	38	500	538
PRUNES	2.7	68% 4.0	80% 3.4	1,840	9,960	11,800	5,066	27,166	32,232	7,413	34,169	41,582
WALNUTS	2.7	68% 4.0	79% 3.4	1,380	12,760	14,140	3,814	34,872	38,686	5,576	43,943	49,519
OTHER DECIDUOUS	3.0	73% 4.1	82% 3.6	60	340	400	179	1,009	1,188	245	1,228	1,473
KIWI	1.9		86% 2.2	0	30	30	0	57	57	0	66	66
CITRUS - OLIVES	2.6	79% 3.3	82% 3.3	1,390	6,560	7,950	3,614	17,417	21,031	4,581	21,364	25,945
GRAPES	1.8		86% 2.1	0	10	10	0	18	18	0	21	21
EUCALYPTUS	2.7		84% 3.2	0	10,090	10,090	0	27,092	27,092	0	32,110	32,110
Total Crop Acreage				**16,430**	**71,610**	**88,040**	**49,767**	**203,078**	**252,845**	**76,577**	**262,176**	**338,753**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**16,430**	**71,610**	**88,040**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: REDDING GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71% 1.4	75% 1.2	60	10	70	60	9	69	84	12	96
RICE												
CORN	1.7	68% 2.5		10	0	10	17	0	17	25	0	25
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.3	74% 4.4	77% 4.3	20	260	280	64	860	924	87	1,115	1,202
PASTURE	3.4	67% 5.0	72% 4.7	2,730	350	3,080	9,260	1,188	10,448	13,776	1,650	15,426
PASTURE - X	1.9	68% 2.8		10	0	10	19	0	19	28	0	28
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.8		80% 1.0	0	20	20	0	16	16	0	20	20
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.5		77% 3.2	0	410	410	0	1,011	1,011	0	1,312	1,312
WALNUTS	2.5	74% 3.4	78% 3.2	480	550	1,030	1,200	1,351	2,551	1,632	1,736	3,368
OTHER DECIDUOUS												
KIWI	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,320**	**1,600**	**4,920**	**10,636**	**4,435**	**15,071**	**15,656**	**5,845**	**21,501**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,320**	**1,600**	**4,920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: TEHAMA COUNTY

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6	71% 1.6	610	2,500	3,110	679	2,873	3,552	968	4,066	5,034
RICE	3.1	55% 5.9	55% 5.4	820	840	1,660	2,675	2,509	5,184	4,858	4,576	9,434
CORN	1.8	68% 2.7	72% 2.6	390	2,100	2,490	719	3,886	4,605	1,056	5,367	6,423
SUNFLOWERS	1.4	67% 2.1	73% 1.9	50	330	380	69	447	516	103	612	715
DRY BEANS	1.4		73% 2.0	0	320	320	0	461	461	0	634	634
SAFFLOWER	1.3	71% 1.4	74% 1.8	20	180	200	20	234	254	28	318	346
OTHER FIELD	1.4	67% 2.1	73% 1.9	30	170	200	42	242	284	63	330	393
ALFALFA	3.5	68% 5.2	74% 4.8	630	3,820	4,450	2,218	13,493	15,711	3,284	18,353	21,637
PASTURE	3.6	64% 5.6	73% 5.0	10,180	13,240	23,420	36,215	48,253	84,468	56,701	66,204	122,905
PASTURE - X	2.0	64% 3.2	72% 2.8	1,000	640	1,640	2,013	1,274	3,287	3,150	1,778	4,928
MEADOW PASTURE	2.9	60% 4.8	71% 4.1	30	40	70	87	116	203	144	164	308
MEADOW PASTURE - X	1.4	64% 2.2		2,360	0	2,360	3,304	0	3,304	5,192	0	5,192
CUCURBITS	0.9	69% 1.3	75% 1.2	170	250	420	153	223	376	221	298	519
OTHER TRUCK	1.6	72% 2.3	74% 2.2	80	200	280	134	319	453	185	431	616
ALMONDS	3.0	73% 4.1	80% 3.7	700	7,790	8,490	2,084	22,974	25,058	2,853	28,707	31,560
PISTACHIOS	2.7	74% 3.8	82% 3.3	10	150	160	28	409	437	38	500	538
PRUNES	2.7	68% 4.0	79% 3.4	1,840	10,370	12,210	5,066	28,177	33,243	7,413	35,481	42,894
WALNUTS	2.7	70% 3.9	79% 3.4	1,860	13,320	15,180	5,014	36,248	41,262	7,208	45,709	52,917
OTHER DECIDUOUS	3.0	73% 4.0	82% 3.6	70	340	410	205	1,009	1,214	281	1,228	1,509
KIWI	1.8	67% 2.4	86% 2.2	10	30	40	16	57	73	24	66	90
CITRUS - OLIVES	2.6	79% 3.3	82% 3.3	1,390	6,560	7,950	3,614	17,417	21,031	4,581	21,364	25,945
GRAPES	1.6	73% 2.2	86% 2.1	120	10	130	192	18	210	264	21	285
EUCALYPTUS	2.7		84% 3.2	0	10,090	10,090	0	27,092	27,092	0	32,110	32,110
Total Crop Acreage				**22,370**	**73,290**	**95,660**	**64,547**	**207,731**	**272,278**	**98,615**	**268,317**	**366,932**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**22,370**	**73,290**	**95,660**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: WEST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.4		72% 4.7	0	40	40	0	136	136	0	188	188
PASTURE-X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.5		83% 3.0	0	10	10	0	25	25	0	30	30
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**0**	**50**	**50**	**0**	**161**	**161**	**0**	**218**	**218**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**0**	**50**	**50**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: EAST MOUNTAIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.4	69% 4.9		200	0	200	680	0	680	980	0	980
PASTURE-X	1.9	63% 3.0	73% 2.6	80	30	110	152	57	209	240	78	318
MEADOW PASTURE												
MEADOW PASTURE - X	1.4	64% 2.2		2,210	0	2,210	3,094	0	3,094	4,862	0	4,862
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS												
OTHER DECIDUOUS	2.6	72% 3.6		10	0	10	26	0	26	36	0	36
KIWI												
CITRUS - OLIVES												
GRAPES	1.6	73% 2.2		120	0	120	192	0	192	264	0	264
EUCALYPTUS												
Total Crop Acreage				**2,620**	**30**	**2,650**	**4,144**	**57**	**4,201**	**6,382**	**78**	**6,460**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,620**	**30**	**2,650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: SOUTH BATTEL CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71% 1.4		60	0	60	60	0	60	84	0	84
RICE												
CORN	1.7	68% 2.5		10	0	10	17	0	17	25	0	25
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.3	73% 4.5	70% 4.7	10	30	40	33	99	132	45	141	186
PASTURE	3.4	65% 5.2	72% 4.7	740	200	940	2,516	680	3,196	3,848	940	4,788
PASTURE-X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.5		76% 3.3	0	140	140	0	350	350	0	462	462
WALNUTS	2.5	74% 3.4	78% 3.2	480	260	740	1,200	650	1,850	1,632	832	2,464
OTHER DECIDUOUS												
KIWI	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,310**	**630**	**1,940**	**3,842**	**1,779**	**5,621**	**5,658**	**2,375**	**8,033**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,310**	**630**	**1,940**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: ROSEWOOD

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	0.9		75% 1.2	0	10	10	0	9	9	0	12	12
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.3	74% 4.2	78% 4.2	10	170	180	31	557	588	42	710	752
PASTURE	3.3	67% 4.9	72% 4.7	220	40	260	726	134	860	1,078	186	1,264
PASTURE-X												
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.5		78% 3.2	0	50	50	0	125	125	0	160	160
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**230**	**270**	**500**	**757**	**825**	**1,582**	**1,120**	**1,068**	**2,188**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**230**	**270**	**500**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: BOWMAN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.4		77% 4.4	0	60	60	0	204	204	0	264	264
PASTURE	3.4	68% 5.0	71% 4.8	1,770	110	1,880	6,018	374	6,392	8,850	524	9,374
PASTURE-X	1.9	68% 2.8		10	0	10	19	0	19	28	0	28
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.8		80% 1.0	0	20	20	0	16	16	0	20	20
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.4		78% 3.1	0	270	270	0	661	661	0	850	850
WALNUTS	2.4		77% 3.1	0	240	240	0	576	576	0	744	744
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,780**	**700**	**2,480**	**6,037**	**1,831**	**7,868**	**8,878**	**2,402**	**11,280**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,780**	**700**	**2,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: VINA

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6		110	0	110	126	0	126	181	0	181
RICE												
CORN	1.9	66% 2.9	70% 2.7	70	70	140	133	133	266	203	189	392
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA												
PASTURE	3.7	60% 6.2	72% 5.1	890	260	1,150	3,293	962	4,255	5,518	1,331	6,849
PASTURE-X	2.0	61% 3.3		120	0	120	240	0	240	396	0	396
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.9		69% 1.3	0	20	20	0	18	18	0	26	26
OTHER TRUCK	1.6	64% 2.5	70% 2.3	10	10	20	16	16	32	25	23	48
ALMONDS	3.0	70% 4.3	77% 3.9	290	400	690	870	1,200	2,070	1,247	1,560	2,807
PISTACHIOS												
PRUNES	2.8	65% 4.3	74% 3.8	370	740	1,110	1,036	2,070	3,106	1,591	2,796	4,387
WALNUTS	2.8	70% 4.0	76% 3.7	770	1,990	2,760	2,156	5,572	7,728	3,080	7,300	10,380
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**2,630**	**3,490**	**6,120**	**7,870**	**9,971**	**17,841**	**12,241**	**13,225**	**25,466**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**2,630**	**3,490**	**6,120**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: LOS MOLINOS

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	69% 1.6	69% 1.6	10	80	90	11	88	99	16	128	144
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.5	65% 5.4	70% 5.0	220	220	440	770	770	1,540	1,188	1,100	2,288
PASTURE	3.6	60% 6.0	71% 5.1	930	120	1,050	3,348	432	3,780	5,580	612	6,192
PASTURE-X	1.9	60% 3.2		50	0	50	96	0	96	161	0	161
MEADOW PASTURE	2.9	60% 4.8	71% 4.1	20	40	60	58	116	174	96	164	260
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS	2.9	71% 4.1	77% 3.8	30	390	420	87	1,131	1,218	123	1,471	1,594
PISTACHIOS												
PRUNES	2.7	64% 4.1	78% 3.4	370	1,460	1,830	988	3,873	4,861	1,532	4,985	6,517
WALNUTS	2.7	64% 4.2	76% 3.6	170	370	540	459	999	1,458	714	1,320	2,034
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,800**	**2,680**	**4,480**	**5,817**	**7,409**	**13,226**	**9,410**	**9,780**	**19,190**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,800**	**2,680**	**4,480**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: DYE CREEK

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD	1.4	67% 2.1		30	0	30	42	0	42	63	0	63
ALFALFA												
PASTURE	3.6	61% 5.9	71% 5.0	2,780	210	2,990	10,008	756	10,764	16,530	1,058	17,588
PASTURE-X	2.0	62% 3.2	73% 2.6	200	30	230	394	57	451	636	78	714
MEADOW PASTURE	2.9	60% 4.8		10	0	10	29	0	29	48	0	48
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.7	64% 4.2	82% 3.3	350	940	1,290	945	2,538	3,483	1,470	3,102	4,572
WALNUTS	2.7	64% 4.2	77% 3.5	170	1,030	1,200	459	2,781	3,240	714	3,595	4,309
OTHER DECIDUOUS	2.8		80% 3.5	0	10	10	0	28	28	0	35	35
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,540**	**2,220**	**5,760**	**11,877**	**6,160**	**18,037**	**19,461**	**7,868**	**27,329**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,540**	**2,220**	**5,760**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: BEND

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71% 1.4	77% 1.3	100	20	120	100	20	120	140	26	166
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	1.0	71% 1.4		20	0	20	20	0	20	28	0	28
OTHER FIELD	1.4		78% 1.8	0	10	10	0	14	14	0	18	18
ALFALFA												
PASTURE	3.5	66% 5.3		220	0	220	770	0	770	1,166	0	1,166
PASTURE-X												
MEADOW PASTURE												
MEADOW PASTURE - X	1.4	64% 2.2		150	0	150	210	0	210	330	0	330
CUCURBITS												
OTHER TRUCK	1.7	74% 2.3	77% 2.2	60	20	80	102	34	136	138	44	182
ALMONDS												
PISTACHIOS	2.6		84% 3.1	0	10	10	0	26	26	0	31	31
PRUNES												
WALNUTS	2.6		84% 3.1	0	30	30	0	78	78	0	93	93
OTHER DECIDUOUS	2.8		80% 3.5	0	10	10	0	28	28	0	35	35
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**550**	**100**	**650**	**1,202**	**200**	**1,402**	**1,802**	**247**	**2,049**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**550**	**100**	**650**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: ANTELOPE

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1		69% 1.6	0	290	290	0	319	319	0	464	464
RICE												
CORN	1.8		72% 2.5	0	10	10	0	18	18	0	25	25
SUNFLOWERS												
DRY BEANS												
SAFFLOWER	1.5		71% 2.1	0	60	60	0	90	90	0	126	126
OTHER FIELD												
ALFALFA	3.5	65% 5.4	76% 4.6	70	440	510	245	1,540	1,785	378	2,024	2,402
PASTURE	3.6	64% 5.6	73% 4.9	640	400	1,040	2,304	1,440	3,744	3,600	1,960	5,560
PASTURE-X	2.0		69% 2.9	0	10	10	0	20	20	0	29	29
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.6	73% 2.2	73% 2.2	10	80	90	16	128	144	22	176	198
ALMONDS	2.9		78% 3.7	0	560	560	0	1,624	1,624	0	2,072	2,072
PISTACHIOS	2.7		79% 3.4	0	30	30	0	81	81	0	102	102
PRUNES	2.7	64% 4.2	77% 3.5	180	1,450	1,630	486	3,915	4,401	756	5,099	5,855
WALNUTS	2.7	64% 4.2	79% 3.4	160	2,940	3,100	432	7,938	8,370	672	10,000	10,672
OTHER DECIDUOUS	2.9	64% 4.5	76% 3.8	10	20	30	29	58	87	45	76	121
KIWI												
CITRUS - OLIVES	2.5		78% 3.2	0	10	10	0	25	25	0	32	32
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**1,070**	**6,300**	**7,370**	**3,512**	**17,196**	**20,708**	**5,473**	**22,185**	**27,658**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,070**	**6,300**	**7,370**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: CORNING WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.6	68% 5.3		60	0	60	216	0	216	318	0	318
PASTURE	3.7	69% 5.4	71% 5.2	240	70	310	888	259	1,147	1,296	364	1,660
PASTURE-X	2.1	65% 3.2		320	0	320	672	0	672	1,030	0	1,030
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK												
ALMONDS	3.1		84% 3.7	0	10	10	0	31	31	0	37	37
PISTACHIOS												
PRUNES	2.8		85% 3.3	0	170	170	0	476	476	0	561	561
WALNUTS	2.8		82% 3.4	0	30	30	0	84	84	0	102	102
OTHER DECIDUOUS	3.0	68% 4.4		10	0	10	30	0	30	44	0	44
KIWI												
CITRUS - OLIVES												
GRAPES	1.8		86% 2.1	0	10	10	0	18	18	0	21	21
EUCALYPTUS												
Total Crop Acreage				**630**	**290**	**920**	**1,806**	**868**	**2,674**	**2,688**	**1,085**	**3,773**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**630**	**290**	**920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: CORNING EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)				Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface		Ground		Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.2	71%	1.7	71%	1.7	190	1,270	1,460	228	1,524	1,752	323	2,159	2,482
RICE	3.3	55%	6.0	55%	6.0	510	70	580	1,683	231	1,914	3,060	420	3,480
CORN	1.9	68%	2.8	73%	2.6	110	990	1,100	209	1,881	2,090	308	2,578	2,886
SUNFLOWERS	1.4	67%	2.1	74%	1.9	40	180	220	56	252	308	84	342	426
DRY BEANS	1.5			71%	2.1	0	130	130	0	195	195	0	273	273
SAFFLOWER														
OTHER FIELD	1.5			71%	2.1	0	40	40	0	60	60	0	84	84
ALFALFA	3.6	71%	5.1	73%	4.9	130	1,730	1,860	468	6,228	6,696	663	8,477	9,140
PASTURE	3.7	68%	5.4	73%	5.1	770	6,240	7,010	2,856	23,100	25,956	4,172	31,836	36,008
PASTURE-X	2.0	69%	2.9	71%	2.8	150	130	280	300	260	560	435	364	799
MEADOW PASTURE														
MEADOW PASTURE - X														
CUCURBITS	0.9	69%	1.3	75%	1.2	170	210	380	153	189	342	221	252	473
OTHER TRUCK	1.6			76%	2.1	0	60	60	0	96	96	0	126	126
ALMONDS	3.0	79%	3.8	81%	3.7	250	3,410	3,660	750	10,230	10,980	950	12,648	13,598
PISTACHIOS	2.8	74%	3.8	80%	3.5	10	50	60	28	140	168	38	175	213
PRUNES	2.8	78%	3.6	81%	3.5	570	2,540	3,110	1,611	7,112	8,723	2,064	8,818	10,882
WALNUTS	2.8	78%	3.6	80%	3.5	110	2,210	2,320	308	6,188	6,496	396	7,779	8,175
OTHER DECIDUOUS	3.0	77%	3.9	83%	3.6	40	250	290	120	750	870	156	903	1,059
KIWI	1.9			86%	2.2	0	30	30	0	57	57	0	66	66
CITRUS - OLIVES	2.7	79%	3.3	82%	3.3	1,390	5,960	7,350	3,614	15,917	19,531	4,581	19,493	24,074
GRAPES														
EUCALYPTUS	2.7			84%	3.2	0	9,420	9,420	0	25,417	25,417	0	30,167	30,167
Total Crop Acreage						**4,440**	**34,920**	**39,360**	**12,384**	**99,827**	**112,211**	**17,451**	**126,960**	**144,411**
Double Crop Acreage						**0**	**0**	**0**						
Total Irrigated Land Area						**4,440**	**34,920**	**39,360**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: RED BLUFF WEST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN												
RICE												
CORN												
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.5		78% 4.5	0	30	30	0	105	105	0	135	135
PASTURE	3.6		73% 4.9	0	340	340	0	1,224	1,224	0	1,666	1,666
PASTURE-X	2.0	63% 3.2		70	0	70	140	0	140	224	0	224
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5		71% 2.1	0	20	20	0	30	30	0	42	42
ALMONDS												
PISTACHIOS												
PRUNES												
WALNUTS	2.7		82% 3.3	0	80	80	0	216	216	0	264	264
OTHER DECIDUOUS												
KIWI												
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**70**	**470**	**540**	**140**	**1,575**	**1,715**	**224**	**2,107**	**2,331**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**70**	**470**	**540**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: RED BLUFF EAST

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	69% 1.6	71% 1.5	140	830	970	154	913	1,067	224	1,277	1,501
RICE	3.0	55% 5.8	55% 5.4	310	770	1,080	992	2,278	3,270	1,798	4,156	5,954
CORN	1.8	69% 2.6	72% 2.5	200	1,030	1,230	360	1,854	2,214	520	2,575	3,095
SUNFLOWERS	1.3	68% 1.9	72% 1.8	10	150	160	13	195	208	19	270	289
DRY BEANS	1.4		74% 1.9	0	190	190	0	266	266	0	361	361
SAFFLOWER	1.2		75% 1.6	0	120	120	0	144	144	0	192	192
OTHER FIELD	1.4		74% 1.9	0	120	120	0	168	168	0	228	228
ALFALFA	3.5	70% 5.0	72% 4.8	40	1,230	1,270	140	4,305	4,445	200	5,943	6,143
PASTURE	3.6	68% 5.3	73% 4.9	330	5,660	5,990	1,188	20,376	21,564	1,743	27,744	29,487
PASTURE-X	2.0		72% 2.8	0	440	440	0	880	880	0	1,229	1,229
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS												
OTHER TRUCK	1.5		75% 2.0	0	10	10	0	15	15	0	20	20
ALMONDS	2.9	71% 4.1	80% 3.6	130	3,020	3,150	377	8,758	9,135	533	10,919	11,452
PISTACHIOS	2.7		84% 3.2	0	60	60	0	162	162	0	192	192
PRUNES	2.7		82% 3.3	0	2,660	2,660	0	7,182	7,182	0	8,808	8,808
WALNUTS	2.7		82% 3.3	0	4,080	4,080	0	11,016	11,016	0	13,490	13,490
OTHER DECIDUOUS	2.9		81% 3.6	0	50	50	0	145	145	0	179	179
KIWI												
CITRUS - OLIVES	2.5		80% 3.1	0	590	590	0	1,475	1,475	0	1,839	1,839
GRAPES												
EUCALYPTUS	2.5		86% 2.9	0	670	670	0	1,675	1,675	0	1,943	1,943
Total Crop Acreage				**1,160**	**21,680**	**22,840**	**3,224**	**61,807**	**65,031**	**5,037**	**81,365**	**86,402**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**1,160**	**21,680**	**22,840**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: SACRAMENTO VALLEY GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6	71% 1.6	550	2,490	3,040	619	2,864	3,483	884	4,054	4,938
RICE	3.1	55% 5.9	55% 5.4	820	840	1,660	2,675	2,509	5,184	4,858	4,576	9,434
CORN	1.9	68% 2.7	72% 2.6	380	2,100	2,480	702	3,886	4,588	1,031	5,367	6,398
SUNFLOWERS	1.4	67% 2.1	73% 1.9	50	330	380	69	447	516	103	612	715
DRY BEANS	1.4		73% 2.0	0	320	320	0	461	461	0	634	634
SAFFLOWER	1.3	71% 1.4	74% 1.8	20	180	200	20	234	254	28	318	346
OTHER FIELD	1.4	67% 2.1	73% 1.9	30	170	200	42	242	284	63	330	393
ALFALFA	3.5	67% 5.3	73% 4.8	520	3,650	4,170	1,839	12,948	14,787	2,747	17,679	20,426
PASTURE	3.6	62% 5.8	73% 5.0	6,800	13,300	20,100	24,655	48,549	73,204	39,605	66,571	106,176
PASTURE-X	2.0	64% 3.2	72% 2.8	910	610	1,520	1,842	1,217	3,059	2,882	1,700	4,582
MEADOW PASTURE	2.9	60% 4.8	71% 4.1	30	40	70	87	116	203	144	164	308
MEADOW PASTURE - X	1.4	64% 2.2		150	0	150	210	0	210	330	0	330
CUCURBITS	0.9	69% 1.3	74% 1.2	170	230	400	153	207	360	221	278	499
OTHER TRUCK	1.6	72% 2.3	74% 2.2	80	200	280	134	319	453	185	431	616
ALMONDS	3.0	73% 4.1	80% 3.7	700	7,790	8,490	2,084	22,974	25,058	2,853	28,707	31,560
PISTACHIOS	2.7	74% 3.8	82% 3.3	10	150	160	28	409	437	38	500	538
PRUNES	2.7	68% 4.0	80% 3.4	1,840	9,960	11,800	5,066	27,166	32,232	7,413	34,169	41,582
WALNUTS	2.7	68% 4.0	79% 3.4	1,380	12,760	14,140	3,814	34,872	38,686	5,576	43,943	49,519
OTHER DECIDUOUS	3.0	73% 4.1	82% 3.6	60	340	400	179	1,009	1,188	245	1,228	1,473
KIWI	1.9		86% 2.2	0	30	30	0	57	57	0	66	66
CITRUS - OLIVES	2.6	79% 3.3	82% 3.3	1,390	6,560	7,950	3,614	17,417	21,031	4,581	21,364	25,945
GRAPES	1.8		86% 2.1	0	10	10	0	18	18	0	21	21
EUCALYPTUS	2.7		84% 3.2	0	10,090	10,090	0	27,092	27,092	0	32,110	32,110
Total Crop Acreage				**15,890**	**72,150**	**88,040**	**47,832**	**205,013**	**252,845**	**73,787**	**264,822**	**338,609**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**15,890**	**72,150**	**88,040**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: REDDING GROUNDWATER BASIN

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.0	71% 1.4	75% 1.2	60	10	70	60	9	69	84	12	96
RICE												
CORN	1.7	68% 2.5		10	0	10	17	0	17	25	0	25
SUNFLOWERS												
DRY BEANS												
SAFFLOWER												
OTHER FIELD												
ALFALFA	3.3	74% 4.4	77% 4.3	20	260	280	64	860	924	87	1,115	1,202
PASTURE	3.4	67% 5.0	72% 4.7	2,730	350	3,080	9,260	1,188	10,448	13,776	1,650	15,426
PASTURE-X	1.9	68% 2.8		10	0	10	19	0	19	28	0	28
MEADOW PASTURE												
MEADOW PASTURE - X												
CUCURBITS	0.8		80% 1.0	0	20	20	0	16	16	0	20	20
OTHER TRUCK												
ALMONDS												
PISTACHIOS												
PRUNES	2.5		77% 3.2	0	410	410	0	1,011	1,011	0	1,312	1,312
WALNUTS	2.5	74% 3.4	78% 3.2	480	550	1,030	1,200	1,351	2,551	1,632	1,736	3,368
OTHER DECIDUOUS												
KIWI	1.6	67% 2.4		10	0	10	16	0	16	24	0	24
CITRUS - OLIVES												
GRAPES												
EUCALYPTUS												
Total Crop Acreage				**3,320**	**1,600**	**4,920**	**10,636**	**4,435**	**15,071**	**15,656**	**5,845**	**21,501**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**3,320**	**1,600**	**4,920**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

State of California, Department of Water Resources, Northern District

Agricultural Land and Water Use for 2000 (Drought Year)

Inventory Unit: TEHAMA COUNTY

Crop	Unit ET of Applied Water (acre-feet/acre)	Unit Applied Water (acre-feet/acre)		Net Irrigated Acreage[1] (acres)			ET of Applied Water (acre-feet)			Applied Water (acre-feet)		
		Surface	Ground	Surface	Ground	Total	Surface	Ground	Total	Surface	Ground	Total
GRAIN	1.1	70% 1.6	71% 1.6	610	2,500	3,110	679	2,873	3,552	968	4,066	5,034
RICE	3.1	55% 5.9	55% 5.4	820	840	1,660	2,675	2,509	5,184	4,858	4,576	9,434
CORN	1.8	68% 2.7	72% 2.6	390	2,100	2,490	719	3,886	4,605	1,056	5,367	6,423
SUNFLOWERS	1.4	67% 2.1	73% 1.9	50	330	380	69	447	516	103	612	715
DRY BEANS	1.4		73% 2.0	0	320	320	0	461	461	0	634	634
SAFFLOWER	1.3	71% 1.4	74% 1.8	20	180	200	20	234	254	28	318	346
OTHER FIELD	1.4	67% 2.1	73% 1.9	30	170	200	42	242	284	63	330	393
ALFALFA	3.5	67% 5.2	73% 4.8	540	3,910	4,450	1,903	13,808	15,711	2,834	18,794	21,628
PASTURE	3.6	64% 5.6	73% 5.0	9,730	13,690	23,420	34,595	49,873	84,468	54,361	68,409	122,770
PASTURE-X	2.0	64% 3.2	72% 2.8	1,000	640	1,640	2,013	1,274	3,287	3,150	1,778	4,928
MEADOW PASTURE	2.9	60% 4.8	71% 4.1	30	40	70	87	116	203	144	164	308
MEADOW PASTURE - X	1.4	64% 2.2		2,360	0	2,360	3,304	0	3,304	5,192	0	5,192
CUCURBITS	0.9	69% 1.3	75% 1.2	170	250	420	153	223	376	221	298	519
OTHER TRUCK	1.6	72% 2.3	74% 2.2	80	200	280	134	319	453	185	431	616
ALMONDS	3.0	73% 4.1	80% 3.7	700	7,790	8,490	2,084	22,974	25,058	2,853	28,707	31,560
PISTACHIOS	2.7	74% 3.8	82% 3.3	10	150	160	28	409	437	38	500	538
PRUNES	2.7	68% 4.0	79% 3.4	1,840	10,370	12,210	5,066	28,177	33,243	7,413	35,481	42,894
WALNUTS	2.7	70% 3.9	79% 3.4	1,860	13,320	15,180	5,014	36,248	41,262	7,208	45,709	52,917
OTHER DECIDUOUS	3.0	73% 4.0	82% 3.6	70	340	410	205	1,009	1,214	281	1,228	1,509
KIWI	1.8	67% 2.4	86% 2.2	10	30	40	16	57	73	24	66	90
CITRUS - OLIVES	2.6	79% 3.3	82% 3.3	1,390	6,560	7,950	3,614	17,417	21,031	4,581	21,364	25,945
GRAPES	1.6	73% 2.2	86% 2.1	120	10	130	192	18	210	264	21	285
EUCALYPTUS	2.7		84% 3.2	0	10,090	10,090	0	27,092	27,092	0	32,110	32,110
Total Crop Acreage				**21,830**	**73,830**	**95,660**	**62,612**	**209,666**	**272,278**	**95,825**	**270,963**	**366,788**
Double Crop Acreage				**0**	**0**	**0**						
Total Irrigated Land Area				**21,830**	**73,830**	**95,660**						

[1] Net irrigated acreage is equal to 95 percent of the gross acreage.

"- X" denotes partially irrigated crops.

Appendix E
Environmental Enhancement Projects in Tehama County

The Natural Resources Projects Inventory lists over 50 environmental enhancement projects for Tehama County (California Biodiversity Council undated). This appendix includes the names and brief descriptions of these projects. Of these projects, 30 of them involve habitat restoration, enhancement and protection including:

- Direct ecosystem restoration (restore riparian vegetation, non-native and noxious weed abatement, erosion control, restore natural geomorphologic processes to stream channels, and addition of gravel to increase spawning habitat); and
- Protection against future ecosystem degradation (development of watershed management plans, land acquisition and easements along flood plains and upland areas to create contiguous or continuous natural areas, rangeland management, fuels management, and mitigation of levee and flood control work along the Sacramento River).

APPENDIX E
Environmental Enhancement Projects in Tehama County

PROJECT TITLE	***PROJECT PURPOSE***
Battle Creek - Fish Passage Investigation (A194)(97-M02)	To provide data and acceptable designs for fish passage facilities, to restoring the utilization of this prime salmonid habitat.
Battle Creek Monitoring Adult and Juvenile Winter and Spring Run Chinook Salmon and Steelhead (98-C14)(F1003)	The goal of this project is to obtain life history information on spring and winter chinook salmon and steelhead in Battle Creek. This information will assess the suitability of the current habitat and provide an evaluation tool for restoration activities.
Battle Creek Restoration Project (DA1)(99-B01)	To increase and enhance habitat for salmon and steelhead.
Battle Creek Spawning Restoration	Decrease erosion/stream sedimentation; Improve spawning habitat
Battle Creek Watershed Conservancy	The BCWC seeks to protect the wider watershed over the long term, both to increase the prospect that the excellent salmonid habitat of Battle Creek will not be compromised by future development, and to preserve environmental values of significance to the local residents.
Battle Creek Watershed Stewardship (G1018)(98-E06)	The Battle Creek Watershed Conservancy is looking to long-term protection of this investment through stewardship. The proposed tasks include direct ecosystem restoration (noxious weed abatement) protection against future ecosystem degradation (fuels management, conservation easements), improvement of degraded habitats, plus an outreach component.
Big Chico Creek Watershed Management Strategy Phases I-II (F219)(97-E01)	Rivers and creeks have various functions - natural, social, spiritual and cultural - including nurturing the living things in their watersheds, supporting human life and productive activities, and providing rest and relaxation. The Big Chico Creek Watershed Alliance (BCCWA) will develop and implement and Watershed Management Strategy sensitive to these needs in three phases, creating a blueprint for the restoration and protection of watershed resources.
Brickyard Creek (DWR# Z60072)	Develop a cooperative effort among three Red Bluff public schools to restore riparian vegetation, help prevent erosions and property damage from high water events, provide habitat for wildlife and provide pubilc education along Brickyard Creek.
California Mallard Program	The purpose of the project is to demonstrate that a planned grazing system can benefit upland nesting birds, restore riparian vegetation and extend bare flow (stream).

PROJECT TITLE	***PROJECT PURPOSE***
California's Coastal NPS Control Implementation and Statewide NPS Program Coordination	The goals of this project are to: (1) enhance coordination of all partners involved in implementing actions identified in the NPS Program Plan and in developing agencies' own five-year implementation plans; (2) support implementation of 61 identified management measures (MMs) by 2013, in part by co-leading and convening meetings for the Interagency Coordinating Committee (IACC); (3) enhance CCC's local NPS outreach efforts by targeting resources on priority issues including local coastal program development and update; (4) continue internal staff NPS oversight and training to ensure consistency in applying NPS measures; and (5) evaluate progress made in implementing the Model Urban Runoff Program and expand it to additional communities.
Central Valley Habitat Joint Venture	Protect, maintain, improve, and restore habitat to increase waterfowl populations to desired levels in the Central Valley consistent with the North American Waterfowl Management Plan objectives.
Central Valley Salmon and Steelhead Angler Harvest Monitoring Program	Survey, study, research
Coldfork Watershed Restoration (1995)	To move towards Ecosystem Management by restoring degraded habitats in the Coldfork Creek Sub-Watershed.
Cottonwood Creek - Bengard Ranch Restoration Project (G171) (97-N07)	The purpose of this project is two-fold: 1) document geomorphic change along lower Cottonwood Creek, and 2) develop a channel and riparian restoration design for the Bengard Ranch and perhaps adjacent properties and then implement such a project.
Cottonwood Creek Watershed Group (G1015)(98-E05)	This project will form a comprehensive organization to address the entire Cottonwood Creek watershed and oversee the implementation of the plan. This planning effort would evaluate and develop recommendations for watershed stewardship including: timber harvesting, land use, fire and fire suppression, managing oak woodlands to reduce erosion, maintaining riparian zones, and providing more sustained runoff patterns in the upper watershed area. The plan will also seek to restore, reactivate and maintain natural sediment supply, flood plain and flood processes, gravel recruitment and stream meander, and protect salmon spawning and rearing habitat in the lower watershed area.
Deer / Mill Creek Conservancies EQIP Project	The Environmental Quality Incentive Program is a voluntary cost share program designed to assist landowners achieve conservation goals and long term sustainability of the natural resources. EQIP may be utilized where there are opportunities to increase irrigation efficiency, enhance streambank vegetation, implement grazing systems and enhance upland wildlife habitat.
Deer and Mill Creeks Acquisition and Enhancement (C1033)(98-F20)	The Nature Conservancy requests funds for the acquisition, revegetation, and management of critical riparian and floodplain easements totaling almost 2,500 acres along the lower and middle reaches of Deer and Mill Creeks in the upper Sacramento Watershed. The project is a part of a comprehensive effort to restore and protect a continuous corridor of riparian, aquatic, and upland habitat along key tributary streams of the Sacramento River in eastern Tehama County, including Deer, Mill, and Battle Creeks. The proposed project supports the objectives of the CALFED Bay-Delta Program by focusing on high-risk species and habitats and by providing broad ecosystem benefits.

PROJECT TITLE	***PROJECT PURPOSE***
Deer Creek Watershed Implementation Program (F237)(97-E02)	To implement the enhancement and restoration actions identified and prioritized by the Deer Creek Watershed Management strategy established by the Deer Creek Watershed Conservancy (DCWC).
Deer Creek Watershed Program Phase 2	Bank Stabilization, Non-native Removal and Upper Meadows Restoration
Deer Creek Weir	Improve fish passage
Deer, Mill and Antelope Creek Sediment Stabilization Phase I (F5)(97-B01)	To complete phase one of a two phase strategy to reduce generation of fine sediment from upland and riparian road-related sources in the Deer, Mill, and Antelope Creek Watersheds.
Development of an Organophosphate Pesticide Management Plan for the Sacramento and Feather Rivers	Organophosphate O-P pesticides have been identified by the Sacramento River Watershed Program (SRWP) as a water quality constituent of concern. The SRWP stakeholders agreed that O-P pesticide levels should be reduced in order to protect aquatic resources.
Eel River Watershed Improvement Group Support	Organizational support
Five County Conservation Planning Effort: Roads, Fish Passage and Spoils Assessment	Organizational support; Survey, study, research
Lassen Watershed Project - Deer Creek Watershed (5-127-255-0)	This project intends to implement a variety of watershed enhancement projects through a cooperative effort which blends the expertise and wisdom of the community with the structure and creative programming of local schools. Projects will be focused on Deer and Mill Creek Watersheds, which collectively provide on of the last refugia and the greatest potential for expansion of wild spring run chinook salmon.
Lassen Watershed Project - Mill Creek Watershed (5-124-255-0)	The purpose of this project is to perform a scoping study to determine existing conditions, resource inventory data and list of unresolved critical resource issues and "hands on learning" educational component with Los Molinos School District.
Lower Inks Creek Medusahead Abatement	Vegetation management.
Metals Transport in the Sacramento River (5-156-250)	Metals transport in the Sacramento River, northern California, from July 1996 to June 1997 was evaluated in terms of metal loads from samples of water and suspended colloids that were collected on up to six occasions at 13 sites in the Sacramento River Basin. Four of the sampling periods (July, September, and November 1996; and May-June 1997) took place during relatively low-flow conditions and two sampling periods (December 1996 and January 1997) took place during high-flow and flooding conditions, respectively. This study focused primarily on loads of cadmium, copper, lead, and zinc, with secondary emphasis on loads of aluminum, iron, and mercury.

PROJECT TITLE	***PROJECT PURPOSE***
Mill Creek - Anadromous Fish Passage at Clough Dam - (B1000)(98-B21)	This project is for final design and construction of fish passage facilities at or near to Clough Dam on Mill Creek near Los Molinos. The California Department of Water Resources (DWR) proposes to improve upstream fish passage for adult salmon and steelhead, and provide fish screening facilities for downstream juvenile passage. DWR will work cooperatively with California Department of Fish and Game (DFG), United States Fish and Wildlife Service (FWS), local property owners, diversion owners, and diverters, to provide designs for a new off-stream fish screen and water diversion inverted siphon which when completed will provide reliable fish passage with minimal operation and maintenance.
Mill Creek Riparian Restoration Project - Phase II (G292)(97-N08)	The proposed project will restore and enhance native riparian vegetation on one or more parcels along lower Mill Creek, a high-priority tributary of the upper Sacramento River.
Red Bluff Diversion Dam Project	Education, training
Red Bluff Diversion Dam: Fish Passage Improvement Project - (B1004)(98-B22)	'The primary biological/ecological objective of the project is to reduce or minimize the impacts of the Red Bluff Diversion Dam (RBDD) on juvenile and adult anadromous fish migration. The RBDD is a barrier to anadromous fish migration from May 15 through September 15 when its gates are closed and obstruct normal river flows. Eliminating the current dependence on the RBDD for agricultural irrigation supply would potentially enable RBDD operations to be modified to improve fish passage for spring run, fall run, late fall run, and winter run chinook salmon, and steelhead trout.
Road Crossing Barriers on the Trinity River System	Survey, study, research
Sacramento River - DFG Fish Screen Project (A129)(97-C04A-B)	Implementation of this proposal will result in reduced entrainment losses at water diversions of special status species, juvenile salmonids and other anadromous and resident fish species.
Sacramento River - Floodplain Acquisition Management and Monitoring (C1028)(98-F18)	The Nature Conservancy, the California Wildlife Conservation Board, California Dept. of Fish and Game, and the U.S. Fish and Wildlife Service request funds for the acquisition and management of fee title or permanent conservation easement interests on floodplain lands within the Conservation Area of the Sacramento River between Keswick and Verona. We will also develop a new project-side floodplain restoration monitoring program to enhance existing monitoring programs. This application builds on a similar application submitted to CALFED in 1997. These acquisitions will facilitate the recovery of ecological processes within the floodplain, including the regeneration of native riparian habitat.
Sacramento River - Restoration of Riparian Forest (G278)(97-N03)	To restore 300 acres of flood-prone agricultural lands to native riparian forest along the Sacramento River between Keswick and Verona.
Sacramento River - Spawning Area of Green Sturgeon (F1002)(98-C13)	The goal of this project is to gain a better understanding of green sturgeon life history in the upper Sacramento River. This will aid in the development and implementation of restoration and management actions used to achieve CALFED goals.
Sacramento River Bank Protection Project - 40BM	To mitigate levee work done on Sacramento River.
Sacramento River Basin National Water Quality Assessment	Contribute to a study on status and trends of water quality conditions as part of a nationally commissioned program.
Sacramento River Discovery Center	Public information and education about watersheds.

PROJECT TITLE	***PROJECT PURPOSE***
Sacramento River Fisheries and Riparian Habitat Management Program (G195)(97-C03)	The purpose of the riparian habitat planning conducted through SB1086 is to provide for enhanced ecosystem function of the Sacramento River by preserving the remaining riparian habitat and by reestablishing a continuous riparian ecosystem using the natural processes of the river.
Sacramento River Flood Control Project: Chico Landing to Red Bluff Phase I	To provide mitigation for flood control work on the Sacramento River.
Sacramento River Floodplain Acquisition and Restoration (G261)(97-N03B)(G261)(97-N02)	To acquire fee title or permanent conservation easement on lands within the Conservation Area (as defined by SB1086) of the Sacramento river between Keswick and verona. These acquisitions are a means to facilitate the recovery of ecological processes within the floodplain, including the regeneration of native riparian habitat.
Sacramento River Meander Project (G291)(97-N04)	To implement a meander belt restoration project.
Sacramento River Public Information and Education - Headwaters to the Ocean (H1006)(98-B33)	This project will provide a public information/education component of CALFED work to ensure that the improvements on the river and the maintenance of a sustainable, balanced, healthy river system are understood and supported by the general public. It will provide a place and programs for the California public, educators, volunteers, students and other participants to learn about the value and importance of the water resources of the Sacramento River.
Sacramento River Rice Water Quality Demonstration Project	The purpose is to establish demonstration sites to accelerate voluntary farmer adoption of alternative rice water management strategies that reduce off-site surface water pollution.
Sacramento River Small Diversion Fish Screen Program	To assist in the restoration of anadromous species on the Sacramento River with special emphasis on Winter-run and Spring-run chinook salmon by helping farmers to screen their small agricultural diversions on the Sacramento River.
Sacramento River Tributaries Citizen Based Watershed Management Activities (8-039-255-0)	The Sacramento River and its tributary watersheds are being impaired by pollutants, nutrients, sediments and loss of habitat. The Sacramento River Watershed Program (SWRP), a watershed management group, has been formed to benefit the river and its tributaries. Local residents are forming their own management programs to focus on issues with particular relevance for the tributary watersheds. Several of these programs have decided to work together and with federal, state, and local agencies to share resources and expertise. The goal of this program is to maximize resources and efforts by forming a working group to increase communication and develop a central resource center available to all interested programs.
San Joaquin Valley Streams Metals Concentration (0-157-150-0)	This project will conduct a study to determine the applicability of using evapo-concentration techniques to accurately and precisely measure the total recoverable and dissolved metal concentrations occurring in the central valley reservoir releases.
South Fork Trinity CCC Work Identification Project	Survey, study, research
South Fork Trinity River Coordinated Resource Management Planning	Education, training; Organizational support
South Fork Trinity River Steelhead Survey	Survey, study, research
South Fork Trinity River Watershed Restoration Project	Decrease erosion/stream sedimentation
Spring-run Chinook Salmon Workgroup	Organizational support; Survey, study, research

PROJECT TITLE	***PROJECT PURPOSE***
Streaminders Hands-on Environmental Education Program - Classroom Aquaria Project	Education, training
Tehama County Dalmatian Toadflax Eradication Project (0336)	To eradicate dalmatian toadflax from the county.
Tehama County Klamathweed Biological Control Project (0138)	Biological control of klamathweed, a noxious weed of rangelands and right-of-ways, in Tehama County.
Tehama County Puncturevine Biological Control Project (0186)	Biological control of puncturevine, a noxious weed of rangelands and right-of-ways, in Tehama County.
Tehama County Skeletonweed Eradication Project (0337)	To eradicate skeletonweed from Tehama County.
Tehama County Spotted Knapweed Eradication Project (0338)	To eradicate spotted knapweed from Tehama County.
Tehama County Yellow Starthistle Biological Control Project (0045)	Biological control of yellow starthistle, a noxious weed of rangelands and right-of-ways, in Tehama County.
Tree of Heaven Control, Battle Creek Wildlife Area (0519)	Tree of Heaven control, Battle Creek Wildlife Area.
Trinity River Basin Salmon and Steelhead Monitoring Project	Survey, study, research
Trinity River Water Diversion Assessment	Survey, study, research
Upper Sacramento River Fisheries and Riparian Management Plan	To provide for the protection, restoration, and enhancement of fish and riparian habitat and associated wildlife in the plan region.
Upper Sacramento River Genetic Comparison of Stocks Considered for Re-establishing Steelhead in Clear Creek (F1001)(98-C12)	The goal of this project is to obtain fine scale information on genetic diversity of several stocks of steelhead/rainbow trout from Coleman National Fish Hatchery; the mainstem Upper Sacramento River; and Mill, Deer, and Clear Creeks. Information gathered will be used primarily to determine the preferred source of a founding stock for re-establishing a self-sustaining steelhead population in Clear Creek, while at the same time maintaining or improving the genetic integrity of the Upper Sacramento River population.
Upper Sacramento River InStreamflow Study	Survey, study, research
Upper South Fork Trinity River Road Inventory and Watershed Analysis	Survey, study, research
Upper-Butte Creek Watershed Road-Related Sediment Survey: Scotts John, Bull and Varey Creeks	The Butte Creek watershed is home to the spring-run chinook (Oncorhyncus Tshawytscha), a species listed as "threatened" by State and Federal agencies, as well as steelhead trout. Considerable amounts of evidence and research point to forest roads as sources of fine sediment that may adversely affect the spawning success of salmonids. Yet, prior to this survey, little was known about the Butte Creek forest road network. This survey was conducted to gain perspective on the relationship between the road network and sediment contribution and magnitude of problems, if any.
USGS CA504 Sacramento Basin National Water Quality Assessment	Various human and natural processes can cause degradation of the quality of ground and surface water resources. To meet the needs for water-quality information at national, state, and local levels, the USGS has implemented the National Water Quality Assessment Program. This program will help determine the status of ans trends in the quality of those resources. The Sacramento River Basin study unit is one of the 60 study units in this national program.

PROJECT TITLE	***PROJECT PURPOSE***
Water Quality Improvement Project - Westside Tributaries	1. To establish a locally directed watershed program. 2. Implement projects that demonstrate improvement in water quality and aquatic habitat. 3. Host stakeholder meetings and educational workshops.
Westside Tributaries Water Quality Improvement Project (8-055-255-0)	This project will address the problems experienced in upland riparian areas and watersheds. This includes rangeland management, erosion control, and riparian mangement. The project will educate local school children in these subjects, provide incentives for volunteers in the area to provide help for individuals who have identifiable restoration needs on their lands, and create demonstration projects for the education of the public.
Wild on Watersheds (WOW): Steps Toward Stewardship (8-099-250-0)	Raise watershed awareness through the campaign theme "We All Live in a Watershed." Promote understanding of the steps a community must take to assess the condition of their watershed, what practices need to be monitored, and how to develop a volunteer monitoring program. Provide RCDs and local groups with the tools to take those steps.

Source: California Biodiversity Council and University of California Davis. Undated. *Natural Resources Projects Inventory for Tehama County*. Available at: http://endeavor.des.ucdavis.edu/nrpi. Accessed in March 2003.