Tehama County Flood Control And Water Conservation District

Coordinated AB 3030 Groundwater Management Plan 2012

Prepared for
Tehama County Flood Control & Water Conservation District Board of Directors

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Preface

Fifteen years have passed since the Tehama County Flood Control and Water Conservation District adopted a Coordinated AB 3030 Groundwater Management Plan (Plan) in November 1996. This update of the original Plan was prepared to describe accomplishments, highlight new knowledge and findings about the County's groundwater resources, and to incorporate revisions that were identified in the course of implementing the action elements of the Plan.

This update was prepared by the Tehama County Flood Control and Water Conservation District (District) through the coordinated efforts of the University of California Cooperative Extension, the Tehama County AB 3030 Technical Advisory Committee (TAC) and the California Department of Water Resources, Northern Region. The District and the TAC are focused on an update that addresses accomplishments, new knowledge, and recommended revisions that will improve the Plan. It is recognized that when originally adopted the Plan had a significant amount of public involvement that included public hearings, Board of Directors discussions, and final approval. The Plan is currently implemented through the use of Memorandums of Understanding between the District and other agencies and entities throughout the County. This update was prepared with the understanding that the original intent and methodology of the Plan is maintained for the management of groundwater resources in Tehama County.

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Purpose of the Plan

Introduction

Plan Authorization

Section 101. The Tehama County Flood Control and Water Conservation District (District) is an authorized groundwater management agency within the meaning of Water Code Section 10753 (b). This Plan will be undertaken in accordance with the consent of local agencies whose governing bodies will be contacted to enter into an agreement with the District pursuant to Water Code Sections 10750.7 or 10750.8. The District was formally directed to proceed with the preliminary development of a County-wide groundwater management plan by the District Board of Directors at the Regular Meeting of the Board held on April 25, 1995 and the updating of said Plan on (date to be determined).

Section 102. The District finds and declares that the management of the groundwater within its territory and the plan area designated herein, is in the public interest and will provide for the common benefit of water users within the plan area.

Section 103. The District has considered the potential impact of this plan upon business activities within the plan area and it has determined that the adoption of this plan will provide benefits to municipal, industrial, agricultural and commercial uses which outweigh any economic hardship that may result.

Purpose of the Plan

Section 104. The purposes of this groundwater management plan can be summarized best as follows:

A. The primary purpose of the Plan is to sustain groundwater levels that balance long-term extraction and replenishment. Annual recovery of spring groundwater levels after the previous summer season of more intensive groundwater extraction and following each winter season will be used to assess annual groundwater recharge. Long-term trends of

annual groundwater recharge shall be the primary basis for evaluating the long-term balance between extraction and replenishment.

B. To the extent of the District's authority, the Plan will seek to sustain groundwater levels so the existing groundwater well infrastructure within Tehama County remains operational over the long term.

C. Develop a comprehensive groundwater management program that would ensure sufficient groundwater supplies of useable quality are maintained for reliable, efficient and cost effective extraction This includes technical elements of groundwater analysis such as:

- Groundwater level monitoring
- Groundwater flow gradient analysis
- Groundwater quality sampling and analysis
- Land subsidence monitoring and analysis
- Inventory and evaluation of water well infrastructure
- Hydrogeologic investigations

The technical element also involves routine evaluation of these types of data to stay current on changing groundwater conditions, uses, and needs. A comprehensive groundwater program also maintains an element of cooperation with land use planning and other Northern Sacramento Valley public agencies that use and rely on the same regional groundwater aquifer systems.

D. Implement groundwater management plan through the development of County-wide consensus wherever possible.

Disavowal of Purpose

Section 105. It is not the intent of the District Board of Directors that in the adoption of this Plan, or in the promulgation of a management program developed pursuant to this Plan, that the District intrude upon, diminish, demean or negate in any manner the police power of the County of Tehama or of any incorporated city within the County of Tehama. By adoption of this Plan, the District Board specifically and expressly disavows any such purpose.

Rule of Construction and Effect

Section 106. In the event any provision of this Plan, or provision contained within any program developed pursuant to this Plan, is in conflict with an enactment of the County of Tehama or a city within the County of Tehama (whether such enactment exists at the time of adoption of this Plan or is subsequently enacted), which enactment is enabled by the constitutional police power of the County or city respectively, then such provision shall be construed and harmonized with such enactment to the maximum extent possible.

Section 107. Harmonization may be achieved, without limitation, by the devise of excision of the language of the provision which gives rise to the conflict if, following such excision, the provision will have a residual operative effect. If it is deemed impossible to harmonize any provision of this Plan, or any provision of a program developed pursuant to this Plan, with such enactment of the County or of any city within the County, then such provision shall be deemed to be null and void and of no effect within the jurisdiction of the enacting city or the County of Tehama as the case may be.

Section 108. The District shall implement the Plan in consultation and coordination with all affected public and private water purveyors. The District will cooperate with affected water purveyors to determine the best method to achieve comprehensive groundwater management within the County and within the service areas of each water purveyor. The Plan will be implemented in three phases. The first phase of the Plan focuses on passive activities such as monitoring, special studies, and education, and is primarily geared towards improving the understanding of the local groundwater resources. The District may undertake passive monitoring, study, and education activities within areas served by public and private purveyors who are signatories to the Plan or are potential signatories to the Plan. Other phases of the Plan that focus more on active management of the groundwater may only become effective within the service area of a local agency water purveyor, a water corporation regulated by the Public Utilities Commission, or a mutual water company, upon the District's receipt of a written request from the purveyor to the District to adopt the Plan within the purveyor service area or under the terms and conditions of an agreement, contract, memorandum of understanding or other written instrument acceptable to the District and the affected water purveyor. Nothing herein shall be construed as an intention for the District to unilaterally impose this Plan within the service area of an affected water purveyor.

2

Study Area

Description of District

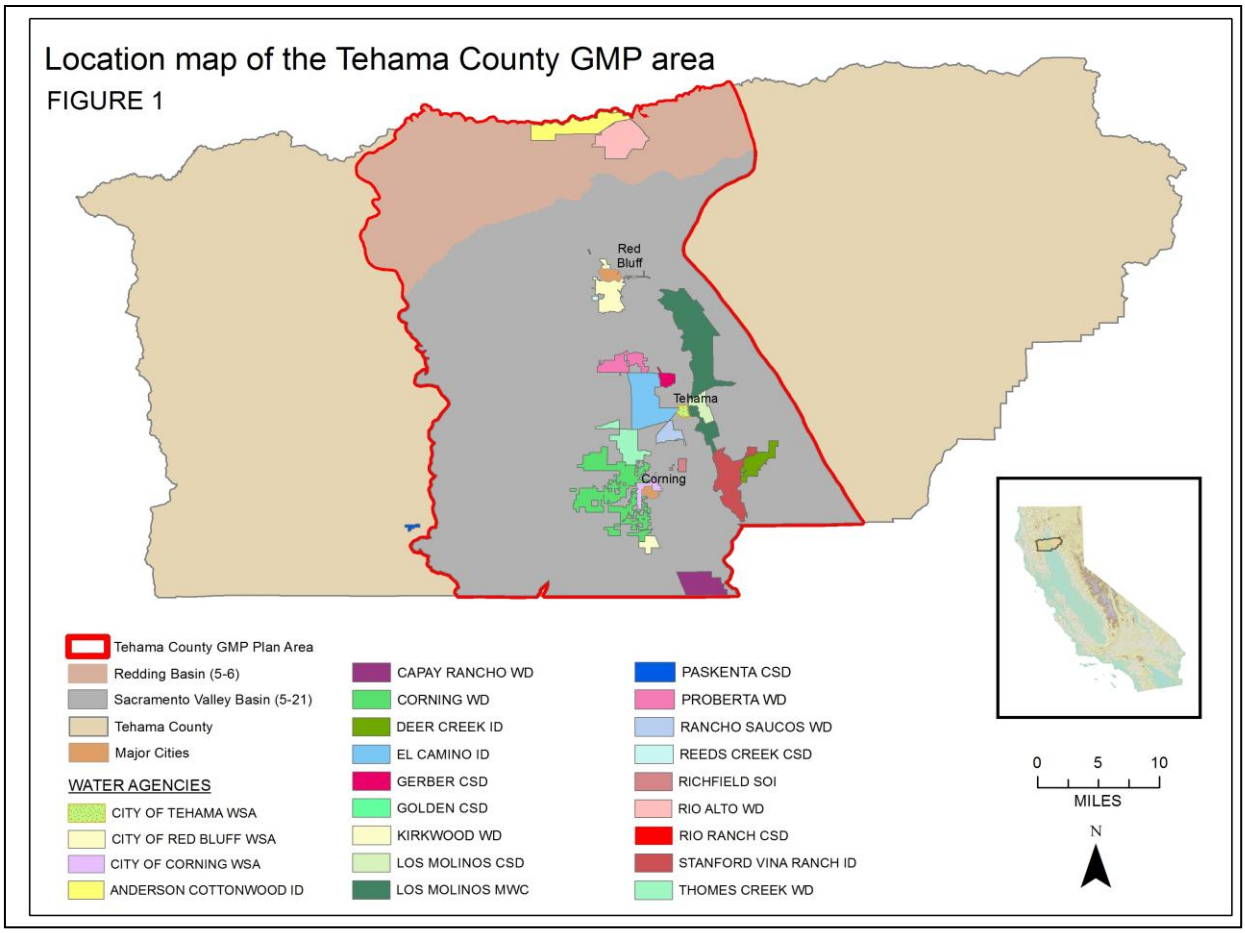
Section 201. As previously noted, the Plan will be administered by the Tehama County Flood Control and Water Conservation District. The district was established in 1957 by the Tehama County Flood Control and Water Conservation District Act. This Act defined the boundary and territory of the district as follows: "all that territory of the County of Tehama lying within the exterior boundaries thereof".

Section 202. For the purposes of carrying out the goals and objectives established herein, the boundaries of the Plan area include all of the territory of the County of Tehama lying within the exterior boundaries thereof, to the extent permitted by Water Code sections 10750.7 and 10753. Any land outside of Tehama County is not included in this Plan.

Section 203. A map of the Plan area is included herein as Figure 1. The Plan area is limited to the valley floor of Tehama County where the majority of groundwater extraction occurs. The Plan boundaries coincide with those defined in DWR Bulletin 118 for the Redding and Sacramento River Groundwater Basins. A more detailed description of the Plan area is provided in Sections 230-247.

Location

Section 204. Tehama County includes approximately 2976 square miles within the northern portion of the Central Valley of California. The County is bisected by the Sacramento River, and borders Shasta County to the north, Plumas and Butte Counties to the east, Glenn and Butte Counties to the south, and Mendocino and Trinity Counties to the west. The county seat is located in Red Bluff, which is also the largest city in Tehama County.



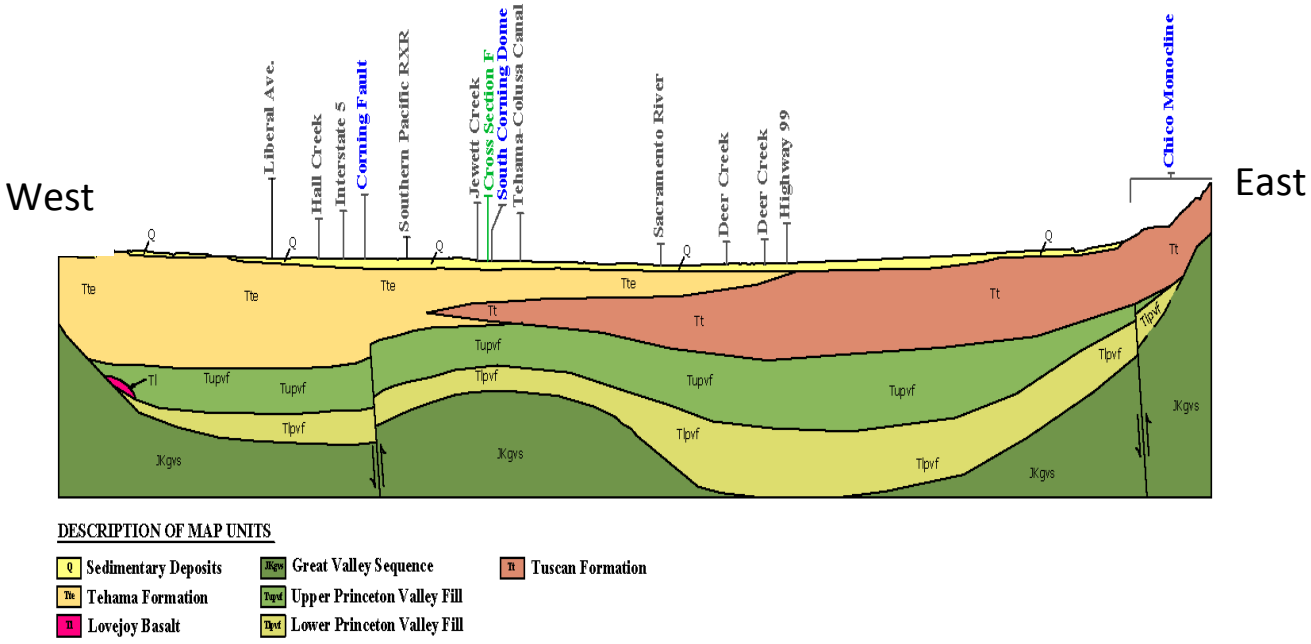
Physiography and Geology

Section 205. The physiography of Tehama County is one that has evolved, in large part, due to the erosive and meandering impact of surface stream flow. The County is bounded on the east by the dissected alluvial terraces which form the foothills of the Cascade Range. The low hills and dissected uplands of the Coast Range stretch for the length of the western County border. The interior of the County is characterized by stream channels, floodplains, and natural levees of the Sacramento River and its tributaries. Alluvial fans are also present near the confluence locations of tributaries with the Sacramento River.

Section 206. The geology of the Tehama County is complex. Beneath the valley floor, marine sediments form the basement of the study area, which acts as a structural trough. On top of this formation, subsequent deposits of mudflow-transported volcanic materials were laid, as well as stream-borne rock fragments from the surrounding mountains. These deposits occurred over a

period of time during which mountains on both sides of the valley were being uplifted and the valley floor was being deformed by tectonic forces. Thus, a great depth of this water-bearing material (between 1000 and 2000 feet deep) accumulated in the northern Sacramento Valley. Refer to Appendix D-2 for further information. Figure 2 shows an idealized depiction of a typical geologic cross-section for Tehama County. Figure 3 also summarizes the geologic ages and the stratigraphic units within Tehama County.

Figure 2. Generalized Geologic Cross-section of Sacramento River Valley
Source: DWR, Northern Region, 2011.



Section 207. The oldest rock unit exposed in the Plan area is the Upper Cretaceous Chico Formation, which is an upper unit within the Great valley Sequence. The Chico Formation consists of sandstone, conglomerate and shale, which are of marine origin. This formation is approximately 2000 feet below the valley floor in the central portion of Tehama County. Groundwater in the Chico Formation is highly saline and unsuitable for either domestic or agricultural use.

Several formations overlie the Chico Formation. The depositional environments of these formations transition from marine to deltaic to non-marine (continental) sediment, moving

upward through the sequence. The Chico Formation and Lower Princeton Valley fill are composed of marine sediments. The Ione Formation is considered a deltaic formation, marking a transition from marine to non-marine depositional environments in the valley. Because the depositional environments for these formations are primarily marine and deltaic, the groundwater quality in these formations is saline to brackish. The Upper Princeton Valley fill is non-marine and is generally considered to mark the base of the fresh groundwater in most areas of the valley. The groundwater quality improves moving upward as the formations become more non-marine.

Section 208. In eastern Tehama County, the marine and transitional marine formations are overlain by the Pliocene Tuscan Formation. The Tuscan Formation consists of pyroclastic and sedimentary rocks primarily deposited by volcanic mudflows. The Tuscan Formation can be seen in surface exposures along the eastern side of the valley and is found under more recent sediments in the subsurface of the valley approximately as far west as Interstate 5 in some locations. The Tuscan Formation is believed to be up to 1000 feet thick in the subsurface of the valley. The Tuscan Formation is a major fresh water-bearing geologic formation.

Section 209. In western Tehama County (west of Interstate 5), the marine and transitional marine formations are overlain by the Tehama Formation. The Tehama Formation was formed from material eroding off of the uplifting Coast Range Mountains. These sediments consist of sand, gravel and clay which were deposited by the ancestral Sacramento River and its west-slope tributary streams. While parts of the Tehama Formation appear to be younger than the Tuscan Formation, fingers of the two formations are inter-layered beneath the central valley floor, which indicates that portions of the two formations are equivalent in age. It is exposed on the west side of the Sacramento Valley and can be found beneath the Sacramento Valley at a depth ranging from the ground surface to 1000 feet or more. Fresh groundwater suitable for domestic and agriculture use is extracted from wells in this formation. The Tehama Formation extends south beyond Glenn, Colusa, and Yolo Counties and north into Shasta County.

Section 210. The floodplains along the Sacramento River and its tributaries consist of alluvial deposits. These flood-deposited materials are layers of gravel, sand, silt, and clay which overly the Tuscan and Tehama Formations. These alluvial deposits are the uppermost groundwater bearing formations in Tehama County. They begin at ground surface and reach to depths of between 50 and 200 feet. Many domestic wells draw water from these formations.

These alluvial deposits are comprised of four different formations based on geologic material, location and age of the geologic material, and the different rates each of the subgroups yield groundwater. The subgroups include the Recent Alluvium, the Modesto and Riverbank Formations, and the Basin deposits.

Gravel outcrops along Thomes and Cottonwood Creeks are examples of Recent Alluvium. This formation is typically less than 50 feet thick and groundwater in the formation is directly influenced by creeks and the river.

The Modesto Formation consists of gravel, sand, silt and clay deposited just beyond the creek and river banks. This formation often borders existing streams on both sides of the Sacramento River. The Modesto Formation underlies much of the farmland in the Los Molinos and Dairyville areas and is, at most, 100 feet thick in some areas.

The Riverbank Formation is composed of older gravel, sand, and silt deposited mainly on the west side of the Sacramento River. The Riverbank Formation is typically found on higher elevation terraces and extends up many of the westside drainages including Thomes, Elder, Oat, and Cottonwood Creeks.

Red Bluff Formation is a relatively thin (15-20 feet thick) formation of red gravel that contains minor amounts of stratified sand and silt. Red Bluff deposits located west of the Sacramento River were derived from metamorphic rocks originating from the Coast Range and Klamath Mountains. The Red Bluff Formation found east of the River was derived from lava flows from the Cascade mountains.

Basin deposits consist of finer clay deposits and do not yield groundwater as readily as the other formations. Basin deposits are not common in Tehama County.

Section 211. Additional references on the physiography and geology of Tehama County can be viewed in Appendix D-2 of this Plan.

Figure 3 – Geologic Ages and Nomenclature of Stratigraphic Units within Tehama County.

ERA	PERIOD		EPOCH	GEOLOGIC FORMATIONS
Cenozoic	Quaternary		Holocene	Recent Alluvium, Stream Channel and Basin Deposits
			Pleistocene	Modesto Formation
				Riverbank Formation
				Red Bluff Formation
	Tertiary	Neogene	Pliocene	Tehama and Tuscan Formations including Nomlaki Tuff
			Miocene	Upper Princeton Valley fill and Lovejoy Basalt
		Paleogene	Oligocene	Period of exposure and erosion of surface topography
			Eocene	Ione Formation, Lower Princeton Valley fill
			Paleocene	Period of carving submarine canyons
Mesozoic	Cretaceous			Great Valley Sequence including Chico Formation

Climate

Section 212. Tehama County exhibits a wide range of temperature and precipitation due to the relatively large elevation difference between the valley floor and the highlands in the extreme eastern and western portions of the County. Figure 4 shows the geographic distribution of precipitation in the county.

Section 213. Using temperature data from Red Bluff as those representing typical valley floor climate parameters, it is apparent that valley lands experience hot and dry summers and mild winters. Typical temperatures in the Red Bluff area during January and July are summarized in Table 2-1, below.

Figure 4. Geographic distribution of annual average precipitation in Tehama County California. Source: Appendix D-1, reference #20.

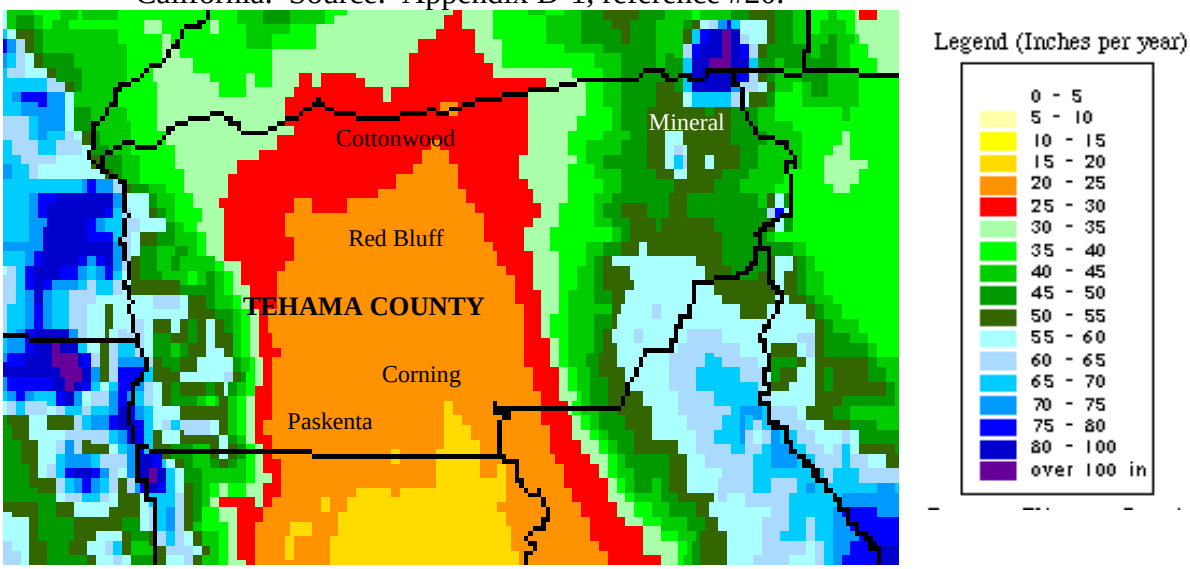


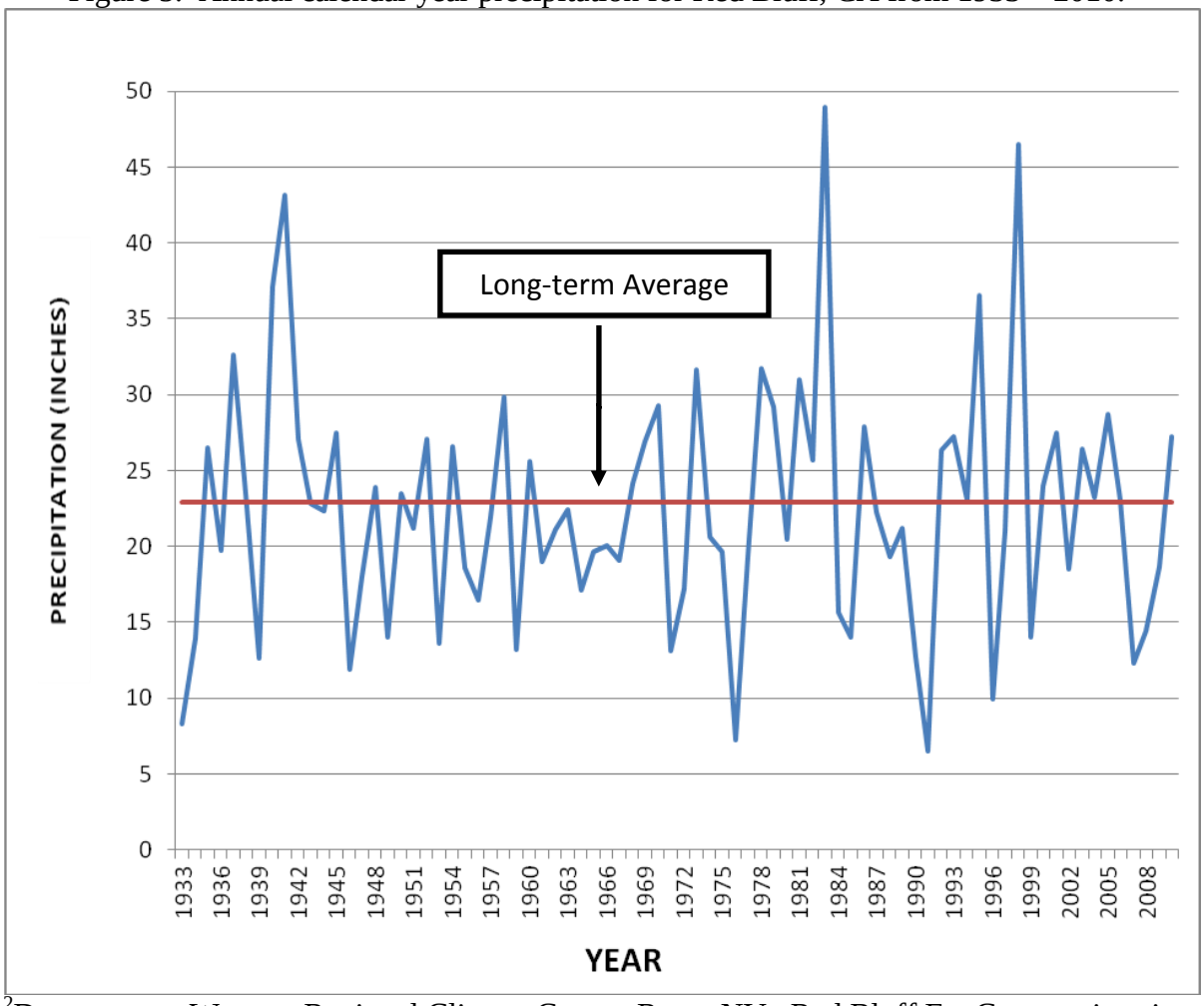
Table 2-1 Average Daily Temperatures. Red Bluff, California. 1933-2010[1]

Red Bluff (Month)	Normal Daily Max Temperature (F)	Normal Daily Mean Temperature (F)	Normal Daily Min. Temperature (F)
January	55°	46°	37°
July	98°	82°	66°

[1]Data source: Western Regional Climate Center, Reno, NV. Red Bluff Fss Cooperative site. Official NCDC data (refer to Appendix D-1, reference #20).

Section 214. The major portion of annual precipitation at Red Bluff occurs from October through May; very little, if any, rainfall occurs between June and September. Average annual rainfall is approximately 23 inches, with a minimum annual total of 7.2 inches (1976-77) and a maximum annual total of 49 inches (1982-83). Figure 5 provides a graphic illustration of long-term precipitation patterns for Red Bluff. Figure 5 illustrates the wide variation in annual precipitation levels that exist in Tehama County.

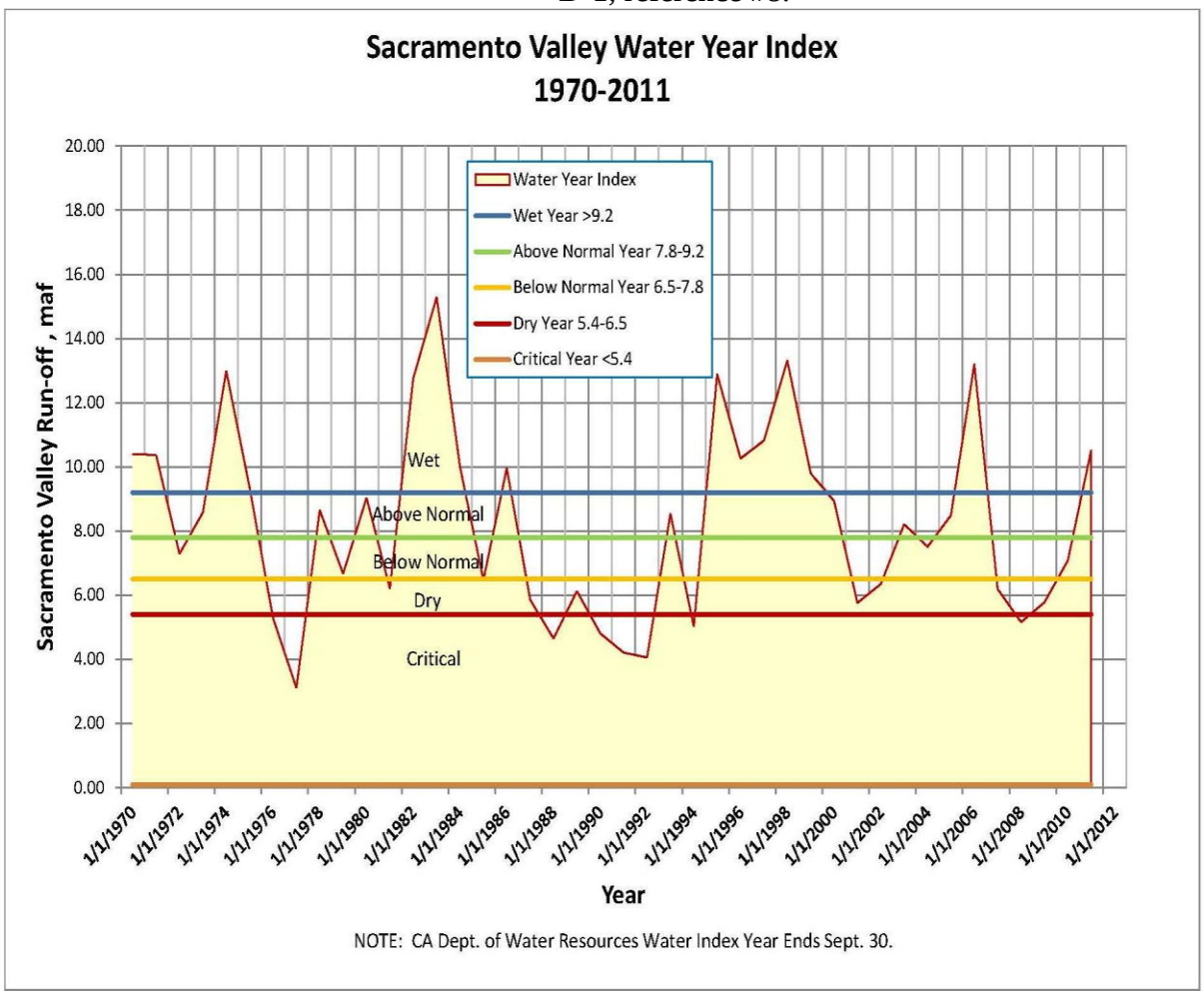
Figure 5. Annual calendar year precipitation for Red Bluff, CA from 1933 – 2010.[2]



[2]Data source: Western Regional Climate Center, Reno, NV. Red Bluff Fss Cooperative site (refer to Appendix D-1, reference #20).

Section 215. Figure 6 provides a graphic of the Sacramento Valley Water Year Index. This index was developed to track and understand the influence of precipitation on wet, normal, and dry year water supply conditions. Further information on the index is referenced in Appendix D-1, reference #8.

Figure 6. Historic Record of the Sacramento Valley Water Year Index. Source: Appendix D-1, reference #8.



Section 216. Class "A" pan evaporation has historically averaged 67 inches annually in Tehama County, of which 77 percent occurs between April and September. Evaporation is highest during June and July. Since 1982, measurements of grass reference evapotranspiration (ETo) have replaced pan evaporation as an indicator of evaporative demand (Appendix D-1, #4). ETo is a measure of the quantity of water evaporated and transpired by an actively growing and maintained grass pasture or turf that is not limited by soil moisture. ETo has replaced pan evaporation because the measurement more closely correlates with irrigated crops and urban landscapes and because the measurement stations are more efficient to maintain and acquire reliable data. ETo data for Tehama County is acquired from Station #8 near Gerber, CA which is part of the statewide California Irrigation Management Information System (CIMIS) supported by the California Department of Water Resources. Annual ETo in Tehama County averages 55 inches which is less than the evaporation measured from the free water surface of a Class A pan. Similar trends were apparent though, 76 percent of the total ETo occurred between April and September and evapotranspiration is highest in June and July.

Population

Section 217. Long term population growth rates in Tehama County have been relatively uniform since World War II. Population projections for Tehama County made by the California State Department of Finance also predict continued growth, especially in the Red Bluff urban area. Table 2-2 represents the past and projected population of Tehama County for the years 1900 to 2050.

Table 2-2. Historic and Projected Population, Tehama County, California, **1900-2050.**[3,4]

Year	Population	Year	Population
1900	11,000	1995	54,689
1940	14,316	2000	56,519
1950	19,276	2005	60,165
1960	25,305	2008	62,836
1970	29,517	2010	63,848
1980	38,900	2015	69,374
1985	44,325	2025	79,698
1990	46,600	2050	111,776

[3] Source: Population estimates between 1900 and 2008 acquired from California Department of Finance and the U.S. Census Bureau (refer to Appendix D-1, citations #2 and #18).

[4] Source: Population estimate for 2010 and projected to 2050 are based upon California Department of Finance's overall anticipated growth rate for the incorporated and unincorporated areas of Tehama County of 1.61 percent annually. This data is consistent with the population growth information developed for the 2008 Update of the General Plan for Tehama County (refer to Appendix D-1, citation #17).

In 1996, when the Tehama County Groundwater Management Plan was first adopted, the population for Tehama County totaled 55,564 people with 36 percent (20,003 people) living within the city incorporated areas of Red Bluff, Tehama, and Corning and 64 percent (35,561 people) living in the unincorporated areas of the County. The Tehama County population totaled 61,550 in 2008. Approximately, 31.5 percent of the population (21,610 people) lived in the city incorporated areas of Red Bluff, Tehama, and Corning. In 2008, approximately 68.5 percent of the population (39,940 people) lived in the unincorporated areas of Tehama County. This represents a continued shift in population distribution from city incorporated to rural areas of Tehama County.

The 2008 General Plan Update for Tehama County recognizes this shift by identifying specific planning areas:

- North I-5 Corridor Planning Area – the north central portion of Tehama County along I-5 including the City of Red Bluff, the Lake California Community, the unincorporated Bowman area, and extends to the Shasta County line.

- Central I-5 Corridor Planning Area – generally located south of Red Bluff and north of Corning and paralleling I-5, Highway 99 E, the Sacramento River, and Highway 99 W. Area includes the unincorporated areas of Proberta, Gerber, El Camino, Dairyville, and Los Molinos.

- South I-5 Corridor Planning Area – includes the incorporated City of Corning and unincorporated areas of Richfield and Vina and extends to the Butte and Glenn County boundaries.

- East Planning Area – eastern portion of the county including the unincorporated communities of Manton, Mineral, Paynes Creek, and Ponderosa Sky Ranch.

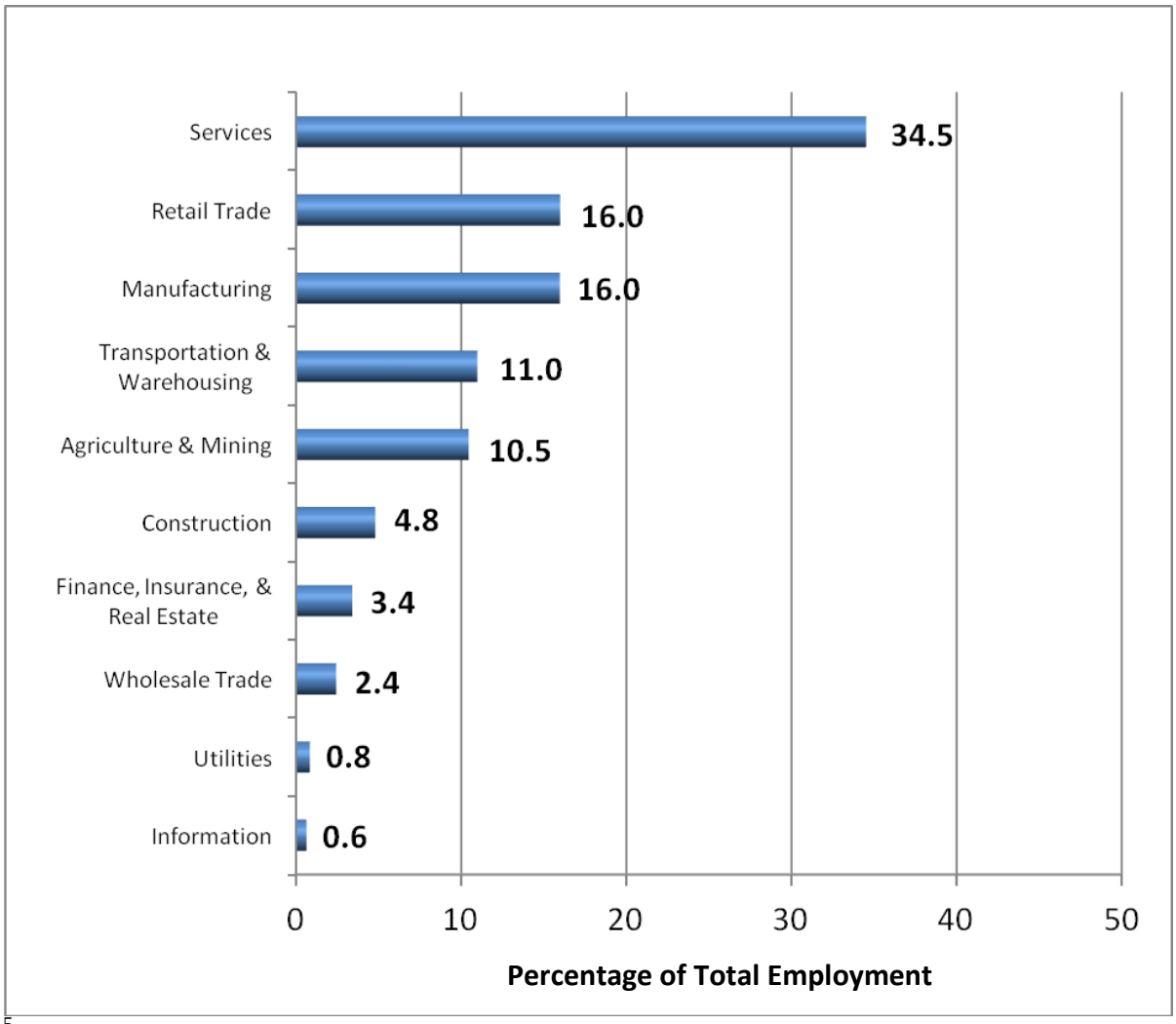
- West County Planning Area – western portion of Tehama County including Paskenta, Flournoy, Henleyville, and Rancho Tehama.

Economy

Section 218. The economy of Tehama County is directly tied to the use of water. In 2003, the annual average water demand in Tehama County was 378,200 acre-feet. Agriculture accounted for 82 percent of the annual water demand and this remains a reliable estimate at the time of this update. In 2009, over $180 million of gross revenues were generated by agriculture in Tehama County. Approximately 43,000 acres of harvested nut and fruit crops contributed 70 percent of this total revenue. An additional 35,000 acres of irrigated pasture for beef production, irrigated alfalfa and forage crops for dairy production, row and vegetable crops, and other specialty commodities contributed to the total agricultural revenue. In 2009, the timber industry achieved over $55 million of gross revenue for Tehama County.

Figure 7 provides an indication of job-type distribution in Tehama County in 2008. In addition to the agriculture and timber industries, service and retail trades, manufacturing, transportation and warehousing, and construction and other industries and trades have provided significant employment opportunities and generated revenue in Tehama County. In 2007, total taxable retail sales attained over $732 million and total construction permit value reached nearly $73 million.

Figure 7. Types and percentage distribution of the total employment in Tehama County in 2008[5].



[5] Source: Tehama County Business Attraction and Retention Program Analysis. 2009. Tehama County Department of Planning (refer to Appendix D-1, citation #15).

Local Interest and Development of the Groundwater Management Plan

Section 219. In 1990, Tehama County Flood Control and Water Conservation District personnel began working with part-time consultants and a volunteer Tehama County Water Task Force to develop a County Master Water Plan. While the participants understood that a total water management plan must incorporate surface water, groundwater and their conjunctive management, the move toward development of a groundwater plan was given priority because of the high degree of local interest in groundwater resources. As of 2011, a County Master Water Plan that incorporates multiple facets of water resource management has not been developed. Instead, emphasis has been placed on developing and implementing a county-wide groundwater management plan. This Plan is an important first step towards a County Master Water Plan since approximately 69 percent of Tehama County's present annual water demand is supplied by groundwater.

Section 220. Local interests in groundwater planning and management energized in 1992, in response to the perceived threat of wholesale groundwater export from the county. The Tehama County Board of Supervisors' enacted Urgency Ordinances No. 1552 and No. 1553. The effect of these ordinances essentially prohibited the extraction of groundwater for off-parcel use without a permit granted by the Board, subject to certain restrictions and limitations. These ordinances were a temporary measure, and contained a sunset clause allowing them to remain in effect until February 28, 1994. Prior to their expiration, in January 1994, Ordinances No. 1552 and No. 1553 were replaced by Ordinance No. 1617, which simply removed the sunset clauses in Ordinances 1552 and 1553. Although challenged in the courts, Ordinance No. 1617 was upheld on appeal and is currently in effect.

Section 221. In April 1992, the formation of a Groundwater Management District Study Committee by the Board of Supervisors further focused local interest on groundwater management issues. The committee focused its initial attention on Senate Bill 867 which would establish a Glenn County Groundwater Management District, with a possible amendment addressing a Tehama County Groundwater Management District. However, SB867 was not enacted because it was vetoed by Governor Pete Wilson in late 1992. Additionally, in late 1992, alternative AB3030 legislation was signed into law, allowing agencies similar to the Tehama County Flood Control and Water Conservation District to develop and administer groundwater management plans and actions, in addition to their existing authority under other provisions of law.

- In 1993, the Tehama County Water Task Force completed the "Report of the Groundwater Committee", summarizing groundwater law, discussing area of origin issues, groundwater management options per AB3030, and explaining how the Tehama County Flood Control and Water Conservation District is well-suited to develop and implement an AB3030 plan. The committee's discussion of groundwater law was subsequently expanded and supplemented, as set forth in Appendix "A-1", "Legal Discussion: Issue Focus".

- In early 1994, the Tehama County Board of Supervisors passed Resolution 15-94, which formally "accepted" the "Report of the Groundwater Committee." However, as stated in the conclusion of the report itself "The concepts summarized in this section of the report are only intended as a guide for the eventual preparation of a Groundwater Management Plan for Tehama County. In no way do they represent the plan itself." Resolution 15-94 stated that the report "be considered, among other things, during the course of the District's anticipated deliberations regarding a groundwater management plan." The non-binding, guidance-oriented nature of these two documents is reflected in the preparation of the Coordinated AB3030 Groundwater Management Plan adopted in 1996 and this update.

- In 1994 the Tehama County Flood Control and Water Conservation District employed a full-time professional water resources engineer and retained an attorney specializing in water law to develop a countywide groundwater management plan for the Board's consideration. In November 1996, the Tehama County Flood Control and Water Conservation District adopted a Coordinated AB3030 Groundwater Management Plan after significant public input.

Key accomplishments since the Plan's adoption are listed below:

- In 1996 bylaws were prepared to guide the development and appointment of a Tehama County Groundwater Management Plan Advisory Group, refer to Appendix A in Plan. The group's title was subsequently amended to the Technical Advisory Committee (TAC).

- In 1998, a Memorandum of Understanding (MOU) to address Groundwater Basin Management in Tehama County was developed for use by the Tehama County Flood Control and Water Conservation District and interested local agencies and parties in the County who desire to partner in the Plan. Refer to Appendix B-1 to view an example MOU that was signed between the District and a local agency in 2004.

- In 1998 nine members were appointed to the Technical Advisory Committee (TAC). Members are nominated through a public process and represent a broad cross-section of interests, serve a three year term, and provide external review and guidance in implementing the Plan.

- Between 1998-2012 the District established a network of monitoring wells throughout Tehama County to monitor groundwater levels and/or groundwater quality. This effort is still in progress.

- In 2003 a Water Inventory and Analysis was completed to aid in the understanding of past, present, and future water needs in the county. It considered the effect of wet, normal, and dry years on water demand and supply which may be influenced by the prospects of climate change. See Appendix D-1, reference #16 for more information.

- In 2004 a Small Water Systems Drought Vulnerability Assessment was completed. See Appendix D-2 for more information.

- Between 2004–2011 the District constructed dedicated multi-completion groundwater monitoring wells in high priority groundwater sub-basins. Priority was placed on areas where either declining groundwater levels are of concern or where growth and land development is anticipated. Additional monitoring wells are needed and will be added as funding is available.

- In 2005 Tehama County signed a Four County Memorandum of Understanding (MOU) with Butte, Glenn, and Colusa Counties. These counties share common surface water and groundwater resources. Based on these common resources, local water resource managers understand that regular coordination, collaboration, and communication can result in an improved water resource understanding at both the county and regional level. This document established a mutual understanding among the four counties to work towards regional coordination, collaboration, and communication in managing these water resources. Refer to appendix B-4 in this Plan for a copy of the Four County MOU.

- In 2005-07 the Tehama County Flood Control and Water Conservation District worked cooperatively with the U.S. Geological Survey and the U.S. Department of Interior to support the collection of groundwater quality data in Tehama County as part of the California Groundwater Ambient Monitoring Assessment (GAMA) Program. See reference #16 for additional information.

- In 2007, the District supported development of the Basin Management Objective Information Center (BMOIC). It is a web based system where the counties of Butte, Glenn, Tehama, and Colusa have worked jointly to develop. Oversight of the center is provided by the Butte County Department of Water and Resource Conservation. It is an interactive website that maintains a database of Key Wells, historic hydrographs, associated Alert Levels or Basin Management Objectives for each key well, and enables public access to them. Refer to citation #14 in Appendix D-1 for more information.

- In 2008 the Tehama County Flood Control and Water Conservation District collaborated in the Sacramento Valley Subsidence Project. A network of surface elevation benchmarks were established across the valley floor of Tehama County to monitor potential land subsidence associated with groundwater extraction. Refer to citation #11 in Appendix D-1 for additional information on the Sacramento Valley Subsidence Project.

- In 2009 District staff and the Technical Advisory Committee worked with a part-time consultant to analyze more than four decades of groundwater level monitoring information throughout the county to define potential Alert levels and awareness actions (i.e., basin management objectives) for the Tehama County Sub-basins. This effort implemented SB1938, which became law in September 2002. The legislation amended Water Code, Sections 10753.4, 10753.7, 10753.8, 10753.9, 10795.4, and created new Sections 10753.1 and 10753.7 relating to groundwater management.

- In 2009 the District initiated a groundwater recharge feasibility study for Tehama County. The study was approved by the Board in June 2011. The study provides guidance on how and where to pursue active groundwater recharge projects, if the District deems it necessary.

- In 2011 the District and Technical Advisory Committee reviewed and recommended updates to the bylaws that guide the Tehama County Technical Advisory Committee. Key revisions include adding a tenth committee member to represent the incorporated city of Tehama and a provision for alternate, voting representation when an appointed committee member is unable to attend a meeting. The by-laws were approved by the District Board in 2011 and provided in Appendix B-2.

- In 2011 District staff and the Technical Advisory Committee began evaluating well log construction data within each groundwater sub-basin in relation to the Alert levels. This assessment is expected to provide a clearer understanding of the construction features of the groundwater well infrastructure in each sub-basin and provide additional insight into

the application of Alert levels for managing and protecting the groundwater resources in the future. See reference #16 in Appendix D-1 for more information.

- In 2011 the Four County MOU (formed in 2005) expanded to six counties with the addition of Shasta and Sutter Counties. Under the Six County MOU, Tehama County entered into the formation of the Northern Sacramento Valley Integrated Regional Water Management group (NSV IRWM) to engage in a region-wide water resources planning effort during 2012 and 2013. This two-year regional planning process will provide the framework for the NSV IRWM to pursue implementation of specific water resource management projects in the region over the long-term. The MOU to form the NSV IRWM is shown in Appendix B-4.

List of Participants

Section 222: A major portion of the water demand in Tehama County is supplied by groundwater but independent pumpers do not have an organized association that represents them. It is important that domestic, agricultural, municipal, and industrial pumpers become engaged in the county-wide Plan by participating in various rural and civic organizations and the various Tehama County water agencies. Table 2-3 denotes key Tehama County rural organizations that helped acquire input from private pumpers during the initial development of the county Plan in 1996.

Table 2-3. Tehama County Rural Organizations

Organization
Deer Creek Watershed Conservancy
Mill Creek Conservancy
Sacramento Valley Landowners Association
Shasta-Tehama Bioregional Council
Tehama County Cattlemen's Assoc.
Tehama County Farm Bureau
Tehama County RCD
Vina Resource Conservation District
University of California Cooperative Extension (Farm Advisors Office)
Tehama County Taxpayers Assoc.

Section 223. In addition to the above stakeholders, during development of the original Plan in 1996, key civic groups were contacted for their input as noted in Table 2-4. These groups (and their successors) will continue to be kept informed as the Plan is further implemented. As new civic groups are identified they will be encouraged to participate.

Table 2-4. Tehama County Civic Organizations.

Organization
Red Bluff Chamber of Commerce
Los Molinos Chamber of Commerce
Corning Chamber of Commerce
Tehama Local Development Corp.

Section 224. A key component of a groundwater management plan prepared under Water Code Section 10750 is the coordination between the Tehama County Flood Control and Water Conservation District and other water-related districts and agencies within Tehama County. Table 2-5 is a list of the institutions that were approached by the District during the development of the groundwater management plan in 1996 and that need to be involved in the future.

Table 2-5. Tehama County Water Agencies

Water Agency	**Water Agency**		
Anderson Cottonwood Irrigation District	Proberta Water District		
Capay Rancho Water District	Rancho Saucos Water District		
Corning Water District	Reeds Creek Estates Community Services District		
Deer Creek Irrigation District	Richfield Irrigation District		
El Camino Irrigation District	Rio Alto Water District		
Gerber-Las Flores CSD	Rio Ranch Estates Community Services District		
Golden Meadows Estates CSD	Stanford-Vina Irrigation Company		
Kirkwood Water District	Thomes Creek Water District		
Los Molinos CSD	City of Corning		
Los Molinos Mutual Water Co.	City of Red Bluff		
Paskenta Community Services District	City of Tehama		

Some additional agencies, districts, and groups that have been identified for future involvement as the Plan progresses include:

- Battle Creek Watershed Conservancy
- Sky View County Water District
- Rancho Tehama Association
- Nine Mile Hill Water District (and other districts formed to serve the proposed Sun City Tehama development)
- Surrey Village Water Company Inc.
- Unincorporated area of Manton
- R Wild Horse Ranch

Legal, Financial and Political Considerations

Section 225. In Tehama County, as in other parts of California, water resources management is dictated by a complex system of local, state and federal laws. Water use, development and allocation are controlled by legal contracts and agreements, common law principles, statutes, constitutional provisions and court decisions. These legal considerations, in combination with the jurisdictional powers of the various governing agencies and the private property rights of groundwater users, form the framework which governs water resources management in Tehama County.

Section 226. A more thorough overview of the institutional framework for water resource management in California is provided in Chapter 2 of The California Water Plan Update (DWR Bulletin 160-93). A discussion of the key constitutional requirements, statutes, court decisions and agreements that impact Tehama County water resources management are discussed in "Report of Groundwater Subcommittee to Tehama County Water Task Force", 1993. The 1996 supplement to this report containing an expanded discussion of groundwater law is included herein as Appendix A-1.

Section 227. The Tehama County Flood Control and Water Conservation District may periodically adopt rules and regulations to implement provisions of the groundwater management plan. All rules and regulations shall be reasonable and established in a manner that is consistent with District authority. In accordance with California Water Code 10753.9 and 10753.10 such rules and regulations shall not make binding determinations on water rights; shall not be construed to limit or suspend extractions unless through study and investigation it has been determined that groundwater replenishment and other alternative sources of water supply have proved insufficient or infeasible to lessen demand for groundwater; and shall to the extent practicable and consistent with the protection of the groundwater resources, minimize any adverse impacts on business activities, including agricultural operations. Refer to citation #12 in Appendix D-1 to view California Water Code on groundwater.

The unincorporated areas of the County are also subject to the provisions of Chapter 9.40 of the Tehama County Code ("Aquifer Protection") (enacted by Ordinance No. 1617 in 1997). See reference #13 in Appendix D-1 to view Tehama County Code on groundwater.

Section 228. Pursuant to Water Code section 10754, the Tehama County Flood Control and Water Conservation District may levy fees and collect assessments in order to finance groundwater management expenses, such as administrative and operating costs, acquisition of replenishment water, and basin studies. As stated in section 10754.3 of California Water Code, fees adopted under the authority of AB3030 must be authorized by a majority of vote

in a county-wide election, in addition to any applicable approval requirements of Proposition 218 (1996) and Proposition 26 (2010).

Section 229. The Plan adopted in 1996 involved three phases: Phase I – Passive Management; Phase II – An extension and expansion of Phase I activities; and Phase III – Long-term management intensive activities. To date Phase I activities have been the main focus. Activities have been non-intervening and focus on water level and water quality monitoring, coordination among agencies and interested parties, development of data inventory and evaluation, interaction with the Technical Advisory Committee, annual reporting, and promotion and education of groundwater resource management. Consistent with Phase I passive activity goals the District has not proposed the establishment of a fee structure. The current MOU between the District and the signatory parties to the Plan is founded on the understanding that the current implementation is focused on Phase I activities where fees will not be imposed (Appendix B-1). If the Plan were to advance beyond Phase I activities to the extent that fees become critical, an amendment to the MOU would be necessary to address the imposition and collection of fees within the respective service areas of the signatory parities.

Condition of the Groundwater Basin

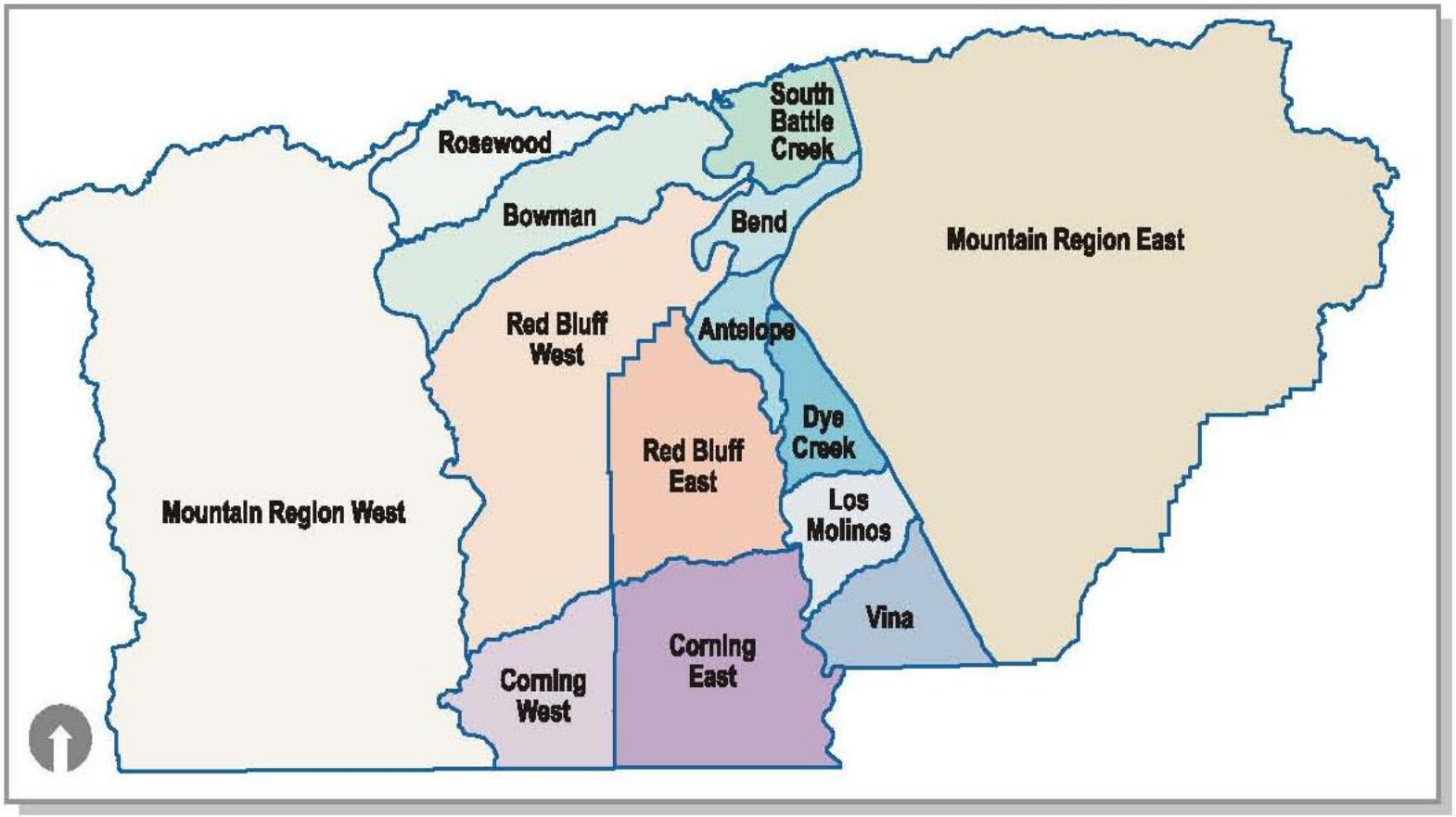
Tehama County Groundwater Basins, Sub-basins and Areas:

Section 230. The California Department of Water Resources has mapped the groundwater basins and area boundaries throughout California. The central portion of Tehama County is underlain by the Sacramento Valley Groundwater Basin. In Bulletin 118, DWR has further sub-divided the overall basin into smaller groundwater sub-basins, several of which are contained within County limits. The northern portion of the County is underlain by the Redding Groundwater Basin, of which three sub-basins fall within the limits of the County borders.

Section 231. The boundaries of the Sacramento Valley and Redding Groundwater Basins roughly approximate the eastern and western edges of the valley floor. The foothill areas constitute the eastern and western portions of Tehama County and are designated as "Mountain" areas, which are noted for their relative lack of groundwater resources.

Section 232. Figure 8 depicts the various groundwater sub-basins and mountain areas of Tehama County. These areas are discussed in further detail below.

Figure 8. Groundwater Sub-basins in Tehama County with East and West Inventory Units shown for the Red Bluff and Corning Sub-basins. Refer to Appendix D-1, citation #5 for additional information.



Redding Groundwater Basin

Section 233. The Rosewood Sub-basin underlies the northwestern corner of the Redding Groundwater Basin within Tehama County. This sub-basin is situated between the middle fork of Cottonwood Creek and the South Fork of Cottonwood Creek, each stream of which acts as a hydraulic boundary for the unconfined aquifer in the sub-basin. The pre-Tertiary rocks which form the western boundary of this sub-basin are assumed to behave as a no-flow boundary.

Section 234. The Bowman Sub-basin is directly south of the Rosewood Sub-basin and is bounded on the north by the South Fork of Cottonwood Creek, on the east by the Sacramento River, on the south by the Red Bluff Arch (a possible geologic no-flow boundary) and on the west by the pre-Tertiary rocks (assumed no-flow boundary).

Section 235. The South Battle Creek Sub-basin is bounded on the north by Battle Creek, on the east by a chain of cinder cones and associated faults, on the south by the Red Bluff Arch and on the west by the Sacramento River.

Sacramento Groundwater Basin

Section 236. The Red Bluff Sub-basin is bounded on the north by the Red Bluff Arch, on the east by the Sacramento River, on the south by Thomes Creek (a groundwater recharge area) and on the west by pre-Tertiary rocks.

Figure 8 shows that the Red Bluff Sub-basin is divided into east and west units. The Red Bluff East Unit is irregularly shaped and bordered by Thomes Creek on the south and the Sacramento River on the east. It extends to the northern limits of the City of Red Bluff and west beyond Paskenta Road. The Red Bluff East Unit includes the more intensely developed areas of the Red Bluff Sub-basin. This includes the Cities of Red Bluff and Tehama, several community service and irrigation districts, and farmlands irrigated with groundwater.

The Red Bluff West Unit is an irregularly shaped area about twice the size of the Red Bluff East Unit. Its southern boundary is also Thomes Creek and its eastern boundary begins west of Paskenta Road. It extends north of Red Bluff towards the Bowman area and west into the foot hills. The Red Bluff West Unit encompasses the community of Rancho Tehama and less intensely developed lands and water resources within the Red Bluff Sub-basin.

Section 237. The Corning Sub-basin is in the southwestern portion of Tehama County. It is bounded on the north by Thomes Creek and on the south by Stony Creek, on the east by the Sacramento River and on the west by pre-Tertiary rocks. Preliminary data suggests that groundwater flow in this area is southeasterly from Thomes Creek and northeasterly from Stony Creek towards the Sacramento River. Thus, the direction of groundwater flow roughly parallels the boundary line shared with Glenn County, which suggests that subsurface flow across the County line may be minimal in the alluvial deposits.

Figure 8 shows that the Corning East Sub-basin is divided into east and west units. The Corning East Unit is bordered by the Sacramento River to the east and by Thomes Creek to the north. It extends south to the Glenn County boundary and west to approximately Freeman School House Road. The Corning East Unit includes the more intensely developed areas of the Corning Sub-basin. This includes the City of Corning, the community of Richfield, three water districts, and farmlands irrigated with groundwater.

The Corning West Unit is also bordered on the north by Thomes Creek and extends south to the Glenn County line. Its eastern boundary begins approximately at Freeman School House Road and extends west into the foothills. The Corning West Unit generally encompasses less intensely developed lands and water resources within the Corning Sub-basin.

Section 238. The Vina Sub-basin is bounded on the north by Deer Creek (a groundwater recharge boundary), on the south by the Big Chico Creek/Little Chico Creek system, on the east by the Chico Monocline (a geologic structure), and on the west by the Sacramento River. Groundwater flow is westerly toward the Sacramento River. Again, the direction of groundwater flow roughly parallels the boundary line shared with Butte County, which suggests that subsurface flow across the County line may be minimal in the alluvial deposits.

Section 239. The Los Molinos Sub-basin is bounded on the north by Mill Creek and on the south by Deer Creek (both groundwater recharge boundaries), on the east by the Chico Monocline, and on the west by the Sacramento River. Groundwater flow is westerly from Mill and Deer Creeks toward the Sacramento River.

Section 240. The Dye Creek Sub-basin is bounded on the north by Antelope Creek, on the south by Mill Creek, on the east by the Chico Monocline, and on the west by the Sacramento River. Groundwater flow is westerly from Antelope and Mill Creeks toward the Sacramento River.

Section 241. The Antelope Sub-basin is bounded on the north by the low permeability mudflow deposits of the Tuscan Formation, on the south and west by the Sacramento River, and on the east by Antelope Creek. Groundwater flow moves in a southwesterly direction towards the river.

Section 242. The Bend Sub-basin is bounded on the north by the Red Bluff Arch, on the east and south by a chain of cinder cones and associated faults, and on the west by the Sacramento River. The boundary between the Bend and the Antelope sub-basins is not well-defined and is based on differences in topographic relief. Further study is needed to define this boundary.

Section 243. The Mountain Region West is the portion of Tehama County that is west of the Sacramento Valley Groundwater Basin. This area is underlain by pre-Tertiary rocks and contains very little groundwater. Any groundwater that does occur here is found in fractures at a relatively shallow depth.

Section 244. The Mountain Region East is bounded by the Tehama County line on the north, east and south. The western boundary is the Chico Monocline. The area is mostly underlain by volcanic rock, which yields water at shallow depths in fractured zones. Most of the area can yield only small domestic supplies, although limited municipal or irrigation supplies are possible in some areas.

Section 245. The Mountain Regions noted in Sections 243 and 244 are not considered to be "groundwater basins". However, these areas do contain groundwater in useable quantities. The groundwater occurs in the fractures or joints that constitute the secondary porosity of the rock (granitic, metamorphic, and some sedimentary rocks), in the interstices that constitute the primary porosity of sedimentary rocks, or in the primary porosity of small deposits of stream material, terraces, colluvium, or alluvium.

Section 246. The Colusa Sub-basin consists of 918,380 acres beginning in southern Tehama County and extending south through Glenn and Colusa Counties into Yolo County. Only a very small portion of the Colusa Sub-basin (approximately 1400 acres or 0.15 percent) exists in Tehama County near Black Butte Reservoir. For the purposes of this Plan, this small part of the Colusa Sub-basin has been incorporated into the Corning East and Corning West sub-basins.

Section 247. It must be noted that all sub-basin boundaries should be considered to be approximate. Key surface stream tributaries are generally assumed to behave as sub-basin boundaries, which may hold true for unconfined groundwater linked to these tributaries. However, for confined aquifers, the boundaries may not follow the sub-basin boundaries.. Boundaries related to geologic structure and topographic high areas must also be considered as preliminary in nature.

Existing Monitoring:

Section 251. Groundwater Level Monitoring.

The California Department of Water Resources, the United States Bureau of Reclamation, and the United States Geological Survey have been measuring groundwater levels in Tehama County since the 1920's. Some of the publications and reports related to these activities are cited in Appendices D-1 and D-2 of this Plan. Currently, the District and the California Department of Water Resources work jointly to monitor groundwater levels across a network of approximately 160 monitoring wells covering the valley floor. This network consists of domestic, irrigation, and dedicated groundwater monitoring wells in 10 of the 12 groundwater Sub-basins of Tehama County. Currently, there are no key wells in the South Battle Creek, the Bend, and the Corning West sub-basins of Tehama County. The District will seek to establish key wells in these sub-basins in the future.

Since 2004, seven dedicated, multi-completion groundwater monitoring wells have been constructed in high priority groundwater sub-basins: Corning East, Red Bluff East, and Bowman.

Their construction has primarily been funded by financial assistance from the Groundwater Management Act of 2000 (Water Code 10795). Priority was placed on these Sub-basins based on evidence of declining groundwater levels or where significant changes in land use and water demand were anticipated. These multi-completion monitoring wells enable groundwater level and water quality monitoring of specific geological formations and the corresponding aquifer systems (refer to Sections 205-211 of this Plan). This provides added understanding of the specific groundwater characteristics within each geological formation and information related to their connectivity.

In May 2009, a group of over 40 "Key Wells" was selected from this larger monitoring network by District staff and the TAC to initiate a groundwater elevation Alert Level and Awareness Action Program. In 2011, 47 key wells consisting of a combination of domestic, irrigation, and dedicated, multi-completion wells are included among these key wells. The monitoring in these key wells is described in greater details in Section 325 of this Plan under the discussion of "Alert Levels and Basin Management Objectives to Define Management Involvement". A subset of these key wells, or of the larger groundwater monitoring network in Tehama County, is typically used to monitor groundwater quality.

In December 2010, the District was recognized by the California Department of Water Resources as a "Groundwater Level Monitoring Entity" for Tehama County as part of the California Statewide Groundwater Elevation Measurement (CASGEM) Program, in accordance with SBX7 6 (2009) (Water Code sections 10920 et seq.). This legislation allowed and encouraged local agencies to assume responsibility for monitoring groundwater elevations. In 2011, the District submitted a groundwater level monitoring plan to DWR for their approval. A copy of the monitoring plan is provided in Appendix C-2. The plan proposes monitoring of the key wells denoted in Section 331, Figure 12. At the end of 2011, the District was approved as the monitoring entity for all of the sub-basins listed in the CASGEM Plan (refer to Appendix C-2). It is too early to know with certainty, but initiation of the CASGEM Program may signal future shifts in responsibility and costs for groundwater level monitoring from the state to local agencies, groundwater users, and interested parties

Section 252. Groundwater and Surface Water Interactions.

Groundwater and surface water have a natural, hydrological connection. Surface water is vital to recharging and sustaining groundwater for irrigation, domestic, and other beneficial uses. Conversely, groundwater extraction influences in-stream and river flows which are vital to anadromous fisheries, riparian ecosystems, and oak woodlands. This Plan recognizes these important interactions and is committed to monitor, understand, and manage these interactions.

In 2007, the District cooperated with the Butte County Department of Water and Resource Conservation to a support needs assessment related to the Tuscan Aquifer. The Tuscan aquifer is a primary source of groundwater for domestic, industrial, and irrigation uses for citizens of Butte and Tehama Counties living on the valley floor between the Cascade Mountains and Interstate 5. Numerous mountain streams in this area flow from the Cascade Mountains to the Sacramento

River and provide pristine habitat for fisheries and water supplies for riparian and oak woodland habitat as well as water for groundwater recharge and extraction. In 2010, the District partnered with Butte County to initiate technical studies to further investigate groundwater and surface water interactions. The investigations are ongoing and focus on several east side watersheds in Butte and Tehama Counties including Mill Creek and Deer Creek watersheds in Tehama County. Project reports are available to the public at the Butte County Department of Water and Resource Conservation web page. Refer to Appendix D-1, reference #1.

This investigation is providing experience with available methods to monitor groundwater-surface water interactions and will help to develop future monitoring protocols. The monitoring techniques include:

- Evaluation of soil infiltration properties of Tuscan outcroppings adjacent to the east side streams with double ring infiltrometers, soil particle size distribution, and soil profile evaluations;
- Development of discharge rating curves using routine stream gage measurements at two points per creek coupled with more intensive measurement of stream flow velocity and cross-sectional area of the stream using sonic water flow measurement technology.
- Evaluation of groundwater-surface water flow directions and interactions using continuous stream stage and temperature measurements of subterranean stream flows.

Section 253. Groundwater Quality Monitoring.

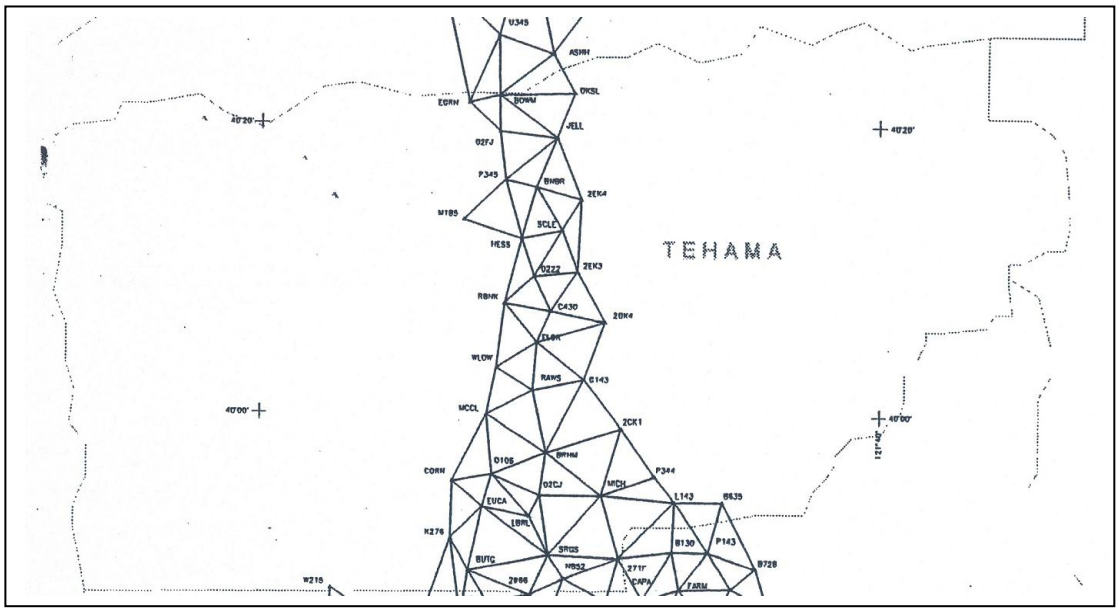
Monitoring groundwater quality is more expensive than monitoring groundwater levels due to the wide variety of inorganic, organic, biological, and physical water quality constituents that may be of interest and that require quantitative laboratory analysis to measure. Routine and in-depth groundwater quality monitoring by the District is cost prohibitive during implementation of Phase I of this Plan. To overcome this constraint, the District worked cooperatively with the U.S. Geological Survey the California State Water Resources Control Board, the California Department of Water Resources, the California Department of Public Health, and the U.S. Department of Interior between 2005-2007 to support the collection of groundwater quality data in Tehama County as part of the California Groundwater Ambient Monitoring Assessment (GAMA) Program. Groundwater was sampled from approximately 34 wells, ranging from about 200 to 500 deep, located throughout the county and analyzed for a broad range of inorganic, organic, biological, and physical constituents. An additional 223 shallow domestic wells, most less than 150 feet deep, primarily in the Red Bluff and Los Molinos areas were also sampled and analyzed for a wide variety of constituents.

Section 254. Land Subsidence Monitoring.

Surface land subsidence is another potential impact of groundwater extraction. It is too expensive and cost prohibitive to monitor during implementation of Phase I activities. In 2008, the District collaborated in the Sacramento Valley Subsidence Project. As part of this valley-wide effort, a total of 34 GPS land surface elevation benchmarks were established in Tehama

County. The benchmark stations are shown in Figure 9. They are distributed approximately 3 to 5 miles apart and provide a monitoring network covering the valley floor. This initial land surface elevation survey will be used to detect subsidence, if any, when compared with surface elevations obtained in future surveys.

Figure 9. Network diagram showing GPS benchmarks on the valley floor in Tehama County in 2008 (Source report cited in Appendix D-1, reference #11).



Section 255. Monitoring Frequency.

Currently groundwater level monitoring is conducted tri-annually in a cooperative effort between the District and DWR, Northern Region for approximately 160 monitoring wells in the Tehama County network. Groundwater levels are typically measured during March/April (Spring), July/August (Summer), and October/November (Fall). Spring measurements provide an indication of the groundwater level recovery near the conclusion of the winter/spring recharge season and before the more intense period of groundwater extraction begins. The mid-summer measurements indicate the groundwater levels when extraction is highest. Fall measurements provide an indication of the groundwater levels at the conclusion of the most intense extraction period and prior to recovery from precipitation. Automated dataloggers with pressure sensors are used to acquire continuous groundwater level measurements from the dedicated monitoring wells**.**

Groundwater quality in Tehama County has historically been of generally high quality and relatively stable over time. Given this trend and the high costs associated with monitoring groundwater quality, monitoring has not been conducted as frequently as groundwater level monitoring. The GAMA Program described previously in Section 252 was the most recent,

comprehensive groundwater quality monitoring effort in Tehama County and the other surrounding northern Sacramento Valley Counties. Currently, it is unknown if or when the GAMA program will be repeated or whether an alternative groundwater quality monitoring effort will occur. In the meantime, the District will continue to explore opportunities with various local, state, and federal agencies to leverage resources and achieve ongoing water quality monitoring at a reasonable frequency. One strategy has been to focus monitoring on specific beneficial uses, constituents, and sub-basins to help limit costs.

The Sacramento Valley Subsidence Project was described previously in Section 253. When it was completed in 2008, it was anticipated that land elevations would be measured approximately every 5 years at the benchmark locations as part of routine monitoring for subsidence in the Sacramento Valley. This timeline is subject to state and local fiscal conditions.

Section 255. The District and the collaborating agencies such as DWR and the United States Geological Survey have committed to providing historic and current groundwater monitoring data and related reports to the general public. References to the California Statewide Groundwater Elevation Monitoring (CASGEM) program, the California Department of Water Resources Northern Region Groundwater Level Monitoring web page, the Basin Management Objectives Information Center (BMOIC), and the Tehama County Flood Control and Water Conservation District web page are cited in Appendix D-1 as sources of groundwater level monitoring data and summarizations.

Suggested sources of groundwater quality monitoring data and summarizations for Tehama County are described below and cited in Appendix D-1:

- United States Geological Survey. Data Series 452. Groundwater Quality Data for the Northern Sacramento Valley, 2007: Results from the California GAMA Program. This report provides a comprehensive review of groundwater quality in the northern one-half of Tehama County (reference #19).

- United States Geological Survey. Data Series 385. Groundwater Quality Data for the Middle Sacramento Valley Study Unit, 2006: Results from the California GAMA Program. This report provides a comprehensive review of groundwater quality in the southern half of Tehama County (reference #19).

- California State Water Resources Control Board. GAMA Domestic Well Project Groundwater Quality Data Report Tehama Focus Area. 2009. This report provides a comprehensive review of groundwater quality primarily in the Red Bluff East and Los Molinos sub-basins of Tehama County (citation #9).

Suggested sources of land subsidence data and summarizations are described below and cited in Appendix D-1:

- California Department of Water Resources/United States Bureau of Reclamation (DWR/USBR) Sacramento Valley Subsidence Project – Project Report. 2008.

This report describes the scope of the subsidence project, specifically provides the geo-referenced benchmarks in Tehama County and the 2008 land elevations (citation #11).

- California Department of Water Resources Groundwater Information Center web page. Information on this web page describes the use of extensometers to continuously and precisely measure surface land subsidence in specific groundwater sub-basins of the Sacramento Valley where there may be potential for it to occur. There are currently no extensometers in operation in Tehama County. The nearest extensometers are in Butte and Glenn Counties (Appendix D-1, reference #5).

Historic Variations in Groundwater Levels:

Section 260. Groundwater levels fluctuate on an annual basis as a reaction to extraction operations, infiltration and downward percolation from precipitation, surface water sources and irrigation, and subsurface inflows and outflows. In Tehama County, groundwater levels show a significant seasonal variation due to high irrigation use during summer months.

Section 261. Monthly measurements of groundwater show that spring water levels start dropping when irrigation begins (usually April) and continue to decline until about mid-July. Later in the summer, starting in late August to early September, levels begin to rise steadily because irrigation declines substantially as the irrigated crops reach maturity and are harvested. In addition, more surface water that is applied for irrigation percolates past the root zone of crops, because water use declines in the fall, and contributes to groundwater recharge. Maximum levels are usually reached by February/March.

Section 262. Long-term trends in static groundwater levels show the influence of drought. Groundwater levels were lowest during the 1976-77, 1987-91, and 2007-09 drought periods. DWR analysis of groundwater levels from the spring of 2006 through the spring of 2009, which encompasses most of the recent drought, showed an average decline in groundwater levels of 6 feet in Tehama County. The maximum decline during this period was 21 feet and in some areas there was no change. Monitoring indicates that groundwater levels generally recovered after each of these droughts during the wet periods that followed in the early 1980's and early to mid 1990's. Groundwater level monitoring in many of the key wells in the Red Bluff East and Corning East sub-basins indicate that recovery of groundwater levels through spring 2011 following the most recent drought of 2007-2009 did not equal the recovery after the two earlier drought periods (1977 and 1986-1991).

More than one variable may contribute to less recovery after the most recent drought. Figure 4 in Section 215 of this Plan shows that calendar year rainfall was about average in 2010 while Figure 6 in Section 216 suggests a range from "Below Normal to Wet Year" water supply conditions in the Sacramento River watershed for the overlapping period of October 1, 2009 through September 30, 2011. This suggests that localized groundwater levels in these sub-basins may be influenced differently by local rainfall and by runoff from the upper watersheds. Reduced use of

surface water as a result of minimizing operation of Red Bluff Diversion during this period (with termination of its operation effective in the fall of 2011) and more demand for groundwater supplies may be increasingly affecting the recovery of groundwater levels in these sub-basins during wet years that follow drought. Also, land use changes, in particular shifts from annual crops to permanent crops may be influencing recent groundwater levels.

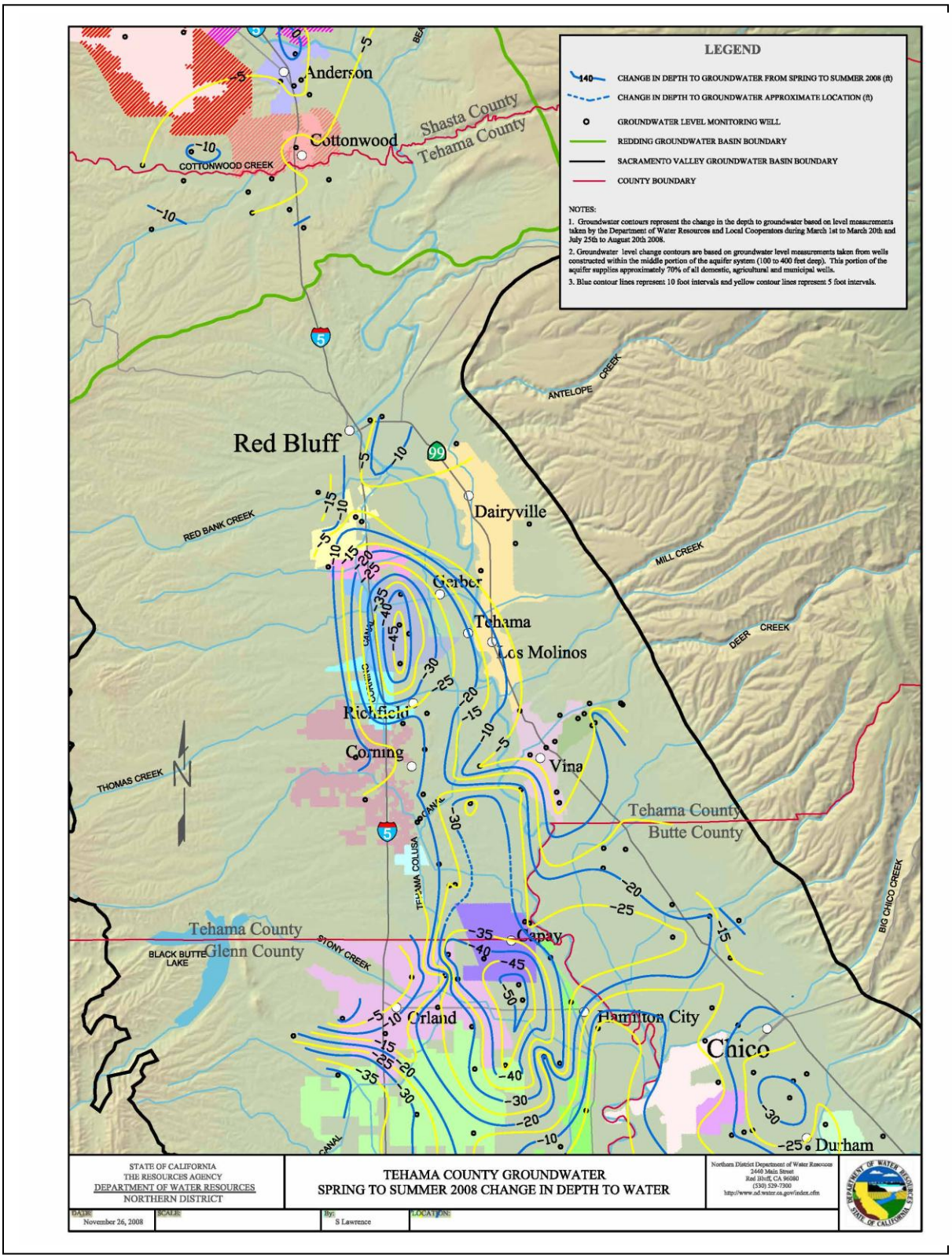
Section 263. Figure 10 is a contour map that shows the change in depth to static groundwater throughout the valley floor of Tehama County from spring (March) to summer (August) in 2008. It represents a recent season of high water demand that occurred during the 2007-09 drought. Static groundwater levels fluctuated between 5 and 45 feet in different areas of Tehama County. In comparison, DWR monitoring has indicated that maximum changes in spring to fall groundwater levels following the 1976-77 and 1987-91 droughts were 30 feet in Tehama County.

In 2008, fluctuations in static groundwater levels from spring to summer were greater on the west side of the Sacramento River than on the east. Declines were largest in the Red Bluff East and Corning East groundwater sub-basins ranging from 20 to 45 feet. Spring to summer fluctuations ranged from 5 to 20 feet in the Antelope, Dye Creek, Los Molinos, and Vina sub-basins.

Historic records show spring to summer groundwater levels actually increased about 10 feet in the Antelope sub-basin after the Red Bluff Diversion Dam was constructed in 1966 through 1991 and when the diversion raised the water level in the river for a large part of the year. In September 2011, the diversion gates were lifted permanently so the Sacramento River level will no longer be elevated. As a result, groundwater levels in the Antelope sub-basin may decline in the future.

Drought, reduced diversion of surface water, and more demand for groundwater supplies to support growth and diversification in land use may be contributing to slightly higher seasonal fluctuations in static groundwater levels in the last decade. The frequency of groundwater level monitoring has also been increased in the last decade with the inclusion of summer measurements. This has allowed evaluation of changes in depth to static groundwater between spring and summer. Before 2000, comparisons were more common between spring and fall. Static groundwater levels begin to recover during late summer and fall as the end of the irrigation season approaches and the demand for groundwater lessens. Summer measurements of static groundwater levels may also be less accurate than fall measurements due to interferences from nearby wells that are in operation or recent extraction from an irrigation or domestic well that is used for monitoring. This may partially explain the slight trend toward greater seasonal fluctuations in static groundwater levels in the last decade.

Figure 10. Change in depth to groundwater from spring to summer 2008 in Tehama County. (Map prepared by the California Department of Water Resources, Northern Region)



Historic Groundwater Pumpage:

Section 270. In the early years of the 20th Century, little groundwater was used in Tehama County. The Sacramento River and its primary tributaries provided the source for most irrigation water used in the County. Many parts of the County have reported artesian wells in past years.

Section 271. Groundwater use was small but significant during the 1950's. Twenty years later, approximately 1/3 of all irrigation water came from groundwater and 2/3 came from surface water sources. By 1990, this ratio was reversed. Further, all water supplies for municipal, domestic and industrial uses are supported by extracted groundwater. While the overall water supply has remained fairly stable, more users are turning to groundwater because of its perceived dependability and improved quality.

Analyses conducted in 2005 by the DWR Northern Region Land and Water Use Section indicated that about 69 percent (257,000 ac-ft) of Tehama County's total annual water demand is from groundwater (McManus, DWR, Northern Region, Presentation at Northern Sacramento Valley Groundwater Management Symposium, December 2009). A 2011 DWR analysis of well completion logs for the Sacramento Valley Groundwater Basin portion of Tehama County showed about 11,543 wells had been constructed for the extraction of groundwater in the area. Of that total, 8,773 were domestic wells, 1,358 irrigation wells, and 113 municipal, industrial, and public wells. Current estimates suggest that the total number of wells constructed in Tehama County is over 13,000 in 2011. This accounts for wells in the Redding Basin portion of Tehama County as well as the Sacramento Valley Basin and includes wells used for other purposes such livestock water and dedicated monitoring wells.

The balance of Tehama County's annual water demand is provided by surface water supplies. Approximately 26 percent (97,000 ac-ft) is supplied by local stream diversions and 5 percent (19,000 ac-ft) is supplied by the Central Valley Project.

Section 272. The increase in groundwater use can be attributed to the following:

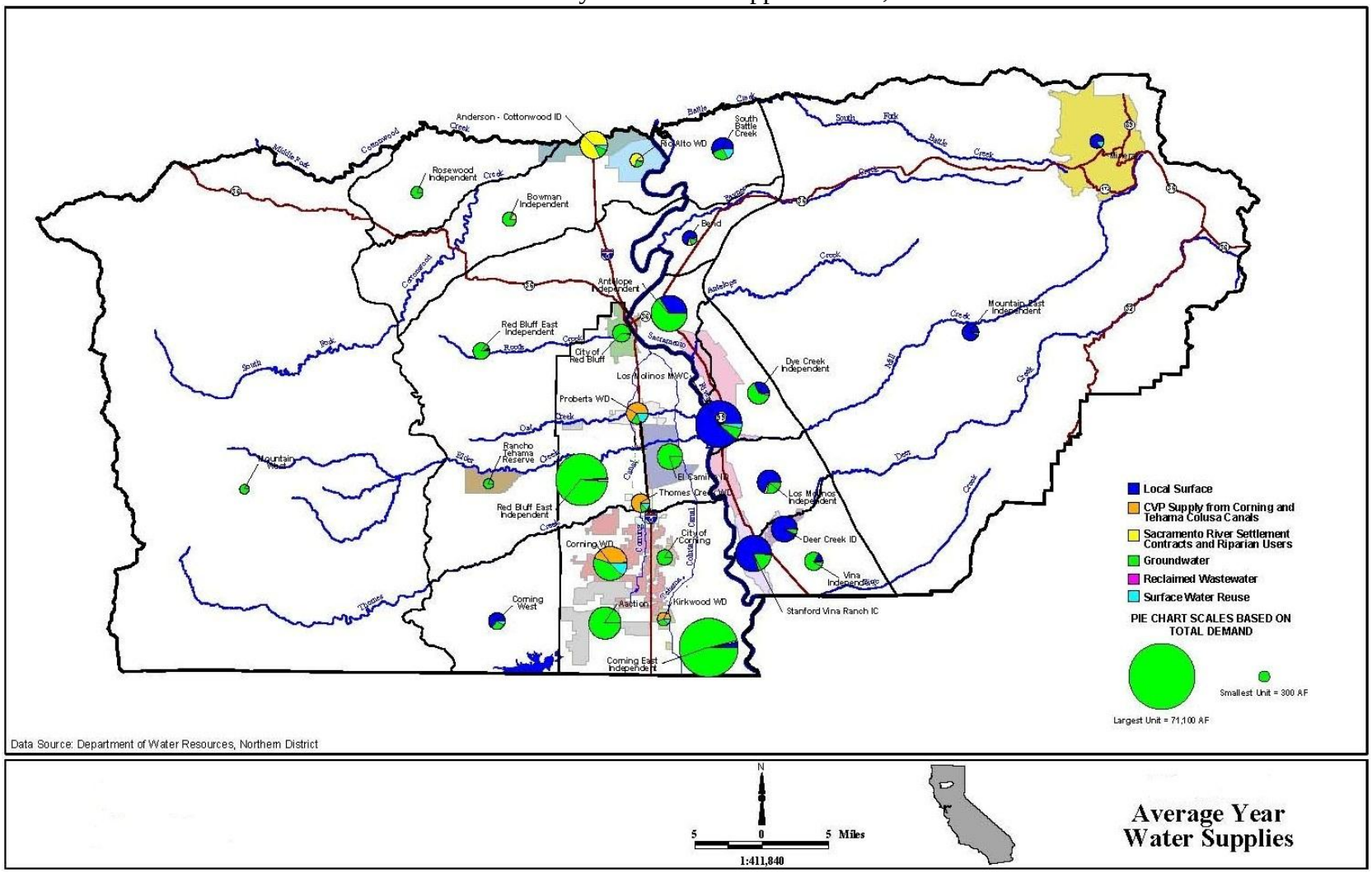
1. A need exists for a more reliable source of water than surface water.
2. Surface supplies, particularly those derived from the Central Valley Project, have diminished due to increased urban and environmental uses in other parts of the state.
3. Additional surface water supplies do not appear to be forthcoming in the near future.
4. The production of fruit and nut crops with drip and microsprinkler irrigation has expanded in Tehama County and contributed to increased use of groundwater.
    a. Orchard crop productivity is more sensitive to soil moisture deficits and require more frequent irrigation. Some water districts are unable to deliver surface water at a sufficient frequency, so groundwater is used.
    b. Compared to surface water, groundwater is relatively free of particulates which may plug irrigation system filters, drip emitters, and microsprinkler nozzles, thereby, lowering their water application uniformity and efficiency. Water filtering is often greater for surface water supplies than for groundwater.

c. Growers are concerned about the presence of phytopathogens in surface water so they prefer to use groundwater when it is feasible.

With additional water needed to satisfy changing cropping patterns and irrigation methods in the local agricultural industry and growing urban and environmental concerns, groundwater use can be expected to continue to increase in the future.

Section 273. Figure 11 shows the source and distribution of water supplies in Tehama County. It illustrates that groundwater extraction occurs throughout the valley floor of Tehama County and that its use is intermingled among surface water supplies from water districts. In some instances, landowners who irrigate crops use surface water and extract groundwater.

Figure 11. Water Supply Sources and Water Districts in Tehama County. Map from the 2003 Tehama County Water Inventory and Analysis. Refer to Appendix D-1, citation #16.



Groundwater Recharge:

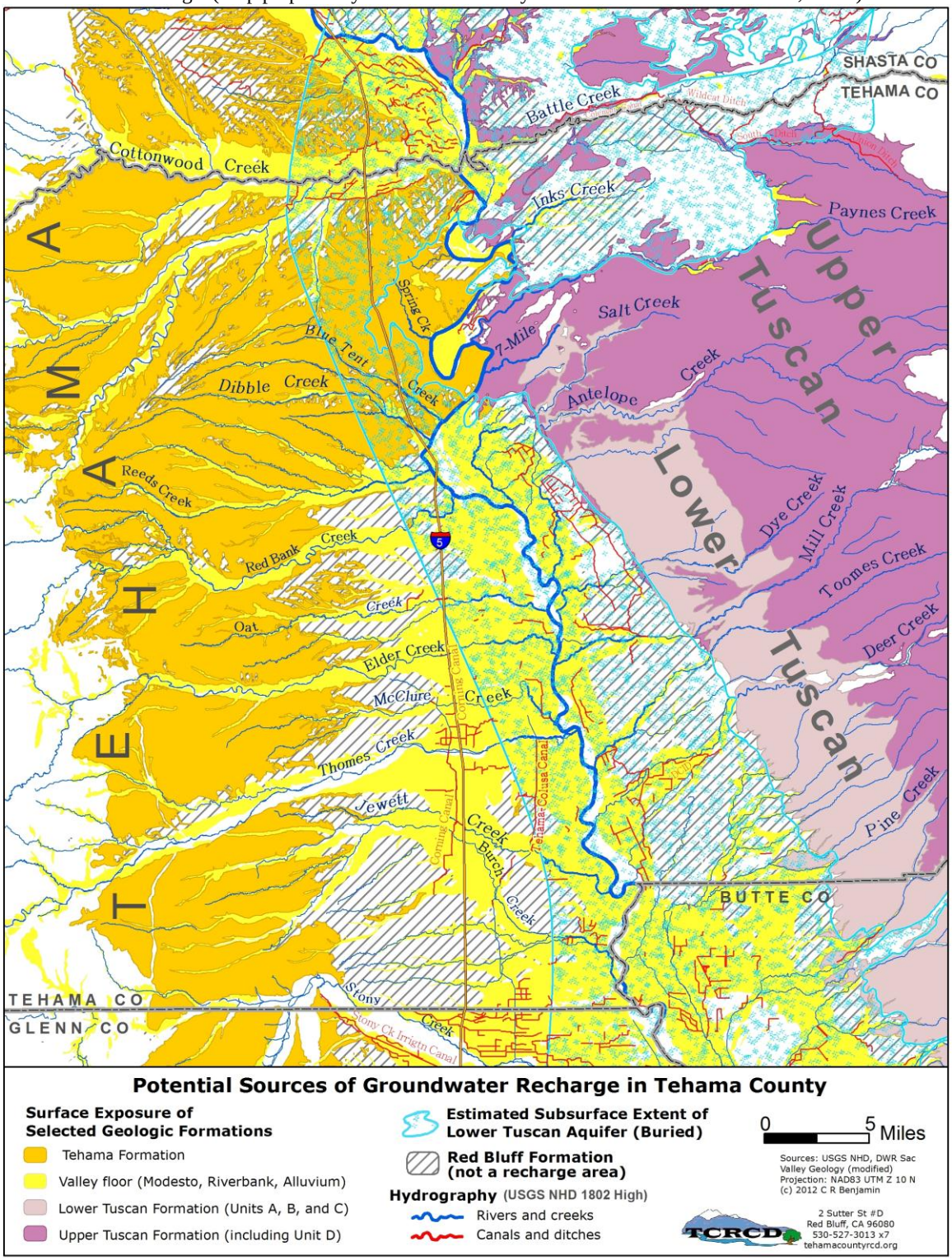
Section 275. Groundwater recharge in Tehama County is complex. Recharge is influenced by a combination of natural hydrogeologic variables and human water management activities. Figure 12 shows a map of the Sacramento River, eastside and westside streams, and surface water canal systems in relation to the location of various geological formations throughout Tehama County.

Section 276. Natural recharge. Over 30 drainages from the upper watersheds of the Cascades and Coast mountain ranges flow through the valley floor of Tehama County to the Sacramento River. They provide recharge from snowpack runoff to the groundwater sub-basins throughout the county. Some of the postulated areas of recharge include: the eastside foothill areas of the Cascade mountain range where the Upper and Lower Tuscan Formations outcrop and where numerous eastside streams flow across; the westside foothill areas of the Coastal mountain range where the Tehama Formation outcrops and several westside streams flow over; the Modesto, Riverbank, and Alluvium deposits that lie along the periphery of the numerous streams and Sacramento River and percolate water. These interactions between the Sacramento River, its many tributaries, and the surface geology provide vital, natural sources of groundwater recharge. The Upper and Lower Tuscan and Tehama Formations are also buried beneath the Modesto, Riverbank, and Alluvium deposits on the valley floor of the county and are recharged by percolation from the river and streams, however, this aspect of groundwater recharge is not fully understood. Natural recharge also occurs throughout the county from annual precipitation received on the valley floor.

Section 277. Red Bluff Formation. Figure 12 shows areas in Tehama County where surface exposure of the Red Bluff Formation occurs. This formation is of very limited significance to regional groundwater. It is a thin veneer, generally considered to be less than 20 ft deep in most locations. Although it is described as coarse sand and gravel, there are areas where cementation of a fine matrix results in lower permeability. As a consequence, it may impede percolation of shallow groundwater in some locations, and result in favorable conditions for the formation of seasonal wetlands (vernal pools) in these locations. In general, the Red Bluff Formation remains only on topographically higher locations in the valley. In areas where it is present and well-cemented, it merely redirects overland surface flow in stream channels. In the major stream channels it has been eroded so recharge from streams is not influenced by the Red Bluff Formation.

Section 278. Active recharge. Water districts and private entities in Tehama County divert surface water for irrigation. Figure 12 shows the various canal and ditch systems that convey surface water that is diverted from the Sacramento River and some of its tributaries to irrigate croplands on the valley floor of Tehama County. These activities provide opportunities for recharge due to conveyance losses of surface water and deep percolation of flood and furrow irrigation water that is not consumed by crops. In orchard crops where drip and microsprinkler irrigation methods are used to apply surface water, in-lieu recharge occurs by substituting surface water for groundwater that would otherwise be extracted. As described in Section 272 of this Plan, the conversion of irrigated lands from flood and furrow

Figure 12. Map illustrating the surface water and geological features of Tehama County that influence groundwater recharge. (Map prepared by the Tehama County Resource Conservation District, 2012.)



irrigation to drip and micro-sprinkler irrigation to support orchard crops has increased reliance on groundwater for irrigation and decreased demand for surface water. In turn, this has affected, or may potentially affect, groundwater depletion and recharge of specific groundwater basins or sub-basins in Tehama County. Efforts to find feasible means to promote more use of surface water supplies with drip and microirrigation in orchard crops may become increasingly important in the future.

Section 278. Appendix C-4 provides a copy of a report titled "2011 Tehama County Groundwater Recharge Area Location Study". It describes potential opportunities for specific groundwater recharge projects. This study and report was funded by AB 303 funding and administered by the District.

Known Groundwater Quality Problems:

Section 280. Relative to other regions of California, Tehama County groundwater is of excellent quality. However, certain areas of the County have experienced problems related to suitable groundwater quality for drinking and irrigation of agricultural crops.

Section 281. The Antelope community in the Red Bluff East sub-basin has had a history of high nitrate levels. The wells producing water containing the highest nitrate concentrations were in residential areas that had sewage disposal systems in close proximity to shallow wells. Efforts to improve the sewage disposal systems and improved design and construction of water wells have helped to manage this problem. Nitrate analysis from the 2005 GAMA Domestic Well Project showed that 2 water samples out of 223 samples from domestic wells in the Antelope and Los Molinos areas exceeded the public drinking water standard of 45 mg/L nitrate. Approximately two-thirds of the domestic wells sampled were from the Antelope area.

Section 282. The 2005 GAMA Domestic Well Project showed that arsenic was the most commonly detected constituent in groundwater in Tehama County. It is a natural occurring element in groundwater from the Tuscan formation that originates from the pyroclastic rocks deposited by volcanic mudflows. Arsenic levels exceeded the public drinking water standard of 10 µg/L in 29 of 145 water samples. Most of the domestic wells that exceeded the public drinking water standard for arsenic were in the Los Molinos area and were privately owned domestic wells. Residents within Los Molinos either acquire their drinking water from the Los Molinos Community Service District or from privately owned domestic wells. The service district operates four wells and its current and approximate service boundaries include: Tehama-Vina Road to the north; Lee Street to the south; Oak Street to the west, and roughly Tina Court to the east. The service district's sphere of influence ranges north to Mill Creek and east to Tehama-Vina Road offering potential for further build-out of the service district. Arsenic levels in three of the four wells in the service district have been less than 4 µg/l arsenic, while the arsenic level in the fourth well is typically about 12 µg/l, which is slightly above the drinking water standard. Currently, the service district utilizes automated control systems and storage to blend water from among these four wells and provide domestic supplies with arsenic levels that are below the drinking water standard. The service district is also considering constructing a fifth smaller, shallow well near the existing well with higher arsenic levels to enhance blending

capabilities. Groundwater quality data from the GAMA Program that was completed in the Northern Sacramento Valley (Tehama and Shasta Counties) in 2007 also showed two samples with arsenic levels above 10 µg/L from wells constructed in the Bowman sub-basin. These wells were constructed in areas planned for future residential communities so there is still opportunity to consider measures to address the concern.

Section 283. The 2005 GAMA Domestic Well Project in Los Molinos also identified other possible constituents of concern. Chromium was detected above the maximum contamination level of 50 µg/L in one well, aluminum was detected above the secondary maximum contamination level of 200 µg/L in six wells, iron was detected above the secondary maximum contamination level of 300 µg/L in 31 wells, and manganese was detected above the secondary maximum contamination level of 50 µg/L in 19 wells. Lead was detected in two wells at concentrations greater than the notification level of 15 µg/L. These minerals are natural occurring contaminates. Fifty six samples tested positive for total coliform bacteria and three samples tested positive for fecal coliform bacteria. Potential expansion of the Los Molinos Community Service District may be an important element of addressing these water quality concerns.

Section 284. Groundwater sampling from 34 deeper wells across Tehama County as part of the 2006 and 2007 GAMA Program showed that all of the wells produced water with boron levels below the public drinking water standard of 1000 µg/L (1.0 mg/L) and pose no limitations for domestic use. Ninety percent of the samples contained less than 0.50 mg/L (500 µg/L) which represents a threshold for irrigation of sensitive domestic plants and agricultural crops such as walnut, almond, and prunes. Some irrigation wells in the Bend, Antelope, and Dye Creek sub-basins have produced water with sufficient boron concentrations to negatively affect domestic plants and sensitive agricultural crops. The boron originates from naturally occurring minerals in the Cretaceous marine sediments that are exposed in higher areas of the watershed. Drought conditions also appear to increase the incidence of high boron in groundwater. Careful evaluation of the geology and groundwater quality at the time of well design and construction is important to avoid boron in irrigation water supplies for sensitive agricultural crops. Cyclical or blended uses of alternative water supplies may also aid in the management of groundwater supplies that are high in boron.

Section 285. Twenty five of the 34 wells (about 75 percent) sampled in Tehama County as part of the 2006 and 2007 Sacramento Valley GAMA program contained bicarbonate and carbonate (alkalinity) concentrations above 2.0 meq/L. When these naturally-occurring minerals surpass this level, they may pose problems with plugging of drip and microsprinkler emission devices used to irrigate orchard crops and influence irrigation uniformity and efficiency. Alkalinity may also lead to corrosion of plumbing fixtures when levels are high in domestic wells. Alkalinity in irrigation water may be managed with water amendments and alkalinity in domestic supplies may be addressed with water softeners and other methods of water treatment.

Section 286. Volatile organic compounds (VOC's) are carbon based substances that evaporate readily at normal temperatures and pressures. In a 1994 DWR groundwater quality investigation, three wells located north and west of Corning had waters with VOC (1,2-dichloroethane) concentrations which exceeded the Maximum Contaminant Levels set by the Environmental Protection Agency. Most VOC contamination is traceable to leaking underground fuel storage vessels, landfills, dry cleaning processes, and agricultural practices. In the last decade, special federal and state programs have been undertaken to close or replace leaking fuel storage tanks and to more closely monitor and manage landfills, dry cleaners, and agricultural practices that may contribute to VOC contamination. Results from the 34 wells sampled in Tehama County as part of the 2006 and 2007 Sacramento Valley GAMA Program still showed some detection of VOC contaminations but none were at concentrations near public drinking water standards or posed restrictions on use.

Section 287. During the late 1980's, eighteen percent of domestic wells tested in Proberta and twenty percent of domestic wells in Las Flores exhibited bacterial contamination. The combination of poorly draining surface clays overlying highly permeable gravels contributed to wastewater discharge from onsite domestic septic drain fields into the shallow aquifer. Construction and operation of the Gerber-Las Flores Community Service District has effectively addressed this groundwater quality problem.

Section 288. Other areas within the County have generated interest in groundwater quality. They include the Tehama County Sanitation District No. 1 in Mineral, the County Sanitary Landfill west of Red Bluff, residential development in Rancho Tehama, and residential development in Sky View County Water District (i.e., the Ponderosa Sky Ranch area). The primary interests in these areas are development of additional water supplies and protection of existing supplies of sufficient groundwater of suitable quality for domestic use.

Need for Groundwater Management Plan:

Section 290. Agriculture, a driving force in the local economy, is turning more to groundwater each year because of dwindling surface water supplies and the more reliable nature of groundwater for satisfying irrigation demands.

Section 291. Throughout the valley floor areas of Tehama County, private, municipal and industrial demands are almost exclusively supplied by groundwater sources. Further, mandated allocations of surface water for instream environmental purposes makes the guaranteed delivery of surface water an increasingly tenuous proposition.

Section 292. There is not an infinite supply of high quality groundwater in Tehama County. As a result, the long-term goal of the Plan is to balance extraction and replenishment so that groundwater can be extracted for domestic, industrial, agricultural, and environmental purposes reliably and at affordable costs.

Section 293. High quality groundwater must be sustained at reasonable levels so that most of the existing well infrastructure remains operational and any necessary improvements in the well infrastructure over the long term are affordable.

Section 294. The Groundwater Management Plan, in conjunction with the existing regulatory powers of the District and other local agencies with jurisdiction over the plan area (including Chapter 9.40 of the Tehama County Code ("Aquifer Protection")), shall provide a mechanism for the responsible agencies in Tehama County to evaluate, manage, protect and preserve valuable local groundwater resources.

3
Elements of the Groundwater Management Plan

Implementation of the Plan

Background and Authority for local Groundwater Management Plans:

Section 301. On January 1, 1993, California Assembly Bill 3030 – the Groundwater Management Act – was codified into California law. California Water Code sections 10750 *et seq.* allowed local water agencies to adopt local groundwater management plans.

Section 302. Water Code Section 10750 et seq. allowed development of a groundwater management plan by local agencies to efficiently manage and maximize groundwater supplies, assure long term water supplies, and distribute costs, benefits and water sharing in an equitable manner. Refer to reference #9 in Appendix D-1 for additional information on California Water Code.

Section 303. In accordance with Water Code Section 10750 et seq., the California Department of Water Resources defined a "groundwater management plan" as "planned use of the groundwater basin yield, storage space, transmission capability and water in storage".

Section 304. Water Code section 10750 *et seq.* defines "groundwater management program" as "a coordinated and ongoing activity undertaken for the benefit of a groundwater basin pursuant to a groundwater management plan as specified in AB 3030".

Section 305. The Local Groundwater Management Assistance Act of 2000 was passed into law and incorporated into California Water Code Section 10795-10795.20. Funds are appropriated annually by the State Legislature and administered by the Department of Water Resources through a competitive grant process to assist local public agencies with groundwater management.

Section 306. California Senate Bill 1938 was codified in California Water Code Sections 10753.1, 10753.4, 10753.7-10753.9, and 10795.4, on September 16, 2002. It requires a Groundwater Management Plan to include basin management objectives (referred to as "Alert Levels" in Tehama County Plan) and to adopt certain groundwater monitoring protocols in order for a local agency to qualify for public funding such as the Local Groundwater Management Assistance Act of 2000.

Section 307. California Senate Bill X7 6 was codified in California Water Code Sections 10920 and 12924 on November 2009. This portion of the Water Code establishes the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Under these Sections of Water Code, specific entities using prescribed procedures may be designated by the Department of Water Resources as groundwater monitoring entities for the purposes of monitoring and reporting groundwater elevations. The Tehama County Flood Control and Water Conservation District has been designated as a monitoring entity for Tehama County. The District has worked cooperatively with the Department of Water Resources to design an approved monitoring program for groundwater elevation to comply with CASGEM.

Section 308. California Senate Bill X7 7 was codified in California Water Code Sections 10631.5, 10608, and 10800 on November 10, 2009. Existing law requires the Department of Water Resources and an independent technical panel to provide information to the department and Legislature on new demand management measures. "Demand management measures" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies. The law focuses on both urban and agricultural water use.

Section 309. California Assembly Bill 1152 was approved by the Governor and filed with Secretary of State on October 8, 2011. It amends Sections 10927, 10932, and 10933 of the Water Code relating to groundwater. It adds to the list of entities that may assume the role of monitoring and reporting groundwater level elevations as part of the CASGEM program previously established by Senate Bill X7 6. It defines conditions within a groundwater basin or sub-basin that may qualify for use of alternate monitoring techniques other than direct measurement of groundwater levels and defines acceptable alternate monitoring techniques. On or before January 1, 2012 the act requires the Department of Water Resources to identify the extent of monitoring groundwater elevations and prioritize groundwater basins and sub-basins for purposes of implementing the CASGEM program.

Section 310. California Assembly Bill 359 was signed by the Governor on October 8, 2011, amending Water Code Sections 10752, 10753, and 10753.2 – 10753.5, and 10753.7. This legislation clarifies that groundwater management projects that are part of an integrated regional water management program must meet the requirements of AB 3030 (as amended by SB 1938) in order to be eligible for state funding. Further, commencing on January 1, 2013, a map(s) identifying groundwater recharge areas must be included in a Groundwater Management Plan to qualify any element of the Plan for state funding opportunities. Sections 276 through 278 of this Plan, Figure 12, and Appendix C-4 address this requirement. A map(s) identifying groundwater recharge areas is in addition to other required elements of a Plan such as monitoring to detect groundwater levels, groundwater quality, inelastic land subsidence, and flow and quality of surface water that directly affect groundwater. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management. AB359 also established new procedural requirements for the adoption or amendment of a Groundwater Management Plan. The present revision to the Plan is being processed in accordance with these requirements.

Section 311. Appendix A-1 summarizes the numerous elements in the Plan Update and provides an index of page numbers where the elements are addressed in the Plan.

Background and Authority of Tehama County Flood Control & Water Conservation District Act:

Section 312. In 1957, the Tehama County Flood Control and Water Conservation District Act was signed into law. This act is now included in the California Water Code as Appendix Chapter 82.

Section 313. Table 3-1, summarizes the key powers granted to the District, particularly as they relate to groundwater resources management.

Section 314. The elements of this Plan, and the District's power to implement the plan and take other actions to evaluate, manage, protect and preserve the groundwater resources of Tehama County, are authorized by California Water Code sections 10750 *et seq*. (AB 3030, SB1938, and AB359), Sections 10920 and 12924 (SB X7 6 and AB1152), Sections 10631.5, 10608, and 10800 (SB X7 7), and California Water Code Appendix Chapter 82 (Tehama County Flood Control and Water Conservation District Act).

Table 3-1. Groundwater Management Authority Vested in the TCFCWCD Act of 1957.

AUTHORITY
To incur indebtedness and to issue bonds. To cause assessments to be levied and collected for the purpose of paying any district obligations.
To establish and fix the boundaries of zones within the district.
To construct, purchase, lease or otherwise acquire works, and surface water and water rights, useful or necessary to make use of water for any of the purposes authorized by this act.
To do any and every lawful act necessary to be done that sufficient water may be available for any present or future beneficial use or uses of lands or inhabitants within the district.
To conserve flood and storm waters by storage in surface reservoirs.
To divert and transport flood waters for beneficial uses within the District.
To release flood waters from surface reservoirs to replenish and augment groundwater aquifers.
To reduce the waste of water and to protect life and property from floods within the District.
To commence, maintain, intervene in, defend or compromise, in the name of the District, on behalf of the landowners therein, or otherwise to assume the cost and expenses of any action or proceedings involving or affecting the ownership or use of waters or water rights within or without the district, used or useful for any purpose of the district or of the common benefit of any land situated therein, or involving the wasteful use of water therein.
To prevent interference with or diminution of, or to declare the rights in natural flow of any stream or surface or subterranean supply of waters used or useful for any purpose of the district or to its inhabitants.
To prevent unlawful exportation of water from District.
To prevent contamination, pollution, or otherwise rendering unfit for beneficial use, the surface or subsurface water used or useful in said district. To commence, maintain, and defend actions and proceedings to prevent any such interference with the aforesaid waters as may endanger or damage the inhabitants.
To acquire by negotiation the right to store water in any reservoirs or to carry water through any canal, ditch or conduit not owned by the district.
To enter into and do any acts necessary or proper for the performance of any agreement with any district of any kind, public or private corporation, association, or firm or individual or any water right or water pumped, stored, appropriated, or otherwise acquired or secured, for the use of the District, or the purpose of exchanging the same for other water, water right, or water supply in exchange for water, water right or water supply to be delivered to the district by the other party pursuant to an agreement.

Procedures to Adopt and Implement Plan:

Section 315. The initial Plan was filed with the California Department of Water Resources in 1996. The process for developing the present revision to the Groundwater Management Plan has proceeded in accordance with the process outlined in Table 3-2. The Department of Water Resources has been involved in the Plan Update in an advisory role. The Plan Update will also be filed with the Department upon its completion. The District Board may add additional steps to this process, in order to improve public participation, as appropriate.

Table 3-2 Procedures to Develop and Adopt Groundwater Management Plan or Revision.

3-2.1 Development of Draft Plan/Revision for Presentation to the Public

STEP NUMBER	TASK
1	Prepare a Plan to work cooperatively with other public and private entities whose service area overlies the groundwater basin.
2	Prepare a map that details the area of the groundwater basin within Tehama County as defined by DWR Bulletin 118.
3	Prepare and implement a Plan that includes basin management objectives (BMO's, also described as "Alert Levels" in the Tehama County Plan).
4	The Plan should have components to monitor and manage groundwater levels, groundwater quality, inelastic land subsidence, changes in surface water flow or surface water quality associated with groundwater extraction, and groundwater recharge.
5	Develop monitoring protocols designed to detect changes in groundwater levels, surface water and groundwater interactions, groundwater quality, inelastic land subsidence, identify and protect key recharge areas, and that generates information to promote efficient groundwater management.
6	Become approved and recognized by the California Department of Water Resources as "Monitoring Entity" within Tehama County and submit and gain approval of a monitoring plan through the California Statewide Groundwater Elevation Monitoring (CASGEM) program.
7	Identify and map both natural groundwater recharge areas and groundwater recharge areas resulting from active recharge.
8	Consider coordination of specific projects identified in the Plan with an Integrated Regional Water Management Plan or Program.

3-2.2 Adoption Procedures

STEP NUMBER	TASK
1	Publish notice of public hearing to consider Resolution of Intention to draft a revised groundwater management plan.
2	Conduct a hearing on whether to consider resolution of intention to draft a revised groundwater management plan.
3	Adopt a resolution of intention to adopt a groundwater management plan.
4	Provide DWR with a copy of the Resolution, and contact information for the person responsible for drafting the revised plan, within 30 days of the date of adoption.
5	Publish the resolution of intention and public notice.
6	Prepare and make available to the public and DWR a written statement describing the manner in which interested parties may participate in developing the revised groundwater management plan.
7	Prepare a groundwater management plan within 2 years. If not, return to Step 1.
8	Once the plan is prepared, publish notice of a (second) public hearing to consider adoption of the revised plan. The notice shall include a summary of the plan and advise the public where copies may be obtained.
9	Hold the second hearing to consider adoption of the plan/revision.
10	Consider landowner protests at the hearing.
11	If protests > 50% of assessed value of property in the county occurs, the plan shall not be adopted. Wait 1 year, and return to Step 1.
12	If protests < 50% of assessed value of property in the county occurs, groundwater management plan may be adopted within 35 days after Step 9.

Section 316. After adoption of the original Plan in 1996, the District devoted a two-year "developmental period" to securing agreements with public entities or private parties for the purpose of implementing the Plan, as contemplated by Water Code section 10755.2. The standard MOU was developed in 1997 (see Appendix B-1). Current signatory agencies and parties to the MOU are listed in Table 3-3 along with many other potential signatories. Locations of these entities are also shown in Figure 1.

Table 3-3. Public and Private Water Entities and their Signatory Status to the 1996 Tehama County AB3030 Coordinated Groundwater Management Plan.

Entity Name	Signatory to Tehama County Plan	Entity has Own AB3030 Plan
Anderson Cottonwood Irrigation District	No	Yes
Capay Rancho Water District	No	No
Corning Water District	Yes	No
Deer Creek Irrigation District	Yes	No
El Camino Irrigation District	Yes	Yes
Gerber-Las Flores Community Services District	No	No
Golden Meadows Estates Community Services District	No	No
Kirkwood Water District	No	No
Los Molinos Community Services District	No	No
Los Molinos Mutual Water Company	No	No
Paskenta Community Services District	No	No
Proberta Water District	No	No
Rancho Saucos Water District	Yes	No
Reeds Creek Estates Community Services District	No	No
Richfield Irrigation District	No	No
Rio Alto Water District	Yes	No
Rio Ranch Estates Community Services District	No	No
Stanford Vina Irrigation Company	No	No
City of Corning	Yes	No
City of Red Bluff	Yes	No
City of Tehama	Yes	No

Management Involvement Levels:

Section 320. The various degrees of District involvement range from "Passive" (Phase I), to "Limited" (Phase II) and "Active" (Phase III). Table 3-4 summarizes the three phases of management involvement. Under the existing MOU between the District and the signatory parties, the District will attempt to limit management involvement to Phase I activities which are the least intrusive to local landowners. That is, District management will emphasize monitoring and basin evaluation over active management methods.

Table 3-4. Summary Description of the Three Phases of the Groundwater Management Plan

Description	Examples of Potential Management Activities for each Phase
Phase I – Passive	Utilize Technical Advisory Committee (TAC) to support District, revise groundwater monitoring protocol, network, and Alert Levels as needed, scientific investigations to identify recharge areas and understand groundwater resources, public education and outreach.
Phase II - Limited	Investigate feasibility of active recharge projects, coordinate with land use planning, promote water conservation, and protect beneficial uses.
Phase III - Active	Construct and operate an active recharge facility, regulate and cleanup contaminated groundwater, and facilitate conjunctive water management operations.

Section 324. As encouraged by the Water Code section 10755.2, the District will explore the possibility of entering a Joint Powers Agreement with affected public entities before advancing from "passive phase" (Phase I) to "limited phase" (Phase II) or the "active phase" (Phase III) of groundwater management.

Alert Levels and Basin Management Objectives to Define Management Involvement:

Section 325. A primary task listed under Phase I is the utilization of a Technical Advisory Committee (TAC). One of the most important activities conducted by this group has been to assist the District in the establishment of "Alert Levels" which are being used to determine the degree of District involvement in groundwater management activities. The Basin Management Objective for each sub-basin is to sustain groundwater levels above the Alert Levels over the long term. Alert Levels may eventually be defined for groundwater quality, land subsidence, and to manage groundwater and surface water interactions within each sub-basin as experienced is gained.

Section 326. Groundwater elevations may fluctuate considerably in response to pumping, recharge, and climatic cycles. The District has developed criteria and actions which establish the Alert Level for 9 of the 12 sub-basins in Tehama County. Signatory entities to the Plan have the opportunity to advise the District as it administers the coordinated AB 3030 Plan and to have direct input on the Alert Levels and actions developed for their respective sub-basin for application within their respective agency boundaries. The management intensity will increase (i.e. "more active" management role by District or local agency) when or if sub-basin groundwater elevations decline to unacceptable levels.

Section 327. In 2009, the District and TAC developed initial Alerts Levels and Awareness Stages/Actions for groundwater levels as an indicator of groundwater storage. The intent of the Alert Levels and Awareness Stages/Actions is to focus on monitoring groundwater levels, communicating groundwater level conditions to water users, and, if appropriate, exploring

creative and collaborative management options to assure reliable groundwater supplies are sustained through coordinated groundwater use and recharge. The District and the TAC recognize landowners retain overlying rights to pump groundwater and it is not the intent to interfere with these rights.

Section 328. Alert Levels have been defined to identify when groundwater elevations in key wells approach or surpass historically low levels. Key wells are representative of the groundwater conditions in other wells throughout each of the sub-basins. The Alert Levels have been defined for specific seasons such as "Spring" or "Fall". Spring Alert Levels enable evaluation of the groundwater level recovery after the winter/spring recharge season is completed but before the intensive "Summer" season of water extraction begins. "Fall" Alert Levels allow assessment of the groundwater elevations and depletion of storage after the most intensive period of the groundwater extraction has passed but before the winter/spring recharge seasons has significantly influenced groundwater levels. When groundwater levels in key wells reach these Alert Levels, various "awareness actions" may be undertaken and may involve public notification, information and education, additional monitoring and investigation, and consideration of a variety of possible management actions.

"Summer" measurements allow evaluation of groundwater levels when extraction is most intensive and continue to increase the understanding of the resource. However, Alert Levels are not defined for summer measurements because obtaining accurate and reliable static groundwater elevations that represent the aquifer conditions are difficult to attain when domestic and irrigation wells are used to acquire the monitoring data. There is a high likelihood that the summer groundwater level measurements will reflect recent pumping within or near the key wells. Furthermore, the extent of drawdown and rate of recovery of water levels in the key wells when they are not extracting groundwater may be influenced by site-specific variables such as how much time has passed since groundwater was extracted from the well, well design and construction features, and proximity to other active wells.

Section 329. Groundwater quality, land subsidence, and groundwater – surface water interactions are also important elements of the Plan. In the future, after sufficient data and experience have been accumulated, Alerts may be defined for these elements to complement the groundwater level Alerts. These "Alert Levels" shall be consistent with other management objectives set forth by the Central Valley Regional Water Quality Control Board and other regulating agencies.

Section 330. A five-step procedure, as outlined in Table 3-4, was used by the District and TAC to arrive at initial groundwater level Alerts for nine of the twelve groundwater sub-basins designated in Tehama County. Complete details of the procedure used to define the initial groundwater level Alerts are described for each groundwater sub-basin in Tehama County. See reference #16 in Appendix D-1 for sources of additional information.

Table 3-5. Five Steps to Develop Groundwater Alert Levels.

Step 1: Describe the purpose of the Alert level.
Step 2: Select one or more key wells within the sub-basin to acquire groundwater level data.
Step 3: Designate the time of seasonal groundwater level measurement.
Step 4: Establish Alerts and define awareness stages for the key wells.
Step 5: Define awareness actions associated with each awareness stage

Section 331. As set forth in Water Code section 10753.7, Figure 13 shows the twelve groundwater sub-basins in Tehama County with the general locations and state identification numbers of the 45 key wells for which groundwater level Alerts have been defined and two additional dedicated monitoring wells which are likely to be used as key wells in the future. Groundwater elevation monitoring has not yet been established in the Bend, Corning West, and South Battle Creek sub-basins because cooperating landowners who are willing to grant access to key wells for routine monitoring have not been identified.

Section 332. Figure 14 illustrates the Alert Level concept and a series of "Awareness Actions" that may be implemented by the District and its signatory partners when either the Spring or Late season groundwater level Alerts are surpassed. Figure 15 shows a Spring season hydrograph for one Key Well (27N02W30COO2M) in the Tehama County groundwater level monitoring network. It illustrates that the Spring Stage 1 and Spring Stage 2 groundwater elevation "Alert Levels" have been defined at 31 and 36 feet below ground surface, respectively. Figure 16 shows a Summer and "Late Season" (Fall) groundwater hydrograph for the same Key Well (27N02W30COO2M) and illustrates the Late Season groundwater elevation "Alert Level" has been defined at 41 feet below ground surface.

Groundwater quality, land subsidence, and groundwater-surface water interactions are also important elements of the Plan. After sufficient data and experience have been accumulated, Alerts may be defined for these elements to complement the groundwater level Alerts. Similarly, Awareness Actions may be implemented to respond to these issues as well .

Section 333. Also, as set forth in Water Code section 10753.7, Appendix C-3 summarizes the Spring season and Late season groundwater level Alerts (also known as Basin Management Objectives or BMO's) for each of the key wells in Tehama County.

Figure 13. Locations of Key Wells in Tehama Currently Used in the Alert Level and Awareness Stage/Action Program. (Map prepared by the Tehama County Flood Control and Water Conservation District.)

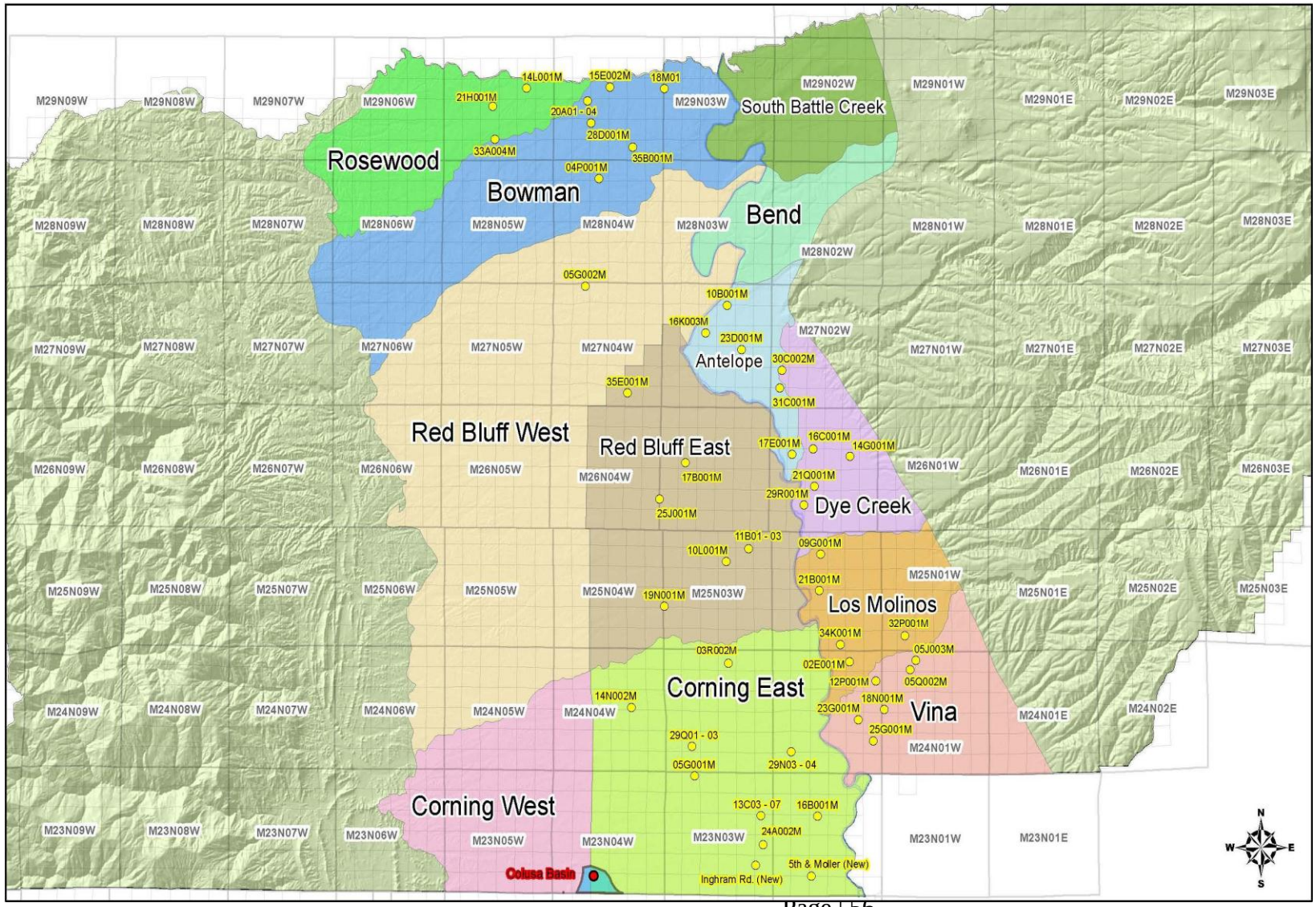


Figure 14. Conceptual Illustration of Groundwater Alerts and Corresponding Awareness Stages and Awareness Actions that Guide the District's Management Involvement.

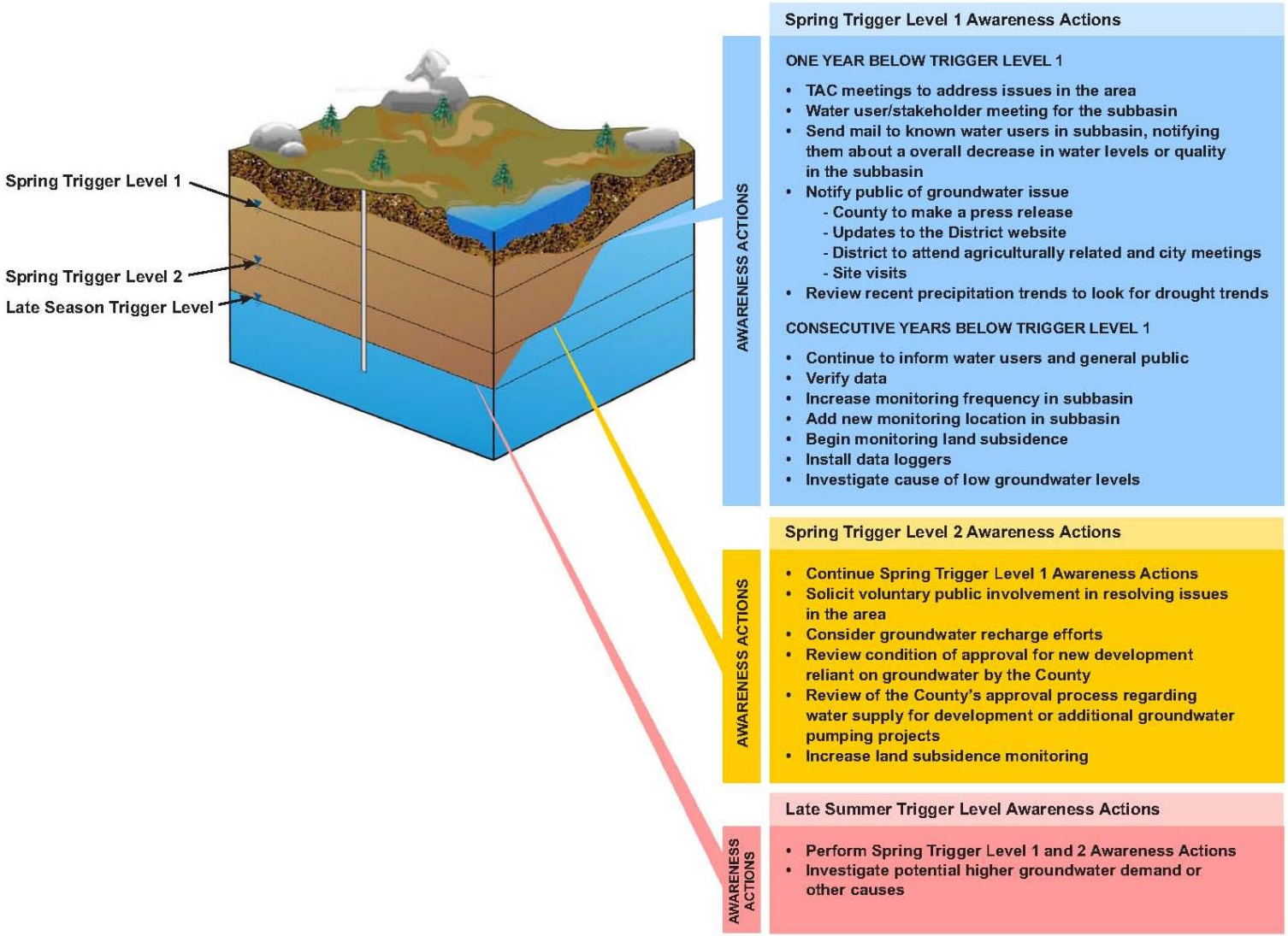


Figure 15. Example Hydrograph illustrating Spring Stage 1 and Stage 2 Groundwater Elevation "Alert Levels" for one Key Well (27N02W30COO2M) in the Cone Grove area of the Dye Creek Sub-basin.

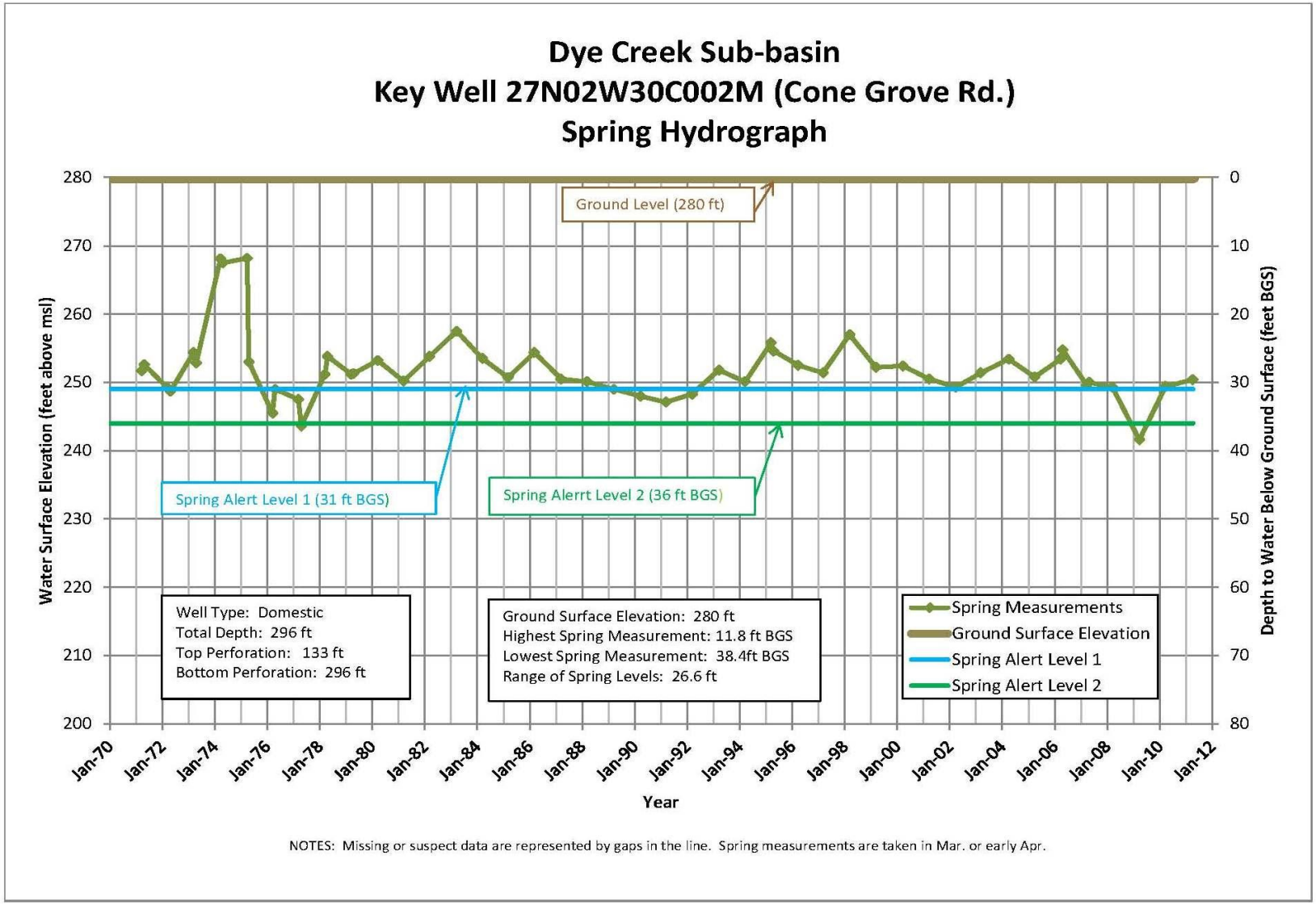
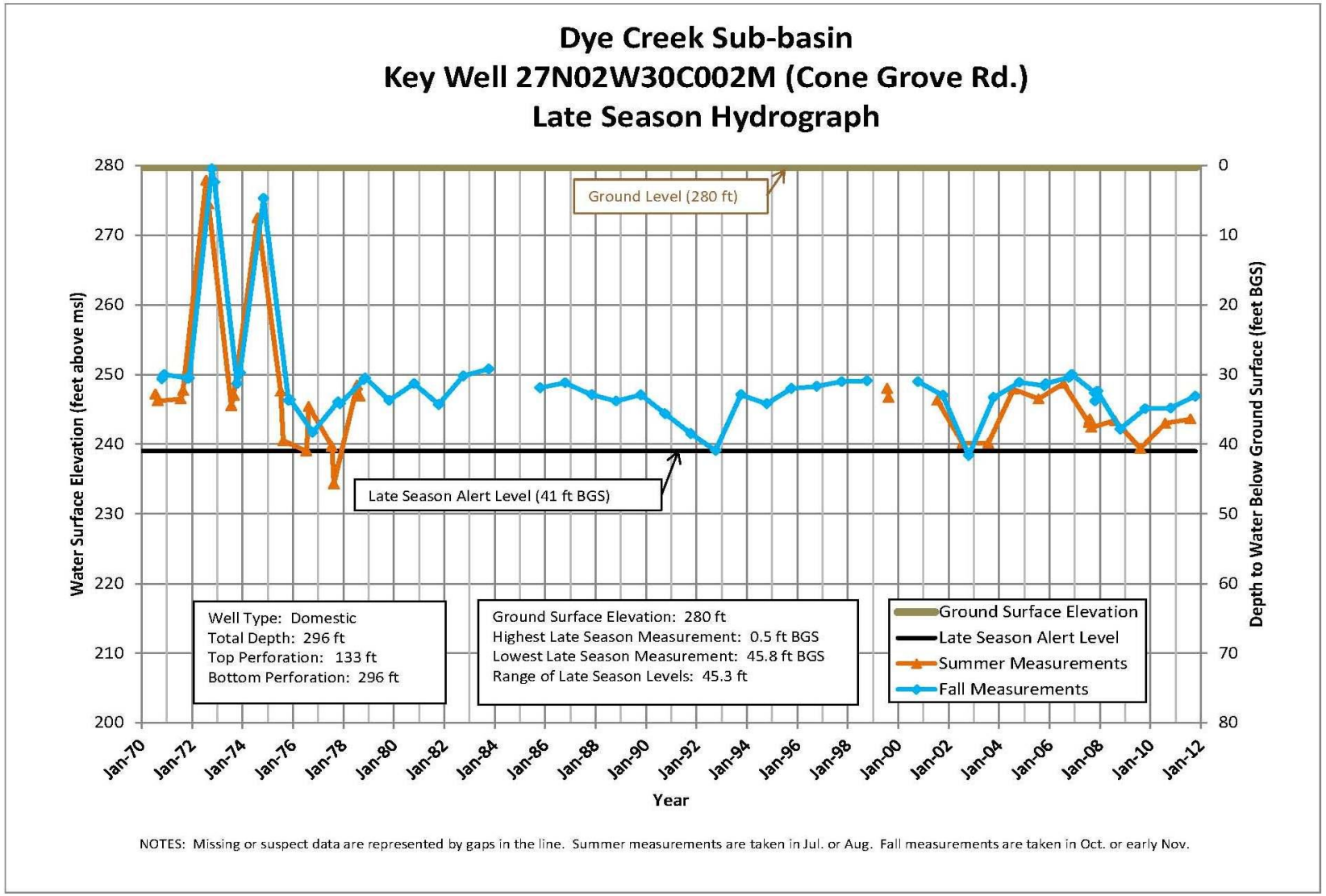


Figure 16. Example Hydrograph illustrating the Late Season Groundwater Elevation "Alert Levels" for one Key Well (27N02W30C002M) in the Cone Grove area of the Dye Creek Sub-basin.



Section 334. The groundwater level Alerts summarized in Appendix C-3 were initially defined in 2009 and continue to undergo review by District staff and the TAC to assess their effectiveness, to improve them as appropriate, and to follow through with Awareness Actions as warranted. Refinements of existing groundwater Alert Levels or additions of new key wells and associated Alert Levels reflect adaptive management as the Plan is implemented and do not constitute a Plan amendment.

The types of review and refinement include:

A. Peer review the historic groundwater level data and well logs from each of the key wells to assure the Alert Levels are founded on sound data and methodologies as recommended by the TAC and desired by the District.

B. Annual evaluation of groundwater levels in each key well in relation to the current Spring and Late Season Alert Levels.

C. Comparison of current Spring and Late Season Alert Levels to well construction log information describing the well depth distribution of other wells surrounding each key well.

Figure 17 provides an example well depth distribution chart for the nine square miles surrounding Key Well (27N02W30COO2M) in the Dye Creek Sub-basin. It shows that the Key Well is constructed to a depth of 296 feet and represents some of the deeper wells surrounding it. It also points out that many of the domestic wells in the area surrounding it are not constructed as deep and that this should be considered during the annual evaluation of groundwater levels in relation to the Alert Levels. All of the known groundwater wells within a nine square mile area surrounding this key well appear to be constructed to depths greater than the Spring Stage 2 and Late Season Alert Levels. This is not necessarily the case for other key wells in the county. The well depth distribution graphic was developed from Well Completion Reports filed with the California Department of Water Resources, Northern Region.

D. Identification of key wells where monitoring has been discontinued and potential replacements for them or the addition of key wells to further address groundwater and surface water interactions.

E. The evaluation of groundwater level data collected from recently constructed dedicated groundwater monitoring wells to determine which well completion is most representative of the neighboring well infrastructure and then develop Alert Levels for that specific completion.

F. Identification of possible key wells in sub-basins that currently that do not have monitoring (Bend, Corning West, and South Battle Creek) and begin developing a history of groundwater levels that could help to eventually establish Alert Levels within these sub-basins.

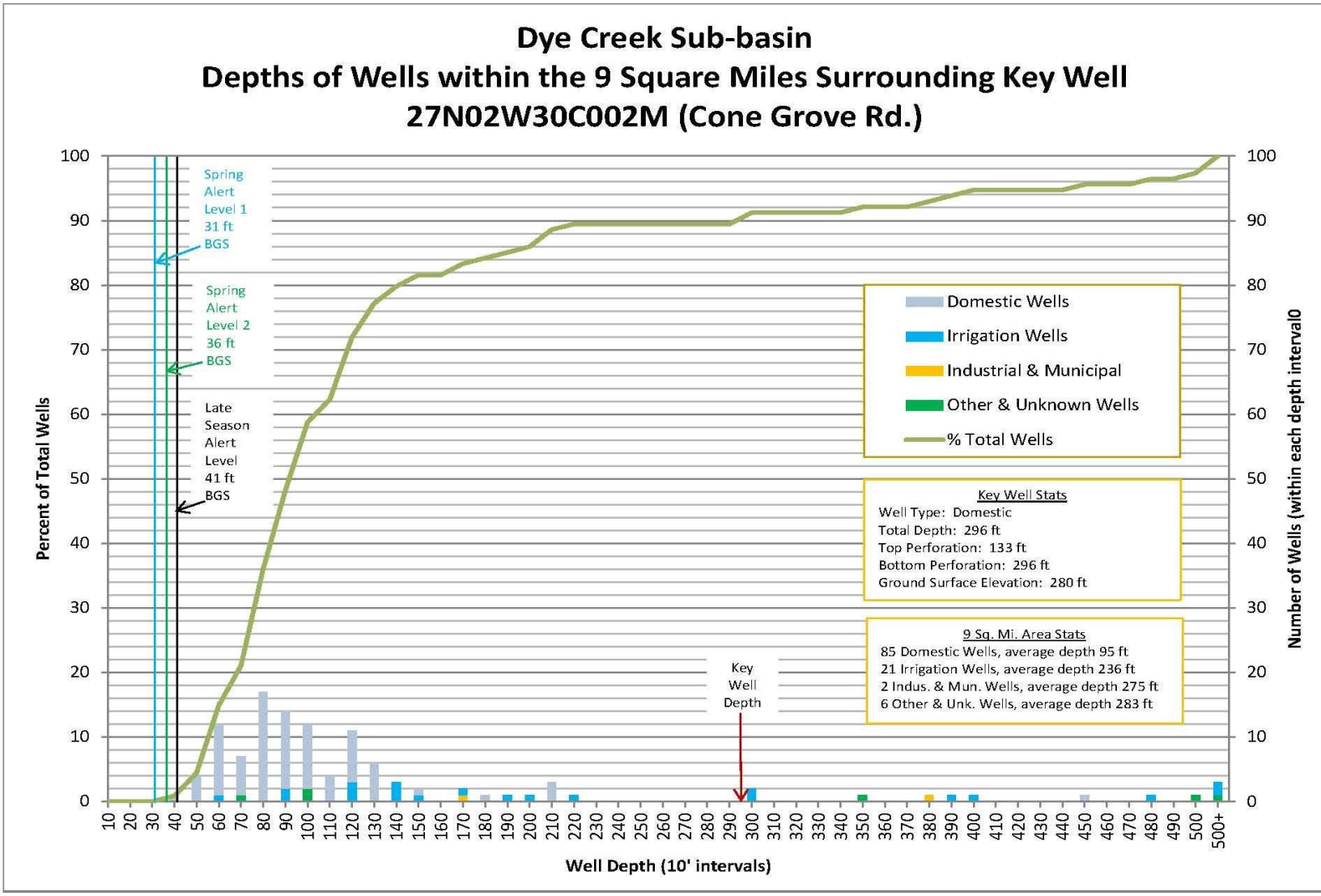


Figure 17. Example of Well Depth Distribution of water wells within nine square mile area surrounding a Key Well (27N02W30C002M) in the Cone Grove area of the Dye Creek Sub-basin.

Plan Administration:

Section 336. The Tehama County Flood Control and Water Conservation District will administer the AB 3030 Coordinated Groundwater Management Plan county-wide. As further discussed in Section 338 and 339, successful implementation of the AB3030 Groundwater Management Plan must achieve collaboration between existing agencies in the County which are empowered with groundwater-related duties. Cooperation with these agencies is essential to a coordinated plan.

Section 337. The primary preference of the District is to include the service areas of all local water purveyors within the boundaries of the Plan. However, any local agency, investor-owned utility or mutual water company that objects in writing to the enforcement of the Plan within their service area may be exempted from the plan.

Section 338. If responsible local agencies within the boundaries of the County are not willing to provide the District with the authority to manage the basin within their service area under Water Code section 10750 *et seq.,* these agencies may implement their own groundwater management plan and coordinate with the District in accordance with the Water Code.

Section 339. Administration of the groundwater management plan will be accomplished by District staff and will receive oversight from the Tehama County Flood Control and Water Conservation District Board of Directors. A Technical Advisory Committee (see Section 400) shall act as an advisory body to District administrative efforts via the Executive Director of the Flood Control and Water Conservation District (Executive Director) or his authorized agent.

Section 340. Resolution 02-2004, adopted January 27, 2004, established a Dispute Resolution Process for the Tehama County AB3030 Groundwater Management Plan. This procedure shall be followed to address disputes relative to the Plan. Refer to Appendix B-3 to view the entire resolution. It is outlined below:

A. Submit concerns to the District's Water Resource Manager who will prepare background information and a report. In the event that this position is vacant, submit concerns to the District Office with attention to the Executive Director;
B. The issue will be scheduled on the AB 3030 Groundwater Management Plan Technical Advisory Committee Agenda for discussion;
C. The Water Resources Manager or other designated District staff will incorporate the TAC comments into a report to the District Board of Directors;
D. The issue will be scheduled on the agenda of the next regularly scheduled Board of Directors meeting within 60-days;
E. Board of Directors will hear the issue and make recommendations based on legal counsel review.

Phase I – Passive Management:

Section 341. Phase I, passive management activities, shall be the first management level implemented by the Tehama County Flood Control and Water Conservation District. These operations consist of non-intervening activities such as water level and water quality monitoring, coordination with government agencies, development of data inventory, data evaluation, utilization of a technical advisory committee, issuance of annual reports, and promotion of public education and involvement with groundwater issues.

Section 342. During each year of implementation of the Plan, the District shall evaluate the results of its efforts and determine the most effective method to continue with its implementation. District staff and the TAC shall work together to prepare written reports that summarize progress in implementing the Plan and priorities for the upcoming year. These reports shall be presented and submitted to the District's Board for review, comment, and approval. They shall also be posted for public access on the District's website. The Executive Director or other designated District staff and TAC Chair or Vice Chair shall attend monthly District Board meetings and provide updates. Public workshops may be conducted as needed to inform the broader public of activities related to implementing the Plan.

Section 343. In accordance with Water Code section 10753, subdivision (c), any amendments to the adopted Plan shall be developed, considered, and approved or disapproved through the same process as the original plan adoption and the present revision.

Data inventory and evaluation strategy – Study / Investigations:

Section 345. The District shall collect data, conduct technical investigations, and receive data to carry out this Plan in a manner that prevents the use of unnecessary and potentially burdensome management techniques. All data collection and technical investigations authorized under this Plan shall be carried out by the District or under its direct supervision. The Guidelines, as described below, shall be followed to carry out data collection and technical investigations under the Plan in as efficient and cost-effective ways as possible:

A. Preference for Utilization of Existing Data Bases. To avoid incurring unnecessary costs, the District shall determine the status of existing studies and monitoring programs carried out within the its Basins by federal, state and local agencies. Where possible, existing data collection programs should be incorporated into the Plan implementation. The District will also compete for public or private grant funds to offset costs to implement the Plan.

B. Expansion of Data Collection Efforts. Where significant and important data are missing or incomplete, the District will make recommendations on methods to develop a more complete data base.

C. The District shall also review the Plan and Plan administration performance on an annual basis.
D. The District may prepare, or receive reports on groundwater and supplemental water supplies and conditions within the plan area. The District may identify information useful to a water replenishment or conjunctive management project and prepare reports on the utility of these types of projects within the Plan area.

E. The District may prepare or receive reports on groundwater quality within the County. The District may identify additional plans, programs or projects for the protection of water quality.

Strategy to monitor groundwater conditions and coordinate with other agencies:

Section 360. The Plan complements Chapter 9.40 of the Tehama County Code ("Aquifer Protection"). To protect and/or enhance the quality and quantity of water within the basin, the District has established a basin monitoring program and shall change or expand it as needed. The monitoring program consists of the measures identified in these sections and shall be implemented through cooperation with other public and private water agencies and by the adoption of rules and regulations as needed.

A. Monitoring Basin Conditions: The ongoing collection and analysis of basic hydrologic data are important elements of the Management Plan. Monitoring is essential to characterize Basin conditions and to provide the technical information needed to make decisions regarding the optimal use and management of the Groundwater Basin. Monitoring of the Basin enables the District to: 1) Increase and document the understanding of the County's groundwater resources, 2) Identify changing conditions, 3) Implement specific programs, and 4) Document the effectiveness of the management program.

B. Use of Existing Monitoring Data: The District shall coordinate with the California Department of Water Resources, Northern Region to comply with the CASGEM program (California Water Code Sections 10920 and 12924). The District shall use groundwater elevation monitoring to achieve local management objectives and CASGEM program goals in the same effort.

C. Monitoring Changes in Water Levels: The District has established one or more key wells within 9 of 12 sub-basins in the County for the purpose of monitoring groundwater levels and storage. The District shall seek to establish key wells and groundwater level monitoring in the South Battle Creek, Bend, and Corning West sub-basins to establish monitoring in all 12 groundwater sub-basins. Groundwater level data within these three sub-basins shall be used to develop a groundwater level history. Monitoring in key wells and establishment of Alerts and Awareness Stages and Actions will allow the District to understand how groundwater levels are responding to variable climatic conditions, growing population, changing land and water use practices, and respond as needed. The

number and location of these wells will change as needed and will be determined by the District.

D. Dedicated monitoring well network. Over the long term, the District shall pursue the establishment of a countywide groundwater monitoring network consisting of dedicated monitoring wells only. Since 2003, the District has worked with DWR, Northern Region to construct seven dedicated groundwater monitoring wells with multiple completions in Tehama County. One dedicated monitoring well is located in the Bowman sub-basin where the Tehama County General Plan indicates considerable potential for future growth. Six are located in the Red Bluff East and Corning East sub-basins where groundwater extraction is the primary source of water and where the 2003 Water Inventory and Analysis indicate water shortages are more likely to occur in the future.

Construction has been funded by grants from the Local Groundwater Management Assistance Act of 2000. These small diameter wells (typically 2.5 inches) are not used to extract groundwater other than very small samples for water quality analysis. Usually one large borehole will contain clusters of three or four of these small diameter wells often referred to as "multiple completions". Each well or completion within the cluster extends to a different depth to target a specific water bearing formation. Well screens are installed in each well at selected depths that correspond with primary gravel and sand strata that are expected to bear water most efficiently. Each well is sealed with bentonite to isolate it from the other wells above or below it, so that there is no influence between aquifer zones.

Dedicated monitoring wells with multiple completions have advantages over using domestic, irrigation, and municipal or industrial (M&I) water wells to monitor groundwater levels. Some advantages include:

1. Groundwater level measurements are not subject to error that may be caused by extraction of groundwater within the well prior to measuring water levels or oil in the well column since pumps are not installed in these wells.

2. Site specific geology associated with aquifer formations and well construction details are known which may not be the case for some domestic, irrigation, or M&I wells used in the monitoring network. This is important when evaluating and interpreting data.

3. Groundwater level data collected from multiple completions representing different water bearing strata can be evaluated to understand various aquifer characteristics such as connectivity between separate water bearing strata, rate of groundwater movement, direction of movement, and storage.

4. These dedicated monitoring wells fall under the District's authority helping to overcome concerns with having access to the monitoring wells into perpetuity.

E. Monitoring Water Quality Conditions: Due to the existence of relatively high quality groundwater in the County and limited District staff and fiscal resources, the District has engaged in cooperative programs with other agencies to monitor and understand the status of groundwater quality in Tehama County. A recent example is the Groundwater Ambient Monitoring and Assessment (GAMA) program that is administered jointly by the California State Water Resources Control Board and the United States Geological Survey (references #9 and #19 in Appendix D-1). Another potential program that the District may at times engage is the California Department of Pesticide Regulation Groundwater Protection Program (reference #3). Along with cooperative efforts, the District shall work towards including approximately one monitoring well within each sub-basin for the purpose of routinely measuring simple physical and chemical water quality constituents within the sub-basin. The number and location of these wells will be determined by the District.

Section 362. The District completed a Water Inventory and Analysis in 2003 to examine the County's net water balance and begin to approximate "Safe Yield". Refer to citation #16 in Appendix D-1 to acquire additional information. Results estimate the net water balance for each sub-basin and in total for Tehama County during normal, dry, and wet years. The District shall rely on results from annual groundwater level monitoring to guide when to update this Water Inventory and Analysis. It may not be necessary from a technical perspective or feasible from a fiscal perspective to conduct an annual update of the Water Inventory and Analysis.

Section 364. Abandoned water wells provide the potential for pollutants or contaminants to enter and/or spread into the groundwater basin. As such, water well abandonment represents a key concern to groundwater management. The District supports the abandonment standards enforced by the County of Tehama via County Code, Chapter 9.42 ("Well Construction, Rehabilitation, Repair and Destruction"). See reference #13 in Appendix D-1 for additional information on this section of Tehama County Code.

Technical Advisory Committee:

Section 400. An interim Technical Advisory Group was formed to serve as an advisory body to the District until the Plan was adopted by the District Board in 1996. By 1998, a permanent nine member Technical Advisory Committee (TAC) had been formed with by-laws guiding the makeup of the committee membership, terms of service, and process for incoming and outgoing members. In May 2011, the District's Board approved updated by-laws that expanded the TAC to 10 members by adding a representative of the City of Tehama. In the future, there may be a need to consider expanding the TAC membership to include other representatives (i.e. watershed conservancies, domestic well representatives, or stream diverters). The new by-laws also provide more flexibility for TAC members to designate a voting representative on their behalf in the event of unavoidable and excused absences to improve attendance and provide a quorum for the meetings. See Appendix B-2 for a copy of the by-laws.

Section 401. The TAC is comprised of licensed engineers, geologist, hydrogeologists, hydrologists, representatives of the agricultural industry, city municipalities, and environmental

interests. The TAC shall review data, studies, reports and information which are collected, received or prepared by the District and make recommendations to the District Board.

Section 402. The TAC committee shall operate pursuant to the rules, regulations and procedures which may hereafter be established by the District and it shall have only those powers set forth therein. Eligibility to serve on the TAC shall be limited to those persons with technical expertise in water-related fields (e.g. engineering, hydrology, geology, water supply and management) or have direct interest in water resources for agricultural, domestic, environmental, industrial, or municipal uses.

Section 403. Zone Advisory Committees. In the future, Zone Advisory Committees may be formed in individual groundwater sub-basins of Tehama County as needed. To date, Zone Advisory Committees have not been needed during implementation of the passive, Phase 1 of the Plan.

Public Education and Community Relations:

Section 410. It is essential to involve the public, agricultural, industrial and business communities during development and implementation of the Groundwater Management Plan. Public education and community relations shall be an integral element to groundwater management in Tehama County

Section 412. The District shall provide groundwater educational services to the public through public presentations, published information items, and references to groundwater data available through its own investigations or other public agencies. The District is working to:

A. Develop scientifically sound, technical data which is the foundation for the information conveyed to general public. Selected examples include:

- The 2003 Water Inventory and Analysis for Tehama County which begins to quantify the net water balance and safe yield for the County;

- Groundwater Level Hydrographs and Alerts which provide historic and site specific trends in groundwater levels and identifies critically low levels;

- Use of groundwater level data to prepare Groundwater level contour maps to depict areas and seasons with significant groundwater demand and drawdown; and

- A summary of well completion logs surrounding Key Wells throughout different groundwater sub-basins of Tehama County. This information helps to understand the existing water well infrastructure in the County so that the Plan can sustain it over the long-term. This information also may provide insight to guide construction of water wells in the future.

B. Conduct public outreach directly and collaborate with other public and private agencies that also engage the general public of Tehama County. Examples include:

- The District maintains its own website where it provides public access to databases and to technical reports, Board agendas and minutes, and TAC agendas and minutes. Refer to Appendix D-1, reference #16.

- The District provides public workshops as needed. An example is a series of seven public workshops held throughout Tehama County in 2009 to implement Groundwater Level Alerts and Awareness Actions.

- Collaborating with the University of California Cooperative Extension, the Tehama County Farm Bureau, and the Tehama County Resource Conservation District by participating in Annual or Biennial Symposiums or Field Tours related to Water Resource Management in Tehama County.

C. Engage surrounding counties and other outside entities that share an interest in the water resources of Tehama County and the northern Sacramento Valley area. Examples include:

- Signatory member of the Northern Sacramento Valley Integrated Regional Water Management Planning process.

- Member of the Northern California Water Association.

- Annual presenter in the Water Education Foundation's Northern California Water Tour.

Phase II Tasks:

Section 500. Water Code section 10753.8 lists 12 components that may be included in a groundwater management plan. These components are in addition to those elements mandated by Water Code section 10753.7 and listed in Table 3-2 of Section 315 of this Plan. The priority management components listed in Table 3-2 are included as "Phase I" tasks. Phase II activities shall consist of extension and expansion of Phase I activities, as well as more involved management activities, as outlined in Table 3-6 below.

Table 3-6. Planned Phase II Groundwater Management Activities.

Component Number	Activity
1	Mitigation of declining groundwater supplies or quality that represent likely threats to existing water well infrastructure.
2	Coordination with land use planning agencies to assess activities of likely risk to groundwater storage or groundwater contamination.
3	Promotion of water conservation programs.
4	Identification and management of wellhead protection areas and recharge areas.
5	Identification of well construction policies.
6	Protection of Beneficial Uses.
7	Facilitating conjunctive water management.
8	The development of relationships with state and federal regulatory agencies.

Phase II - Extension of Phase I Activities

Section 510. Phase II Management shall continue with the management activities established during Phase I. These activities may also include additional data collection and evaluation of the management activities described in Sections 315 through 335 of this Plan as well as other possible options not yet identified.

Phase II - Declining Groundwater Supplies, Water Quality, and Groundwater Replenishment

Section 520. Where necessary to ameliorate declining groundwater conditions that present a likely threat to existing water well infrastructure or water quality degradation, the District may undertake a groundwater replenishment program. The District may carry out the water replenishment activities identified herein.

Section 521. In the event periodic Water Inventory and Analyses identify groundwater sub-basin(s) in Tehama County with a potential water supply shortage, and the ongoing Alert Level program demonstrates a likely threat to existing water well infrastructure, or a threat to groundwater quality, or presence of inelastic land subsidence, the District shall cause an investigation to identify potential replenishment projects to be carried out for the benefit of the sub-basin(s).

Section 522. Upon a determination that the basin or a sub-basin in the County is experiencing a likely threat from declining groundwater supply, water quality degradation, or subsidence, the technical advisory committee, upon direction by the District, shall make a recommendation concerning preferred projects and the feasibility of developing and operating a replenishment project within the Plan area.

Section 523. The District may acquire supplemental water for the purpose of replenishing the affected sub-basin(s).

Section 524. If a replenishment project or projects appears viable, the District shall not levy any assessments or fees under the authority of Water Code sections 10750 et seq. related to the operation of a replenishment project until the assessments or fees have been approved by a popular vote within the Plan area. The District shall determine the area in which the vote is to be conducted in accordance with the requirements of Water Code section 10754.3. Any project must also comply with all applicable provisions of Proposition 218 (1996), Proposition 26 (2010), and the California Environmental Quality Act.

Section 525. Upon receiving authorization of a majority vote of those cast, as set forth in the preceding section, the District may recover the costs associated with the acquisition of supplemental water and operation of the replenishment project.

Section 526. After determining that alternative water supplies and/or a replenishment program are unavailable or infeasible, the District may consider other management options, including as a last resort, adopting rules and regulations limiting the quantity of water extracted from extraction facilities within the affected sub-basin(s) and establishing priorities for available supplies.

Section 527. In the event the District adopts restrictions on the extraction of groundwater, the following beneficial uses shall be ranked highest priority to available water supplies, as summarized in Table 3-7. Under the Plan, the District may consider imposing a hierarchy between subcategories of each priority designation listed in this table, or other methodology to impose reductions in an equitable manner.

Table 3-7. Priority Ranking of Beneficial Uses in Tehama County.

Priority Designation	Beneficial Use
A.	Fire, health and sanitation within the plan area.
B.	Essential household domestic uses, agricultural irrigation, manufacturing, processing, and business uses.
C.	Domestic lawn and yard irrigation.
D.	All other uses overlying the 12 defined groundwater sub-basins in the County (e.g. swimming pools, water ski lakes, car washes, etc…).
E.	All other areas within the Plan area that do not overlie a defined groundwater sub-basin (e.g. Mountain Region East and Mountain Region West).
F.	Essential export uses.
G.	All other uses.

Section 528. Upon a determination that a significant threat of water quality degradation exists within any sub-basin within the Plan area, the District will work with parties and/or agencies responsible for the degradation and/or mitigation to conduct an analysis of what remedial measures are required to reverse or alleviate the degradation. The analysis shall be completed within one year from the District determination of degradation.

Section 529. Upon a determination that ground levels are subsiding within the Plan area, the District will conduct an analysis of the magnitude of the subsidence problem and potential remedial measures required to mitigate the land subsidence. The analysis shall be completed within one year of the date the District determines that subsidence exists within the basin.

Phase II - Water Conservation

Section 535. Urban water users shall be encouraged to comply with the provisions of the Best Management Practices Memorandum, first adopted in December 1991 by the California Urban Water Conservation Council and last amended in September 2009. Future revisions to the Memorandum may occur and urban water users will be encouraged to meet new provisions. This is consistent with Water Code 10608 (g), a call for 20 percent per capita reduction in urban water use statewide by 2020.

A. The District shall coordinate with the Tehama County Planning Department to provide groundwater conservation information to prospective developers in the County.

B. The District shall coordinate with the Tehama County Department of Building and Safety to provide groundwater conservation information to builders in the County.

C. The District will encourage the use of recycled water as a potential conservation technique.

D. The District will collaborate with the Cities of Red Bluff, Corning, and Tehama, signatories to this Plan, to support activities that promote urban water conservation.

Section 536. Since 1996 when the Tehama County Groundwater Management Plan was adopted, the types of irrigated crops have changed. Orchard crop acreage has increased about 41 percent through 2010. Drip and microsprinkler irrigation methods, which have the potential to be highly efficient, are being used to irrigate almost all of the additional orchard crops that have come into production since 1996. A large majority of the orchards that were in production prior to adoption of the Plan have been converted to drip or microspinkler irrigation. Agricultural water users shall be encouraged through programs of education and incentives to conserve water in their irrigation practices and produce food, feed, and fiber crops as efficiently as possible. Such activities are consistent with Water Code, Sections 10631.5, 10608, 10800, and 85021 and the draft report to the legislature "Quantifying the Efficiency of Agriculture Water Use". See Appendix D-1, citation #7.

A. The District shall provide educational materials to assist agriculture operations to become as efficient as possible.

B. The District shall provide references to public and private programs and materials designed to improve agricultural efficiency. Selected examples of water conservation and efficiency programs include:

1. Natural Resources Conservation Service (NRCS) incentive programs
2. Pacific Gas and Electric incentive and rebate programs
3. Tehama County Resource Conservation District Mobile Irrigation Lab
4. University of California Cooperative Extension Irrigation program

C. The District shall continue to coordinate with the DWR, Northern Region office of local assistance, Tehama County Farm Bureau, Tehama County Cattlemen's Association, and the various agricultural water districts in the county to expand upon and further support agriculture efficiency and water conservation programs.

Phase II - Coordination with Local Land Use Planning Agencies to Assess Activities of Potential Risk to Groundwater Supply or Risk of Groundwater Contamination

Section 540. In Tehama County, land use decisions are made by city and county government agencies in accordance with their respective General Plans. In the unincorporated area, the County's actions are governed by the 2009-2029 Tehama County General Plan. Section 6.2 in the Open Space and Conservation Element of the General Plan highlights the heavy reliance on groundwater in Tehama County, and acknowledges the role of this AB3030 Groundwater Management Plan as a mechanism to manage and sustain groundwater supplies over the long-term. The District recognizes that review of land use plans and coordination with local, sub-regional and regional land use planning agencies is an integral component of a successful groundwater management plan.

Section 541. The District shall develop communications with the Tehama County Department of Planning, the Tehama County Department of Agriculture, and other local planning agencies in Tehama County and nearby counties, regulatory agencies and private individual landowners to assist in ensuring that land use decisions are made based on a sound understanding of local water supply and quality. The District shall assist local planners whenever necessary to strengthen land use decisions which contribute to the protection of groundwater quality in the basin. The District shall support and encourage Technical Advisory Committee members to serve on land use planning committees (and vice-versa) to strengthen linkages between land use planning and groundwater management.

Section 542. The District recognizes the existing roles and responsibilities of city planning departments, the Tehama County Planning Department, Tehama County Department of Environmental Health, adjacent counties, State Water Resources Control Board (Water Code

Section 13100), Department of Water Resources (Water Code Section 10912), Department of Public Health, and the Environmental Protection Agency relative to management of groundwater supplies and protection of groundwater quality within the Plan area. Working with these agencies shall assure conformity with approved practices and avoid redundant jurisdictional overlaps.

Phase II - Identification and Management of Wellhead Protection Areas and Recharge Areas.

Section 545. A Wellhead Protection Area (WHPA), as defined by the 1986 Safe Drinking Water Act Amendments, is "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The WHPA may also be the recharge area that provides the water to a well or wellfield.

Section 546. Wellhead protection programs are not regulatory by nature, nor do they address specific sources. Beginning in 1997, the California Department of Public Health Division of Drinking Water and Environmental Management began administering drinking water Source Water Assessments and Source Protection Assessments for municipalities and community service districts. This program is designed to focus on identifying potential sources of drinking water contamination in urban and small community settings and on identifying the best suited management practices that prevent contamination. In 2004, the California Department of Pesticide Regulation initiated a Groundwater Protection Program focusing on groundwater contamination in farm settings. This program focuses on preventing potential contaminants in recharge areas from reaching groundwater with a specific focus on wellhead protection. The District shall collaborate and support these programs as appropriate.

Section 547. Included in their Phase II Management duties, the District may consider assessments as required to assist in the management of local Wellhead Protection Areas. Consideration of any assessments shall be subject to approval by signatories to this Plan and any applicable public approval process required under AB 3030, Proposition 218 (1996), and/or Proposition 26 (2010)**.**

Section 548. The District shall support implementation of Section 9.42 in Tehama County Code "Destruction of Wells". Requirements to properly abate and abandon wells including exploration and test holes to prevent groundwater contamination. The Department of Environmental Health is responsible to implement this section of County Code.

Phase II - Identification of Well Construction Policies:

Section 550. Chapter 9.42 of Tehama County Code provides standards for well construction, testing, and inspection (Ordinance No. 1707, 1999). Well drilling methods, well design and construction, and well development influences extraction rates, the radius of influence, groundwater levels, prevention of groundwater contamination, and overall aquifer performance.

Section 551. The District shall support activities to identify reasonable well construction policy that assists managing competition for groundwater extraction and reduces risk of third party impacts on pumping levels and groundwater quality. Such policy may be specific to individual groundwater sub-basins.

Phase II - Protection of Beneficial Uses

Section 555. No groundwater shall be transferred from an extraction facility lying within any sub-basin for use on land overlying any other sub-basin or be transferred for use outside the Plan Area unless the operator has applied for, and obtained, a transfer permit from the District. The transfer permit shall establish the terms and conditions applicable to the transfer and it shall state the quantity of water which may be transferred. The District shall not issue any permits for transfer unless the applicant has first established that the sub-basin from which the transfer will originate has sufficient groundwater available in excess of the amount required for reasonable and beneficial uses within the relevant sub-basin and the District determines that the transfer would not adversely affect the rights of the groundwater users within the sub-basin or the public interest.

In establishing sub-basin boundaries and implementing permitting requirements, the District will carefully balance the Plan goal of protecting sub-basin hydrologic integrity against the pragmatic need to achieve practical administration of the Plan.

Section 556. All permits issued pursuant to Section 555 shall declare that they are subject to the right of the District to reduce or suspend such transfers pursuant to the rules established by the District from time to time, and all permits shall be subject to the continuing jurisdiction and review of the District. The District shall, after published notice and a hearing which discloses evidence of overdraft of a sub-basin or a substantial threat of overdraft, consider whether the transfer be reduced or suspended.

Section 557. Any operator seeking to obtain a transfer permit under this Section shall also be required to demonstrate compliance with any ordinances, regulations or requirements concerning the off-parcel us or export of groundwater as established by the County of Tehama. Nothing herein is intended nor shall it be construed as limiting or abridging the power of the County to adopt ordinances, rules or regulations concerning the off-parcel use or export of groundwater as the County may in sole discretion determine. (See Sections 105 – 107).

Phase II - Facilitating Conjunctive Water Management Operations

Section 560. Conjunctive water management is the coordinated operation of groundwater and surface water supplies to add reliability to existing supplies and to maximize the number of beneficial uses within the Plan area. It also includes important components of groundwater management such as monitoring, evaluation of monitoring data to develop local management objectives (Alert Levels), and use of monitoring data to establish and guide local management

policies. The District shall evaluate the potential for facilitating conjunctive water management operations within the Plan Area.

Section 561. The District may develop conjunctive water management evaluations to maximize the beneficial use of water within the Plan Area, including, but not limited to the following:

A. Identify potential surplus surface water sources in years of high precipitation.
B. Identify potential conveyance facilities.
C. Identify potential recharge areas.
D. Determine useable storage capacity in aquifers.
E. Identify and/or develop groundwater extraction facilities.
F. Identify and/or develop distribution facilities for surface water and groundwater.

Section 562. The need for investigation, construction and operation of these facilities shall be determined by the District, according to the needs of the County. In 2011, the District completed a preliminary study: "Tehama County Groundwater Recharge Area Location Study". Refer to Appendix C-4 and Appendix D-1, reference #16. The study was conducted to identify areas within the County that would be potential locations for operation of a groundwater recharge project. The study was initiated partly in response to declining groundwater levels in the Corning East and Red Bluff East sub-basins over the past decade. Also, the District will be in communication with the Glenn County Water Advisory Committee as they conduct an In-lieu Recharge Feasibility Study in the Glenn County portion of the Corning East Sub-basin. The Corning East Sub-basin crosses the Tehama-Glenn County boundary and engagement in the study is pertinent to the District and Tehama County.

Phase II - Development of Relationships with State and Federal Regulatory Agencies

Section 565. The District shall develop effective relationships with appropriate state and federal agencies as it implements the County's Groundwater Management Plan. It is advantageous to the District and the citizens of Tehama County to develop these relationships to ensure the desire for local management is recognized, conformity with regulations is achieved, and jurisdictional overlaps are avoided. This activity is also a listed component of groundwater management in Water Code Section 10753.8.

Phase III Activities:

Section 570. Long-term management-intensive activities (Phase III – "Active Management") are summarized in Table 3-8.

Table 3-8. Phase III Management Components.

Component Number	Activity
1	The construction and operation of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
2	Regulation of the migration of contaminated groundwater.

Section 571. The components listed in Table 3-8 are tasks which can be included in a groundwater management plan, as specified in Water Code Section 10753.8. Each of these items is briefly discussed below. The groundwater management plan developed by the District shall not be limited to these components, since other features may be adopted in the future, as required, by the District Board of Directors.

Phase III - Construction and Operation of Groundwater Management Facilities

Section 575. The District may plan, construct, and maintain certain project facilities to assure that water quality is protected and that the quantity of groundwater in storage is managed to meet long-term demands. Future results from the Alert Level element of this Plan and Water Inventory and Analysis may reveal the need for feasibility studies, and if warranted, construction and operation of the following types of facilities:

A. Groundwater Recharge Facilities
   1. Stream beds
   2. Spreading grounds
   3. Percolation basins
   4. Injection wells
   5. Surface water delivery systems

B. Groundwater Extraction Projects
   1. Shifting of groundwater extractions from one part of the basin to another.
   2. Use of surface water instead of groundwater during surpluses, in exchange for increase extraction of groundwater during dry periods.

C. Groundwater Contamination Cleanup Projects

Phase III - Regulation of Contaminated Groundwater Migration

Section 580. Effective control and cleanup of contaminated groundwater requires the following components:

A. Coordination between regulatory agencies.
B. Source control.
C. Understanding of the local hydrogeology.
D. Delineation of the contamination.

The District shall support the regulatory authority and expertise practiced by the Tehama County Department of Environmental Health, State and Regional Water Boards, State Department of Toxic Substances, and the U.S. Environmental Protection Agency relative to these four components in Tehama County.

Section 581. The District may confer with the County, the California Regional Water Quality Control Board and retail water purveyors within the Plan area to determine whether coordination of their individual or cumulative extraction and/or discharge activities may have a beneficial impact on the quality of water within the groundwater basin.

Section 582. The District shall encourage all water users within the Plan area to exercise good faith to avoid the possibility of contaminating groundwater within the Plan area.

Phase III - Control of Saline Water Intrusion and Other Contaminants

Section 585. While saline water does not currently constitute a problem to Tehama County groundwater, there are indications that the potential does exist for increased future salinity in some areas. One potential source of saline water intrusion into fresh water aquifers is from unsealed or improperly sealed natural gas wells that are no longer productive and have been abandoned or abandoned test holes during exploration phases for natural gas. Natural gas wells are deep wells that are constructed in the marine aquifer formations described in Sections 207 of this Plan. The District shall support regulation and oversight by the California Department of Conservation's Division of Oil, Gas, and Geothermal Resources, the California State Water Resources Control Board, and other state and federal agencies. The District shall consider the control of saline water intrusion a Phase III management activity, with anticipated controls generally described at this time in Table 3-9, below.

Section 586. Other types and sources of potential groundwater contaminants include nitrate from private and public sewage disposal systems, pesticides from home, urban, and agricultural, urban and farm fertilizer practices, and organic compounds from various industrial activities. The District shall work cooperatively with appropriate agencies with jurisdiction over these types of activities and groundwater quality concerns. This may include local agencies such as city governments, the Tehama County Department of Environmental Health and Safety, the Tehama County Department of Agriculture, and others. It may also include regional and state entities

such as the Northern Sacramento Valley Integrated Regional Water Management Planning group, the Central Valley Regional Water Quality Control Board, the California Department of Pesticide Regulation, and the California State Water Quality Control Board.

Table 3-9. Saline Water Intrusion and Other Contaminants: Anticipated Sources and Controls.

Saline Water Source	Control
Upward migration of saline groundwater	Well construction policy, extraction reduction, and artificial recharge, and Coordination with other appropriate regulatory agencies.
Downward seepage of sewage, agricultural, or industrial contaminants	Coordination with land use planning agencies other appropriate regulatory agencies, and public education.
Interaquifer Migration of Saline groundwater	Enforcement of well construction and abandonment standards.

Exemptions

Section 600. Operators who extract less than 1.5 acre feet per year from their wells are exempt from all provisions of this plan. Single family residences served by a single well are statutorily exempted per Water Code Section 10755.4.

Implementing Rules and Regulations

Section 610. The Tehama County Flood Control and Water Conservation District shall review the Plan and Plan administration performance on an annual basis, as discussed in Section 342. Consequently, the District will have to adopt rules and regulations from time to time, to implement provisions of this plan and applicable future modifications. These rules shall be adopted by the Tehama County Flood Control and Water Conservation District Board of Directors through ordinance or resolution and do not constitute a Plan amendment.

List of Appendices

List of Appendices

APPENDIX A – PLAN ELEMENTS, DEFINITIONS, AND PLAN BACKGROUND

Appendix A-1

Alphabetized Index to Elements of Groundwater Management Plan as Required or Suggested by California Water Code or Voluntarily Included in Plan

APPENDIX A-1
ALPHABETIZED INDEX TO ELEMENTS OF GROUNDWATER MANAGEMENT PLAN AS REQUIRED OR SUGGESTED BY CALIFORNIA WATER CODE OR VOLUNTARILY INCLUDED IN PLAN.

Required/ Sugggested/ Voluntary	Description	Page(s)
Required	**Agency Cooperation** – Work cooperatively with other local public and private entities whose service area overlies the groundwater basin.	3, 5, 20-21, 36, 44, 45, 48, 49, 59, 61, Appendix B-1
Suggested	**BMO's, Goals, and Actions –** Goal to maintain reliable groundwater for long term beneficial use. Description of how management objectives and planned actions work towards goal.	1, 2, 42, 43
Required	**Basin Management Objectives** – Specific objectives relating to groundwater recharge and extraction as indicated by monitoring groundwater levels, groundwater quality, inelastic land subsidence, recharge investigations, and assessment of existing groundwater well infrastructure.	50-58, Appendix C-3
Voluntary	**Conjunctive Use Operations** – Plan identifies conjunctive use of surface and groundwater resources as a potential means of increasing water use availability, reliability, and is flexible to consider facilitating conjunctive water use operations.	66, 71
Voluntary	**Construction and Operation of Groundwater Management Projects** – Plan discusses strategies, opportunities and potential limitations to construct and operate specific groundwater management facilities.	23, 73
Voluntary	**Groundwater Contamination** – Plan describes approach to manage and regulate migration of contaminated groundwater.	69
Voluntary	**Groundwater Extraction and Replenishment** – Strategies for groundwater extraction and replenishment.	37, 73, Appendix C-4
Required	**Plan Adoption** – Status of Groundwater Management Plan Update and adoption as local policy.	Preface, 48
Suggested	**Groundwater Management Plan Guidance** – Managing entity (District) establishes an advisory committee of interested parties to guide implementation of the Plan.	63, 64, Appendix B-2
Suggested	**Groundwater Management Plan Implementation** – Managing entity (District) summarizes groundwater basin conditions and management activities in reoccurring reports to governing Board and public. Intent is to communicate and illustrate progress in achieving management goals and objectives. Plan implementation includes dispute resolution outlining process to resolve conflicts.	59, 60
Required	**Groundwater Management Outside of Plan Area –** Description of local agencies outside of the Plan area but within Tehama County using similar principles to manage groundwater.	26, 27

Suggested	**Integrated Regional Water Management (IRWM) Planning –** Actions taken to coordinate with other land use, zoning, and water management planning entities beyond the scope of this Plan.	19, Appendix B-4
Voluntary	**Land Use Planning –** Review land use plans and coordinate with land use planning agencies to assess activities for risk to groundwater supplies and quality.	14, 69
Suggested	**Management Area –** Describe physical setting and characteristics of the aquifers underlying the Plan area. Include discussion of historic surface water and groundwater conditions and need for Plan. Assess and anticipate changing water resource needs.	4-19, 32-42, Appendix A-3
Required	**Map of Plan Area –** Map and general description of overall Plan area, boundaries of specific groundwater basins within the Plan area, alignment between Plan boundaries and boundaries defined in California Department of Water Resources (DWR) Bulletin 118, and identity other local water agencies with authority to manage water resources within the Plan area.	4, 5
Voluntary	**Monitoring Entity(s)** - Recognized by DWR as a monitoring entity for Tehama County and as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) Program.	61, Appendix C-2
Suggested	**Monitoring Plan Description** – General description of "phased approach" taken to implement monitoring and other aspects of Plan.	50
Required	**Monitoring Protocols –** Description of monitoring protocols to effectively detect change in groundwater levels, groundwater quality, inelastic land subsidence, surface and groundwater interactions, and to generate information that promotes active and efficient groundwater management.	27-32, 50-58, Appendix C-3
Required	**Recharge Areas –** Description and map of recharge areas that affect groundwater conditions within the Plan area.	37, 38
Voluntary	**State and Federal Agencies** – Development of relationships with State and federal agencies.	72
Voluntary	**Saline Groundwater Intrusion –** Monitor and manage saline groundwater intrusion into freshwater aquifers.	74, 75
Voluntary	**Wellhead Protection, Abandonment, and Destruction –** Administration of wellhead protection, abandonment, and destruction programs.	70
Voluntary	**Well Construction Policies –** Development, implementation, And oversight of well construction policies.	70

APPENDIX A – PLAN ELEMENTS, DEFINITIONS AND PLAN BACKGROUND

Appendix A-2

Definition of Terms

DEFINITION OF TERMS

Unless expressly otherwise provided in the ordinances, resolutions, rules, regulations and agreements implementing the provisions of this plan, the terms defined in this plan shall control the interpretation of this plan.

1. Definitions.

    a. "District" means the Tehama County Flood Control and Water Conservation District.

    b. "Aquifer" means a geologic formation or structure that transmits or stores water in sufficient quantities to supply the extraction of water by wells or springs.

    c. "Basins" means the two basins as originally established in DWR Bulletin 118-80

    d. "Board" means the Board of Directors of the Tehama County Flood Control and Water Conservation District. The Board of Supervisors of the County of Tehama act as the ex-officio Board of Directors of the Tehama County Flood Control and Water Conservation District.

    e. "Conjunctive Use" means the coordinated operation of groundwater and surface water supplies to add reliability to existing supplies and to maximize the number of beneficial uses that may be safely supplied with water in the Plan Area.

    f. "Export" means the extraction of groundwater from land overlying a basin within Tehama County for use outside of Tehama County.

    g. "Extraction" means the act of obtaining groundwater by pumping or by some other controlled means.

    h. "Extraction Facility" means any device or method for the extraction of groundwater within the basin.

    i. "Groundwater" means percolating groundwater lying beneath the surface, in which the soil is saturated with water. Groundwater shall not include water which flows within known and defined channels and which forms the subsurface flow of a river, stream or creek.

    j. "Groundwater basin" means a geologically and hydrologically defined area, consisting of one or more aquifers and which stores and transmits significant quantities of water.

    k. "Groundwater management activities" means programs, measures, or action taken to preserve, monitor, protect, and enhance groundwater resources within the territory of the District.

l. “Operator” means a person who operates a groundwater extraction facility. If the District is unable to determine who operates a particular facility, then ”operator” shall mean the person to who the extraction facility is assessed by county assessor or, if not separately assessed, the person whom owns the land upon which the facility is located.

m. “Person” included any state, or local agency, private corporation, firm, partnership, individual, group of individuals, or to the extent authorized by law, any federal agency.

n. “Program” means a groundwater management program prepared by the District pursuant to this ordinance/resolution under the provisions of Water Code Section 10750 et seq.

o. “Recharge” means the natural or artificial replenishment of groundwater storage by subsurface infiltration, percolation, or injection of one or more sources of water.

p. “Replenishment” means spreading or injection of water for the purpose of enhancing the recharge to the basin, or otherwise adding to the storage of groundwater within the basin.

q. “Safe yield” is defined to be when the amount of water being pumped equals the replenishment coming into the basin by rainfall, return waters, runoff and underflow.

r. “Supplemental water” means surface water or groundwater imported from outside the watershed or watersheds of the basin and other water supplies that are conserved and added to the natural sources of recharge to the basin, which would have been otherwise lost or would not have reached the basin.

s. “Transfer” shall mean the extraction of groundwater from an extraction facility located on real property lying within one sub-basin for use on land overlying another sub-basin or outside the Plan Area.

t. “Well interference” means a substantial static water level decline in a short period of time in a localized area, which is caused by pumping of groundwater from extraction facilities.

APPENDIX A- DEFINITIONS AND PLAN BACKGROUND

Appendix A-3

Plan Background, Legal Discussion, and Issue Focus

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

SUPPLEMENT TO TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT COORDINATED AB 3030 GROUNDWATER MANAGEMENT PLAN

LEGAL DISCUSSION

ISSUE FOCUS

A number of comments on the Preliminary Draft AB 3030 plan raised legal issues concerning California water law. Appendix D to the Preliminary Draft, entitled *"Summary of Groundwater Law" – excerpt from "Report of the Groundwater Committee"*, provides an excellent summary and overview of the subject. However, the District acknowledges that the laws governing water rights in general, and groundwater management in particular, are commonly viewed as arcane and complex. Given the extent of the many verbal and written comments raising legal issues, a more detailed discussion of some of the legal issues raised by the Plan is warranted.

The discussion is offered to address the concerns raised by the comments and to elucidate the legal rationale and under-pinnings of the District Preliminary Draft. The district acknowledges that this Appendix is by far from the "final word" on any of the items addressed herein. The more humble intention is to supplement the text and facilitate understanding of Plan goals and implementation issues for those interested in the legal framework applicable to water rights and regulation of groundwater as it applies to the District's AB 3030 Plan.

I. INTRODUCTION

A. BASIC GROUNDWATER HYDROLOGY

Legally and technically, all water beneath the surface of the earth is subsurface water or "groundwater." However, in the California water rights context, groundwater has a very specific meaning and importance. For the purpose of determining rights of use, groundwater in California is generally grouped into two classifications: it is either "subsurface flow" through known and definite channels or "percolating groundwater."

Subsurface flow is characterized as water that is moving through permeable material, typically alluvium (sand, gravel, silt and clay), which underlies or comprises the bed of a stream and is essential to the existence of the stream. Although technically groundwater as is found beneath ground surface, subsurface flow is subject to the State Water Resources Control Board (SWRCB) permitting and regulatory processes.

Basically, all water beneath the earth which is not subsurface flow (or groundwater flowing within a known an defined channel) is percolating groundwater. Contrary to images of huge underground lakes, generally percolating groundwater is the water that accumulates in tiny spaces between alluvial material, or in the crevices in fractured hard rock. These water-bearing geologic formations are known as aquifers. A groundwater basin, as a hydro-geologic unit, may contain one large or several connected and interrelated aquifers. However, unlike subsurface flow, the appropriation, extraction or use of percolating groundwater is, absent special circumstances, not subject to SWRCB jurisdiction. Accordingly, the SWRCB does not require a permit to use percolating groundwater.

Indeed as most people in Tehama County are aware, in contrast to the state-controlled licensing process applicable to surface water (and subsurface flow), there is no comprehensive statewide regulatory framework applicable to groundwater. Instead, local communities must manage their local groundwater resources through some combination of local ordinances and AB 3030 plans, or by lobbying the state legislature to create a specific local agency with the power to adopt and enforce a groundwater management plan.

B. WATER RIGHTS INVOLVE THE RIGHT TO USE THE RESOURCE, NOT ABSOLUTE OWNERSHIP OF THE WATER ITSELF

Water rights are property rights. However, this does not mean that landowners "own" unconditionally the water under their property, and therefore are able to do whatever they want with it without government intervention, to the contrary, California long ago rejected what is called the English common law or absolute ownership rule, where landowners own everything beneath their land and are entitled to whatever groundwater can be pumped.

In California, all water is the property of the people of this state. (Water code §§ 100-104.) State law provides that property rights in water, including groundwater, are "usufructuary" only, meaning the right is not one of absolute ownership but merely the opportunity or right to use water within certain prescribed limits (*Locke v. Yorba Irr. Co*. (1950) 35 Cal.2d 205, 211; *See* Water Code § 102; *People v. Shirokow* (1980) 26 Cal.3d 301, 308-309.)

The most important limitation on the right to use water is the reasonable use mandate provided in article X, section 2 of the California Constitution. (*National Audubon Society v. Superior Court* (1983) 33 Cal.3d419, 441-443; *Joslin v. Marin Municipal Water District* (1967) 67 Cal.2d 132.) This constitutional provision requires that use of water must be reasonable and beneficial. Examples of beneficial uses are agricultural irrigation, domestic or municipal use.

(See Water Code §§ 106, 106.5 Cal,. Code Regs., tit., 23 § 661 et seq.). Generally, the reasonable use criteria ensures that water is used efficiently and not wasted. For example, using substantial quantities of a stream to flood a field to drown gophers is very likely to be found "unreasonable". Conversely, using 2.5 acre feet per acre per year to irrigate citrus crops is much more likely to satisfy both the reasonable and beneficial requirements.

C. CORRELATIVE RIGHTS DOCTRINE

In rejecting the absolute ownership rule, in 1903 the California Supreme Court adopted instead what some have argued as a more community-oriented approach to groundwater rights. This common ownership approach has been refined through case law as the doctrine of "correlative rights". Under the doctrine of correlative rights, all landowners overlying a common groundwater supply have a co-equal right to an equitable proportion of the water supply based on several factors.

California, however, is not a pure correlative rights state. A person not owning land overlying groundwater may still acquire the right to use water as an appropriator. Accordingly, California applies what is called a dual system of water rights, creating two types of classes of groundwater users' rights:--overlying rights and appropriative rights.

D. OVERLYING RIGHTS

Overlying rights are analogous to riparian rights to surface water. Owners of land overlying a groundwater basin(overlying owners) can extract as much groundwater as necessary to meet the reasonable and beneficial needs for use on the land. Overlying rights are considered correlative with all other similarly situated property owners who overlie the common groundwater supply. A correlative overlying right simply means that all overlying owners have equal rights to pump groundwater from the basin for use on their respective overlying properties.

E. APPROPRIATIVE RIGHTS

When overlying owners do not fully utilize the available safe yield of the basin a surplus exists which is available for non-overlying users or uses. These rights are called appropriative rights. Appropriative rights, for example, allow extraction of groundwater for use on non-overlying lands and for service to public at large in communities that may or may not overlie the basin.

As between appropriators, priority is determined on the basis of first in time, first in right. In other words, the first appropriator to put the water to beneficial use enjoys a priority right to that amount of water as against later appropriators. Consequently, a single appropriator can effectively exclude all other appropriators from a groundwater basin if the first appropriator utilizes all the available surplus in the basin.

As a matter of public policy, and consistent with California's treatment of riparian rights, the corporate boundaries of a political entity or retail water supplier do not vest the entity with overlying water rights. (*See e.g. Eden Township Water Dist. v. City of Hayward* (1933) 218 Cal. 634; *City of San Bernardino v. City of Riverside* (1921) 186 Cal.7; *Orange County Water District v. City of Colton* (1964) 226 Cal.App.2d 642.) Accordingly, the public or private water purveyors who extract water from a basin and provide it to customers overlying the same basin are considered appropriative users in the vast majority of cases.

Generally, in times of shortage appropriators must give way to the rights of overlying users. However, in some circumstances arising from overdraft and the accrual of prescriptive water rights, retail water suppliers may obtain some priority over other competing uses including those exercised by property owners overlying the basin. (*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199.)

F. OVERDRAFT

All groundwater rights, whether overlying or appropriative, are limited by the scientific/legal concept known as "safe yield." Safe annual yield is generally characterized as the amount of water that can be withdrawn from a groundwater basin on an annual basis without causing an undesirable result. This quantity of water is equivalent to the annual replenishment the groundwater basin receives from all hydrologic sources.

Safe yield is reached when the amount of water being pumped equals the replenishment coming into the basin by rainfall, return waters, runoff and underflow. The legal definition of safe yield is a mirror of the hydrologic one. The hydrologic definition has actually been incorporated into the cases. (*See City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199; *City of Pasadena v City of Alhambra* (1949) 33 Cal.2d908.) Other than for the caveat created by a "temporary surplus[1]", overdraft of the groundwater basin begins when extractions exceed the safe yield.

Overdrafting a groundwater basin can cause both temporary and permanent problems. Land subsidence, the lowering or settling of the land surface, can occur when aquifer materials are dewatered. In some cases, the subsidence can be permanent, causing a permanent reduction in the capacity of the basin. Some coastal basins may be prone to seawater intrusion if the level of groundwater drops too low. In other critically overdrafted basins the reduced capacity simply causes an increased concentration of natural minerals, resulting in compromised water quality. Finally, lowering water levels lead to increased pump costs and eventually to dry wells.

G. PRESCRIPTIVE RIGHTS

Once the safe yield is exceeded and a basin is in a condition of overdraft, a third type of water right may be established, known as a "prescriptive right". Acquiring a prescriptive water right is similar to gaining a real property interest by adverse possession with the right being established after five years of continuous extraction by an appropriator that has been actual, open, notorious, adverse, and exclusive. (*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199; *Hi-Desert County Water District v. Blue Skies Country Club, Inc*. (1994) 23 Cal.App.4th 1723.)

Each of these requirements has a specific legal meaning; a prescriptive water right cannot be established unless each condition is met for the required prescriptive period,. The prescriptive period begins when there is sufficient notice of the overdraft conditions to the affected water users. (*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199.) Thus, it takes at least five years of overdraft conditions before a prescriptive right is established. A break in the five year continuity will preclude the accrual of a prescriptive claim. However, once a prescriptive right is perfected, it can take priority over overlying and appropriative rights to the extent of the prescription. (*Hi-Desert County Water District v. Blue Skies Country Club, Inc* (1994) 23 Cal.App.4th 1723.)

H. GROUNDWATER BASIN ADJUDICATION – DOCTRINE OF MUTUAL PRESCRIPTION

Until there is an overdraft condition in a groundwater basin, there is generally little reason to seek court intervention to quantify rights to the basin for the simple reason there is enough water for all. However, once a basin is subject to overdraft conditions, basin users often resort to litigation to establish limitations on the quantity of groundwater use and to establish operating limitations for the respective basin. The most common method is known as a court administered "groundwater basin adjudication".

In 1949, the California Supreme Court established the "mutual prescription" doctrine as a method to allocate groundwater among competing claimants. Under this doctrine, both overlying and appropriative rights merge into prescriptive rights. In effect, once a basin goes into overdraft, each well owner begins to establish a prescriptive right as against all other users – they mutually prescript against one another. Historical use for each well owner through the five years preceding the filing of the basin adjudication is used to calculate a base prescriptive entitlement. The court then determines the basin's safe yield and applies a proportionate reduction to each well owner's historical prescriptive entitlement. Thus, under the mutual prescription doctrine each user is forced to share pro-tanto in the "misery index" associated with a forced reduction on pumping.

In practice, the allocation formula was used as a method to equitably distribute the cost of acquiring supplemental water to mitigate any adverse of impacts from overdraft. Those parties with higher priority groundwater rights were usually required to apply for a lesser amount of replenishment water.

Unfortunately, This doctrine encouraged a "race to the pumphouse" in those basins close to or in the midst of overdraft because pumpers received a greater allocation if they pumped more during the five-year historical period, irrespective of when they first began their use. Accordingly, under "mutual prescription", every pumper was encouraged to pump more groundwater although other competing users may have relied upon the same supply for decades.

In 1975, the California Supreme Court re-evaluated the doctrine of "mutual prescription" and severely limited its application in *City of Los Angeles v. City of San Fernando*. The court returned to the concept of priority of appropriation by insulating public entity and private utility water purveyors from prescription under Civil Code § 1007. (*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199.) Under San Fernando, public and private utility water purveyors retained their priority right against subsequent appropriators on the basis of first in time, first in right. Meanwhile, the private overlying landowners retained their overlying rights to the extent not diminished by prescription.(*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199; *Hi-Desert County Water District v. Blue Skies Country Club I*nc. (1994) 23 Cal.App.4th 1723.)

I. PHYSICAL SOLUTION AND COURT ADJUDICATION

In addition, to abandoning the "mutual prescription" rule of allocation, the Court of San Fernando also touted the role of "physical solution" in resolving groundwater conflicts. In practice, courts are urged to find equitable resolutions to conflicts between competing groundwater users. To be sure, the process of adjudication still includes quantification of each well owner's historical use and the protection of priority groundwater rights. However, the trial court judge is encouraged to use concepts of equity in fashioning all allocation among competing users which maximizes the reasonable and beneficial use of water. (*City of Los Angeles v. City of San Fernando* (1975) 14 Cal.3d 199; *Wright v. Goleta Water District* (1985) 174 Cal.App.3d 74: *Hi-Desert County Water District v. Blue-Skies Country Club, Inc.* (1994) 23 Cal.App.4th 1723.)

While the finality and comprehensive result are the primary benefits of an adjudication, the process is subject to frequent criticism because adjudications are often costly, adversarial and time consuming. Consequently, it is viewed as the remedy of last resort.

Absent an adjudication, overlying landowners do not have a specific or quantified water right to groundwater. Their relative need and correlative rights to groundwater are predicated and balanced upon the facts and circumstances of each case. Because the rights are not subject to forfeiture by nonuse or granted a priority by historic use, the overlying right is subject to some degree of uncertainty. Moreover, to the extent an appropriator is only entitled to surplus in

excess of the cumulative requirements of all overlying owners, their rights are even less certain. (*Tulare Irrigation Dist. V. Lindsay-Strathmore Irr. Dist*. (1935) 3 Cal.2d 489; *Wright v. Goleta Water District* (1985) 174 Cal.App.3d 74.)

J. NON ADJUDICATION GROUNDWATER MANAGEMENT IN CALIFORNIA

In many areas of California, groundwater problems have reached a crisis proportion. Groundwater contamination, salt-water intrusion and overdrafting are common occurrences. Despite the importance and value of groundwater as resource and in the face many of these problems, California has not implemented a comprehensive state-wide program to regulate or manage its groundwater resource Consequently, the responsibility for regulating groundwater use has fallen to the courts Given the dissatisfaction with court adjudications as a method to retroactively allocate water among users, an effort has been mounted to address groundwater through local management programs.

The management options include AB 3030 groundwater management plans, local ordinances, or special act agencies such as the Honey Lake Valley Groundwater Basin Management District, the Pajaro Valley Water Management Agency or the Fox Canyon Groundwater Management Agency. These management schemes *do not* displace the historic groundwater rights enjoyed by the water users in the groundwater basin. While the activities undertaken pursuant to the management plan may modify or control groundwater use they generally operate as resource management overlay to the existing water rights framework.

Because no two groundwater basins are identical, local basin management programs necessarily differ in purpose and scope. Typically, local groundwater management strategies include monitoring groundwater levels and well extractions, cooperative arrangements among pumpers to minimize or eliminate problem conditions, and, where applicable, conjunctive use of groundwater and surface water supplies.

1. AB 3030

The Groundwater Management Act of 1992, commonly referred to as "AB 3030," is a relatively recent program giving local public agencies a legal framework to develop groundwater management programs in their communities. AB 3030 plans are voluntary and the details of each plan are left to the local agencies and communities. When AB 3030 was first adopted it was hailed as a major step towards effective groundwater management. In some areas it has been a perfect tool to build consensus which will lead towards successful basin management. In other areas, the lack of consensus has made implementation much more difficult. Ultimately a successful AB 3030 plan, as any other groundwater management program will turn on a technical understanding of the groundwater resource and may include a wide variety of management tools, including extensive basin monitoring and data collection efforts, pump charges and restrictions on extraction when absolutely necessary.

2. Basin Adjudication

In connection with the court administered adjudication process noted above, a watermaster is oftentimes appointed as the administrator of the management program. Also the court will retain jurisdiction over the judgment so that the parties have immediate access to the court to resolve any future disputes related to their adjudicated rights The judgment may establish pumping limits and charges, a monitoring program, as well as a variety of other use limitations depending upon the details of the physical solution developed.

3. Special Act Agencies

Special act groundwater management agencies, such as the Honey Lake Valley Groundwater District, are formed by action of the legislature. Generally, these agencies are governed by a board of directors that may be appointed or elected. These agencies are empowered to conduct studies and perform groundwater management by regulation. Each agency's authority and limitations are customized for the particular technical and political context in which they operate. There are close to a dozen special act groundwater management agencies that have been established in California.

4. Local Ordinance

As Tehama County residents are well aware, some cities and counties have used local ordinances and regulations to regulate groundwater use within their jurisdictions. The *Baldwin v. County of Tehama*, decision confirmed the right of cities and counties to adopt local regulations concerning groundwater. Moreover, the *Baldwin* decision further confirmed that the County is the general police power to regulate groundwater and water transfers has not been the subject of "occupational" preemption, and they are free to adopt local ordinances that do not conflict with state legislative mandates.

The County has a more generalized power to regulate the use of groundwater within their jurisdiction than that offered to special act agencies or through AB 3030. Therefore, Tehama County's power and authority to regulate the export and use of groundwater is a core acknowledgment of the District's proposed AB 3030 plan. The District AB 3030 Plan is designed to compliment the County's actions pursuant to its police power.

II. GROUNDWATER MANAGEMENT UNDER AB 3030

After carefully weighing the various alternatives to groundwater management, the District has opted to acknowledge and promote the use of local ordinance(s) enacted at a city and county level concerning groundwater use and to actively engage the AB 3030 process to build a broad consensus for the management of groundwater resources in Tehama County. As noted in section 105 of the plan, it is not the intent of the district that a adoption of its AB 3030 Plan that the District in any way compromises the regulatory authority of Tehama County, or any city within the County. Indeed, the District fully expects that the County and cities in the County will enact local ordinances to compliment the management efforts institutionalized by the Plan. However, the provisions of AB 3030 can form the basis of a comprehensive and integrated management program, which is buttressed by the police power of local ordinances.

A. PURPOSES OF THE DISTRICT PLAN

AB 3030 does not mandate any specific form or function of a groundwater management plan adopted under its provisions, nor does it ordain any specific result. Rather, AB 3030 is but one tool made available by the Legislature to local communities so that each community can customize its own groundwater management efforts. Communities, in theory, are supposed to carefully examine the pertinent groundwater resource issues and use the AB 3030 mechanism to build a management scheme to address those issues. This is precisely what the District's AB 3030 Plan seeks to accomplish.

The District, in its preliminary planning and scoping process, has examined the local resource issues and as a first step developed the broad set of purposes of the Plan as set forth in section 104. To paraphrase this section, the initial purposes of the plan were initially identified to: 1) protect the groundwater resource so that local users have a reliable long-term water supply; 2) ensure that on a long-term basis extractions from and replenishment to the basin are balanced consistent with the public interest; 3) implement the Plan through County-wide consensus wherever possible; and 4) protect basin groundwater quality.

As a part of the revision process in producing the Plan, the District has concluded that a more specific statement for the purpose of "preventing overdraft" should and will be added to the Plan. This will provide more explicit acknowledgement that the Plan is inspired, in part, by the County Charter amendment, and that the overriding and paramount concern is the prevention of overdraft. In any event, these are admittedly general and broadly stated purposes for the Plan. It will be the challenge of the District and other participants to give practical meaning and effect to the Plan purposes. In summary, the plan is analogous to a "constitution" for groundwater management. While the Plan will establish the goals and process, the ultimate success of the Plan will be rise or fall upon the establishment of a consensus for groundwater management and in the virtue of the mechanisms established to implement the Plan.

B. NEITHER AB 3030 OR THE PLAN PROMOTE OVERDRAFTING OF THE BASIN

1. Conjunctive use is a management tool which does not create, trigger or foster overdraft conditions.

AB 3030 generally, and the Plan in particular, is not intended to promote conjunctive use and intentional overdrafting of Basin groundwater. By way of background and accepted general definition, "conjunctive use" means the coordinated and planned operation of surface and groundwater resources to reduce waste or loss and to optimize water supply use. Generally, there are timing and usage practices for basins or subunits which have both surface water and groundwater supplies available, which if put in place, would ensure that the total water supplies are put to optimal use.

For example, any given area might be able to alter its seasonal use of groundwater or surface water sources to maximize the recharge capability of the local groundwater basin. If an area does not have both surface and groundwater sources available, it generally cannot engage in conjunctive use practices.

We know of no legal or hydrologic link between conjunctive use and the intentional overdrafting of a groundwater basin. Overdraft will occur if more water is removed from a basin than is replenished on an annual basis. If such a condition should exist without mitigation and outside of stringent controls, the goal of comprehensive groundwater management generally, and the specifically stated primary purpose of the District's AB 3030 Plan would be defeated. As such, the conjunctive use operation would be prohibited.

2. AB 3030 sets threshold conditions before extractions can be limited but does not require conjunctive use.

As noted above, AB 3030 does not require the use of specific resource management tools and certainly does not promote overdrafting of groundwater basins. Instead, AB 3030 provides a framework to achieve groundwater management objectives. Conjunctive use is a management tool which may be utilized under AB 3030, that is, if the local proponents of the plan so choose. In no instance does AB 3030 explicitly or implicitly suggest that intentionally overdrafting a groundwater basin on a long-term basis is an appropriate method of groundwater management. Moreover, the primary purpose of District AB 3030 Plan as amended, the ability of any overlying landowner to enjoin the overdraft of groundwater and the desire to avoid a basin adjudication suggest practical and legal limitations on intentional overdrafting, irrespective of whether proponents sought to justify overdraft under the guise of conjunctive use.

As a protection to the rights of the local basin users, AB 3030 does impose threshold criteria before the District or other Plan proponents could limit or suspend extractions. AB 3030 provides:

> "Nothing in this part [AB 3030] shall be construed as authorizing the local agency [the District and other Plan proponents] to limit or suspend extractions unless the local agency

has determined through study and investigation that groundwater replenishment programs or other alternative sources of water supply have proved insufficient or infeasible to lessen the demand of groundwater." (Wat. Code § 10753.8(c).)

In a similar manner, another provision of AB 3030 requires that the Plan proponents consider the impacts on local business activities which may result from any rules or regulation which involve limiting or suspending extractions:

> "In adopting rules and regulations pursuant to Section 10753.8, the local agency shall consider the potential impact of those rules and regulations on business activities, including agricultural operations and to the extent practicable and consistent with protection of groundwater resources, minimize any adverse impacts on those business activities." (Wat. Code § 10753.9)

These sections impose a duty on the local community to maximize the use of its available water supplies before it imposes pumping restrictions under its AB 3030 plan. To meet the precondition to limit or suspend extractions, the Plan proponents must simply find that groundwater replenishment programs (whether by conjunctive use or otherwise) or other alternative sources of water supply (reclamation, importation, etc.) are insufficient or infeasible. And in imposing pumping restrictions, the Plan proponents must attempt to minimize the impacts on local businesses.

The District surmises that most local users would prefer less intrusive regulation unless absolutely necessary. These preconditions serve to protect private property right in the use of groundwater without negating the District's overriding interest to prevent the adverse impacts associated with overdraft. In other words, the District and the Plan proponents cannot attempt to limit extractions without making some prior effort to ensure that the groundwater resources available are being efficiently used and that the local economic impacts are carefully considered before restrictions are imposed.

Meeting these requirements will obviously vary with subunit conditions. In other words, some subunits may have more management options than others which foster creative solutions to future water supply issues. However, this does not mean that AB 3030 *mandates* conjunctive use or overdrafting, or that the local agency must wait until an overdraft condition has persisted for any length of time before extractions may be limited or suspended. To be sure, every indication is to the contrary.

The fact that the District has taken strong, proactive steps in promoting groundwater management ought to be some evidence of its commitment to the aggressive protection of its local groundwater resources. In the absence of the AB 3030 Plan, coordinated groundwater management is less likely.

3. The Plan does not require conjunctive use or overdrafting

The core of the District's AB 3030 Plan provides as its fundamental purpose the protection of the viability of the local groundwater resources so that local users have a reliable, long-term water supply. Certainly, if in developing the detailed programs for each subunit, implementation of conjunctive use practices would provide benefits in terms of the quantity or quality of water available for local users, the District would be irresponsible if it did not promote such practices. While the District is presently unaware of any specific program, preparing a framework to address future scenarios is a part of good management.

Contained within the revised Plan's primary stated purpose of prohibiting overdraft is the statement that the Plan will "balance long-term average annual replenishment with extractions and other losses to the basin as may be consistent with the public interest." Apparently some have interpreted this purpose as an endorsement of combining intentional overdraft with conjunctive use. Again, as revised above, the clear and unequivocal statement that the prevention of overdraft is a primary purpose of the Plan should be dispositive of this concern.

From a legislative and judicial perspective, the District power to protect landowners and the "public interest" is designed to increase, rather than restrict the ability of the District to address problems in the future. By no means does the District embrace intentional overdraft.

By analogy, the District views this purpose as a statement of the fundamental requirement of any resource management effort – to develop a management program based on a sound hydrologic understanding of each subunit. (Necessary elements of this hydrologic model includes the quantification of annual replenishment (rainfall, runoff, percolation, imported sources, etc.) and outflows (extraction, evaporation, migration, etc.).) Again, if after developing these types of hydrologic models, altering resource use can be accomplished without triggering overdraft and it would provide some over-riding public benefit, the District may wish to consider the option.

Any action in this regard at the present time would be premature. Presumably, the District would first be required to develop a program, rules and regulations, comply with the California Environmental Quality Act, and satisfy all affected water rights users in the area. Failure to address any one of these requirements will prevent the conjunctive use project from ever going forward.

C. THE PLAN IS MEANT TO COMPLIMENT AND WORK IN TANDEM WITH LOCAL ORDINANCES

As noted repeatedly above, the Plan is meant to compliment and work in tandem with the County export ordinance and any other local ordinances adopted by the County and cities within the County. It is vital to note that the County ordinances operate independently of AB 3030 and thus do not have to meet the preconditions listed is Water Code section 10753.8 and 10753.9. In

other words, the County export ordinance will operate on its own terms independent of the Plan, as will other local ordinances adopted outside the context of AB 3030.

For example, persons who intend to export groundwater within the meaning of the County's ordinance will remain subject to all the preconditions and limitations set forth in that ordinance. Nothing in AB 3030 or the Plan will limit or condition the requirements of the export ordinance. In other words, Water Code sections 10753.8 and 10753.9 do not apply to the County ordinance.

In addition as discussed below, the Plan contemplates the imposition of other independent permit requirements for extraction and use of groundwater across subunit boundaries (i.e. a "transfer" within the meaning of the Plan). Once in place, these transfer permits will augment the County export ordinance, but will be subject to the limitations and preconditions set forth in AB 3030 and the Plan.

D. THE PLAN PERMITTING PROCESS IS INTENDED TO PROVIDE MAXIMUM PROTECTION FOR THE BASIN

Sections 545-547 of the Plan are intended to provide *maximum protection* for the basin water supplies. Accordingly, these provisions impose a permit requirement on any extraction from one subunit for use in another subunit. Further, all permits issued will be subject to immediate reduction or suspension. As discussed above, reductions or suspensions under AB 3030 must be implemented consistent with the requirements of Water Code sections 10753.8 and 10753.9. Thus, while the District does contemplate the potential that permits may be issued for use of water across subunits under the Plan, there will be a strict, quick and aggressive program to monitor basin conditions and impose permit restrictions. Overdraft conditions are not a goal and will be actively combatted.

In evaluating its management opportunities under AB 3030 as well as other alternatives, the District has acknowledged that current California law does not offer methods to prohibit new uses of surplus water, including export of groundwater out of the basin, without having to engage in problematic issues of enforcement. (*See Tulare Irrigation District v. Lindsay-Strathmore Irrigation District* (1935) 3 Cal.2d 489; *Peabody v. City of Vallejo (*1935) 2 Cal.2d 351.) However, the permitting criteria adopted by the County and the complimentary permitting process which will be implemented under AB 3030 will provide local users with the maximum protection allowed by law.

The District believes this protection will occur in several ways. First, as discussed above the Plan restrictions will be imposed in conjunction with and complimentary to all other local ordinances. Water uses will be monitored carefully and likely by several local agencies with enforcement authority.

Next, in circumstances where no permitting criteria are imposed, as long as surplus groundwater is available new appropriators may extract water from the basin. Once these appropriative uses are established (the water is diverted and put to a reasonable and beneficial use), the right may become perfected as a property right. However, in the absence of a permitting scheme which places an accepted and agreed upon limitation on the acquired right, the District or any other entity would likely have to utilize the courts to restrict or suspend an appropriative use when overdraft conditions exist. In contrast, the permitting criteria (under the Plan and under independent county and city ordinances) imposes conditions on the exercise of such an appropriative right before it becomes perfected. In effect, the appropriative right can only be exercised subject to the terms of the permit and the restrictions may be enforced under the terms of the permit and the rules and regulations under the Plan. A similar precondition has been effectively enforces on appropriative rights acquired under the Water Code for decades.

Finally, as noted in section 546 of the Plan, the permitting restrictions will be invoked and subject to reduction when there is evidence of overdraft of a subunit or substantial threat of overdraft of a subunit. Appropriative use is permissible only to the extent it exceeds the cumulative water requirements of all overlying landowners. (*Wright v. Goleta Water District* (1985) 174 Cal.App.3d 74.) If actual overdraft conditions actually occur, this will ensure that permitted appropriators never satisfy the preconditions necessary to establish a prescriptive right (i.e., the restrictions and reductions will be imposed well before the five year prescriptive period has run).

For More Information

1. Slater, California Water Law and Policy, (1995) (Butterworth Legal Publishers).
2. Governor's Commission, Groundwater Rights in California, (1977) (Staff paper No.2)
3. Neese, Certainty in Groundwater Rights: Is Prescription Still Available?, California Real Property Journal, Volume 12 (1995)

APPENDIX B – PLAN ADMINISTRATION

Appendix B-1

Example (blank) Memorandum of Understanding (MOU) for consideration between the Tehama County Flood Control and Water Conservation District (TCFCWCD) and signatories to Tehama County Coordinated AB 3030 Groundwater Management Plan

MEMORANDUM OF UNDERSTANDING
REGARDING GROUNDWATER BASIN MANAGEMENT

This MEMORANDUM OF UNDERSTANDING (MOU) REGARDING GROUNDWATER BASIN MANAGEMENT (MOU) IS MADE AND ENTERED INTO AS OF THE _____ day of _____, 20___, at _____, California, by And between the Tehama County Flood Control and Water Conservation District (District), a political subdivision, and the _____ (Entity), and with reference to the following facts and intentions.

A. Tehama County includes approximately 2,976 square miles within the northern portion of the Central Valley of California. The County is bisected by the Sacramento River. The central and southern portions of Tehama County are underlain by the Sacramento Valley Groundwater Basin. The northern portion of Tehama County is underlain by the Redding Groundwater Basin. Each of the two groundwater basins are further composed of smaller groundwater subbasins.

B. The boundaries of the Sacramento Valley and Redding Groundwater Basins roughly approximate the eastern and western edges of the valley floor. The foothill areas which constitute the eastern and western boundaries of Tehama County are noted for their relative lack of groundwater resources.

C. Throughout, Tehama County groundwater resources provide a primary source of water for consumptive uses. A good quality, long-term reliable groundwater supply is critical to the ongoing health, safety and welfare of the county, its residents and businesses.

D. The Entity, located within Tehama County, encompasses about _____acres, with a population of about _____ people. The Entity normally produces about _____acre feet per year of groundwater for _____ purposes from the _____Groundwater Basin.

E. To guarantee the protection and long-term reliability of the local groundwater resource, the District and the Entity recognize that the groundwater basins within Tehama County must be effectively and properly managed.

F. The District was established in 1957, pursuant to Water Code Appendix section 82-1 et seq., with the boundaries of Tehama County as its jurisdictional territory.

G. The Entity is an _____, formed pursuant to _____ of the California Water Code §_____. The Entity provides water to the inhabitants of the _____. The Entity relies on surface and/or groundwater within the _____ and the _____Groundwater Basin for its water supply and has an interest in the protection and maintenance of these resources.

H. Water Code section 10750 et seq. (AB 3030) grants certain local agencies the authority to adopt and implement a groundwater management plan within its jurisdiction. AB 3030 also provides a basis for local agencies within the same groundwater basin to adopt and implement a coordinated groundwater management plan.

I. The District and the Entity are authorized groundwater management agencies within the meaning of Water Code Section 10735(b).

J. On April 25, 1995, the Tehama County Flood Control and Water Conservation District Board of Directors formally directed the District to proceed with the development of a county-wide groundwater management plan pursuant to AB 3030. The District, with a broad spectrum of public participation, has prepared a groundwater management plan.

K. In accordance with Water Code section 10753.2, on December 4, 1996, the Tehama County Flood Control and Water Conservation District Board of Directors adopted a resolution of intent to draft a county-wide groundwater management plan pursuant to AB 3030.

L. The District and Entity desire to jointly develop a coordinated groundwater management plan within the boundaries of _____and for their mutual benefit pursuant to the provisions of AB 3030. A coordinated groundwater management plan for the Redding and Sacramento Valley Groundwater Basin can best be achieved by the cooperative action of the District and _____through the execution of the MOU.

M. The District and Entity desire that the plan be used as the coordinated groundwater management plan within the jurisdictional boundaries of the Entity and that the District act as the authority having management responsibility and control of the coordinated groundwater management plan as developed pursuant to the provisions of this MOU.

NOW, THEREFORE, IT IS AGREED that:

1. Definitions. For the purposes of this MOU, the following definitions apply:

   a. "MOU" means this Memorandum of Understanding regarding groundwater basin management.

   b. "Groundwater basin or Basin" means a geologically and hydrologically defined area, consisting of one or more aquifers and which stores and transmits significant quantities of water.

   c. "Coordinated groundwater management plan" or "coordinated plan" means the coordinated groundwater management plan developed by the District and the Entity pursuant to AB 3030. The coordinated plan describes the activities intended to be included in a groundwater management program.

d. "Plan" means the groundwater management plan prepared by the District and approved by the Tehama County Flood Control and Water Conservation District Board of Directors on_____, 20___.

e. "Groundwater" means percolating groundwater lying beneath the surface, in which the soil is saturated with water. Groundwater shall not include water which flows within known and defined channels and which forms the subsurface flow of a river, stream or creek.

f. "Groundwater extraction facility" means any device or method for the extraction of groundwater.

g. "Groundwater management program" or "program" means the coordinated and ongoing activities undertaken for the benefit of a groundwater basin or sub-basin pursuant to a coordinated groundwater management plan.

h. "Groundwater management activities" means programs, measures, or action taken to preserve, monitor, protect, and enhance groundwater resources.

i. "Groundwater sub-basin" or "sub-basin" means a geologic or hydrologic unit of a groundwater basin which may be largely distinct or isolated from the larger basin such that it may be adequately monitored and managed independent and/or in coordination with other sub-basins.

j. "Jurisdictional boundaries of the Entity" means the geographic boundaries within which the coordinated groundwater management plan applies. For the purpose of this MOU the jurisdictional boundaries of the Entity means the geographic or political boundaries of the Entity.

2. **Purpose of the MOU**. The purpose of this MOU is to provide for the development of a coordinated groundwater management plan within the jurisdictional boundaries of the Entity.

3. **Powers** The Entity shall have the power to adopt and develop rules and regulations to govern and coordinate a groundwater management plan within the jurisdictional boundaries of the Entity pursuant to AB 3030. The Entity may exercise any powers in the manner and according to the methods provided under the laws applicable to the Entity, including those granted pursuant to Water Code section 10754.

4. **Coordinated Plan.**

a. Preparation of the Plan. The District in coordination with the Entity, shall prepare a coordinated groundwater management plan in accordance with AB 3030.

b. Participation. The governing body of the District and its staff shall be responsible for the adoption, implementation and enforcement of the coordinated plan. Representatives of the District and the Entity shall be jointly responsible for the activities described in Phase I of the plan. As noted below, the District and the Entity shall implement Phases II and III of the Coordinated Groundwater Management Plan by separate agreement.

5. **Plan Components**. To the extent possible and feasible, the plan shall be used as the coordinated groundwater management plan. As set forth in the plan, the coordinated groundwater management plan will include the following components which will be implemented in three (3) phases:

   a. **Phase I**. Coordinated by the District, with input from the Entity, this phase implements the priority management components from a passive management perspective. Phase I passive management will consist of nonintervening activities such as water level and water quality monitoring, coordination with other entities involved with groundwater management, development of data inventory, data evaluation establishment of a technical advisory group, issuance of annual reports, and promotion of public education and involvement. The District will act as the clearing house for the activities identified in Phase I.

   b. **Phase II**. Phase II will be implemented under separate agreement between the District and Entity consisting of an addendum to this MOU. This phase shall consist of more involved management activities. These new management activities include the identification and management of wellhead protection and recharge areas, development of procedures and process of 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 program.

   c. **Phase III**. Phase III will be implemented under separate agreement between the District and Entity consisting of an addendum to this MOU. This final phase will focus on long-term management-intensive activities. These long-term management activities will include control of saline water intrusion, regulation of migration of contamination, facilitation of operations of various groundwater management projects (i.e. contamination cleanup, recharge, storage, conservation, water recycling, or extraction projects.)

6. **Rules and Regulations**. The District, in cooperation with the Entity. Shall adopt rules and regulations to implement and enforce the coordinated groundwater management plan. However, nothing in this MOU shall be construed as authorizing the district to make a binding determination of the water rights of any person or entity.

7. **Consideration of Business Activities**. In adopting rules and regulations to implement and enforce the coordinated groundwater management plan, the District and Entity shall consider the potential impact of those rules and regulations on business activities, including

agricultural operations, and to the extent practicable and consistent with the protection of the groundwater resources, minimize any adverse impacts on those business activities.

8. **Fees and Assessments**.

   a. Authorization to Impose Fees and Assessments. The District and/or the Entity may impose equitable annual fees and assessments for groundwater management based on the amount of groundwater extraction from the Basin to pay for costs incurred by the District/Entity for groundwater management, including, but not limited to, the costs associated with the acquisition of replenishment water, administrative and operating costs, and costs of construction of capital facilities necessary to implement the coordinated groundwater management plan. The District/Entity may not impose fees or assessments on the extraction and replacement of groundwater pursuant to a groundwater remediation program required by other provisions of law.

   b. Elections Authorizing Fees and Assessment. Before the District and/or the Entity may levy a fee or assessment as authorized by this MOU or otherwise fix and collect fees for the replenishment or extraction of groundwater pursuant to the coordination groundwater management plan, the District/Entity shall hold an election on the proposition of whether or not they shall be authorized to levy a groundwater management assessment or fix and collect fees for the replenishment or extraction of groundwater. The election shall be conducted in the manner prescribed by the laws applicable to the District/Entity.

9. **Annexed Land.** If the Entity annexes land subject to a groundwater management plan other than the coordinated plan, which was adopted pursuant to AB 3030, the annexed land shall be subject to the groundwater management plan applicable to it prior to the annexation. If the Entity annexes land not subject to a groundwater management plan adopted pursuant to AB 3030 at the time of annexation, the annexed territory shall be subject to the coordinated groundwater management plan of the Entity.

10. **Meetings.** The District and the Entity shall meet as necessary, but not less than annually, to coordinate the groundwater management plan.

11. **Limitation on Application.** The requirements of the coordinated groundwater management plan adopted pursuant to this MOU do not apply to operations who extract less than 1.5 acre feet per year from their groundwater extraction facilities. Single-family residences served by a single well are statutorily exempted in accordance with Water Code section 10755.4.

12. **Term.** This MOU shall be effective during the period that a coordinated groundwater basin management plan is being promulgated, implemented and enforced.

13. **Entity.** The parties executing this MOU hereby represent and warrant that they have the authority to enter into this MOU and to perform all acts required by this MOU, and that the

content, approval or execution by any third party is not required to legally bind either party to the terms and conditions of this MOU.

14. **Governing Law**. The validity and interpretation of this MOU shall be governed by the laws of the State of California, with venue proper only in the County of Tehama, State of California.

15. **Good Faith.** The parties agree to exercise their best efforts and utmost good faith to effectuate all the terms and conditions of this MOU and to execute such further instruments and documents as are necessary or appropriate to effectuate all the terms and condition of this MOU.

16. **Severability.** If any term, provision, covenant, or condition of this MOU shall be or become illegal, null, void or against public policy, or shall be held by any court of competent jurisdiction to be illegal, null or void or against public policy, the remaining provisions of this MOU shall remain in full force and effect and shall not be affected, impaired or invalidated. The term, provision, covenant or condition that is so invalidated, voided or held to be unenforceable shall be modified or changed by the parties to the extent possible to carry out the intention and directives set forth in this MOU.

17. **Assignment.** Neither party shall have the right to assign its rights or delegate any of its obligations or duties under this MOU without the express written consent of the other party, which consent shall not be unreasonably withheld.

18. **Notices.** All notices, request, demands and other communications under this MOU shall be in writing and be deemed to have been duly given on the date of service if served personally on the party to whom notice is to be given or on the second day after mailing if mailed to the party to whom notice is given, by first class mail, registered or certified, return receipt requested, postage prepaid, and properly addressed as follows:

To: Tehama County Flood Control and Water
Conservation District
9380 San Benito Avenue
Gerber, CA 96035

_____

_____

_____

_____

Any party may change its address for purposes of this paragraph by giving the other party written notice of the new address in the manner set forth above.

19. **Entire Agreement.** This MOU constitutes the entire agreement of the parties concerning the MOU and supersedes any prior representations, agreements and understanding in connection with the MOU. This MOU may be amended only in writing by duly authorized representatives of the parties.

IN WITNESS WHEREOF, the parties have executed this MOU as of the day and year first written above.

DATED: _____

TEHAMA COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT

BY: _____

DATED: _____

BY: _____

ATTEST:_____

BY: _____

APPENDIX B – PLAN ADMINISTRATION

Appendix B-2

Tehama County Groundwater Management Plan Technical Advisory Committee
By-laws, Amended April 19, 2011

TEHAMA COUNTY GROUNDWATER MANAGEMENT PLAN ADVISORY GROUP BYLAWS

GENERAL PROVISIONS

Section 10. The Tehama County Flood Control and Water Conservation District Coordinated AB 3030 Groundwater Management Plan Technical Advisory Committee (Committee") shall be a groundwater management plan advisory body to the Tehama County Flood Control and Water Conservation District Board of Directors ("Board").

Section 20. The purpose of the Committee is to enable Tehama County citizens to have a meaningful say in how the AB 3030 groundwater management plan document is implemented.

Section 30. The Executive Director of the District shall serve as staff to the Committee, and shall assist the Committee in presenting information and reports to the District Board of Directors..

Section 40. The Committee will operate on principles of collaboration. Committee members are sought who are committed to work together with other interests for the long-term benefit of Tehama County groundwater resources and the people who rely on these resources.

Section 50. Specific goals of the Committee shall include, but are not limited to the following:

1. Further refine the data requirements and presentation format required for the annual reports discussed in Section 350 of the plan.

2. Facilitate coordination between the District and those entities who have agreed to implement the Coordinated Plan in accordance with the Memorandum of Understanding developed between the District and those entities.

3. Assist the Board and staff in drawing resources from a "technical pool" (see Section 330, below) as the need for this action arises.

4. Review and evaluate implementation and performance of the Tehama County Flood Control and Water Conservation District Coordinated Groundwater Management Program.

5. Advise the District Board on policies, goals and operations of the District Groundwater Management Program by way of an annual report.

6. Encourage support throughout the County for the development and implementation of the Coordinated AB 3030 Groundwater Management Plan.

MEMBERSHIP

Section 60. Membership of the Committee shall consist of ten voting members in the categories listed below:

Section 70. Agriculture

Five water users from the agricultural sector, including two agriculture-related water districts which are participants of the Plan (i.e. not exempt), hereafter referred to as Members AD1, and AD2; and three representing a private pumper or diverter, hereafter referred to as Members AP1, AP2 and AP3. These members shall be appointed by the District Board of Directors.

Section 80. Domestic and Industrial

One person (Member D1) representing, collectively, Gerber, Los Molinos, Rancho Tehama, and the smaller domestic water suppliers (CSD's, Rio Alto, etc). This member shall be appointed by the District Board of Directors.

Section 90. Natural Resources Interests

This position (Member "NR") would represent, as a whole, the environment, water-based recreation industry, and timber interests in Tehama County. This member shall be appointed by the District Board of Directors.

Section 100. Municipal

One person representing the City of Red Bluff, (Member "RB"), one person representing the City of Corning, (Member "C"), and one person representing the City of Tehama, (Member "T"). The city councils of Corning, Red Bluff, and Tehama shall appoint their respective representatives.

MEMBERSHIP QUALIFICATIONS AND RESPONSIBILITIES

Section 110. All Committee members shall have technical expertise in a water-related field, preferably involving local groundwater issues. Members should be residents of Tehama County, and/or be employed in Tehama County, and have an economic interest in preservation, protection and enhancement of the groundwater resources of Tehama County.

Because the functions of the Committee are purely advisory and not part of the governmental functions of the District, and the members of the Committee receive no compensation, voting members and alternates of the Committee shall not be considered public officers by virtue of their appointment to the Committee.

NOMINATION CRITERIA FOR MEMBERS APPOINTED BY THE DISTRICT BOARD OF DIRECTORS

Section 120. The Flood Control and Water Conservation District will call for nominations to the Committee at a Regular Flood Control Board meeting. Nomination forms will be made available through the District Office in Gerber.

Section 130. Individuals can nominate themselves. Nomination forms shall provide:

- Sufficient information relative to application Process
- Address and phone number
- Education and career highlights
- Training or experience
- Knowledge of groundwater issues
- Demonstrated commitment to cooperative solution development
- Area of interest to be represented

Section 140. The nominations will be reviewed and selected by the District Board of Directors. The seven positions appointed by the Board will be nominated and seconded by Board members, and voted upon by the entire Board.

A. All members appointed to the advisory committee must meet with the approval of at least a majority of the voting Board members.

B. In making their appointments to the committee, the Board shall strive to appoint a body that reflects geographically balanced representation in the county.

C. When considering appointments from the agricultural, domestic and industrial applicants, the Board will appoint members who, in the opinion of the Board, best represent the areas of concern.

VACANCIES

Section 150. All vacancies shall be filled pursuant to the Maddy Act (Government Code sections 54970 et seq.).

TERM OF SERVICE

Section 160. Members will serve for three years, with staggered terms as follows: Members AD1, D1 and NR term will expire in one year; Members AD2. A1 and RB term will expire in the next year; and Members AP2, AP3 and C term will expire in the year after that. The above reappointment schedule will be repeated in future years in the 3-year cycle stated above. It is the intention of this Section to maintain the terms of service in effect on the date of the adoption of this Section.

MEETINGS AND QUORUM

Section 170. The Committee shall meet at least quarterly or more frequently as decided by the majority of the Committee. The Executive Director of the District has the authority to call additional meetings as needed.

Section 180. The majority of the total Committee members (or their Temporary Alternates, when granted the privilege of voting under Section 200) shall constitute a quorum.

ATTENDANCE

Section 190. The Chairperson of the Committee shall contact any Member who has exceeded 2 consecutive unexcused absences from regular Committee meetings or missed more than three meetings in an 18-month period due to unexcused absences.

A. If no response is received from the member within 30 days or if the member states that he/she does not wish to remain a member, the Board of Directors shall be notified to appoint a replacement.

B. If the member states that he/she wishes to remain with the Committee, he/she shall be considered a member in good standing, unless otherwise provided by the Board of Directors.

C. If Committee members cannot attend a meeting, they may send a representative to take notes and gather information. The representative may not vote on issues, but may enter into discussions of the Committee.

D. The representative would not be considered an alternate and the action would still constitute an absence of the missing Committee member.

ALTERNATE REPRESENTATIVES

Section 200. The appointing authority for any Member may appoint an Alternate Representative, who shall serve at the pleasure of the appointing authority. The Alternate Representative shall be a person having a professional affiliation with the Member and must have developed and demonstrated prior interest and knowledge of the Committee by attending prior Committee meetings during the Member's term. The Alternate Representative shall serve and vote in place of the Member only if the Member is absent. Any meeting attended by the Alternate Representative shall not constitute an absence of the Member for purposes of Section 190.

ELECTION OF CHAIRPERSON AND VICE CHAIRPERSON

Section 210. The Chairperson and Vice Chairperson shall be elected each year at the last quarterly meeting of the Committee and shall assume the duties of such office at the first quarterly meeting of the new year.

Section 220. No member shall hold the office of Chairperson or Vice Chairman for more than two consecutive terms.

Section 230. The Chairperson may be removed from office and relieved of duties by a majority of the membership.

DUTIES OF CHAIRPERSON

Section 240. The Chairperson shall preside at all meetings of the Committee and perform duties consistent with the procedures outlined herein.

Section 250. The Chairperson shall make an annual report to the Tehama County Flood Control and Water Conservation District Board of Directors in December of each year or more often as recommended by the Executive Director of the District.

Section 260. In the absence of the Chairperson, the Vice Chairperson shall execute the duties of Chairperson.

Section 270. The presiding officer shall maintain order and decorum and decide questions of procedure (according to Robert's Rules of Order) subject to the right of the Committee to make the final determination. He/she shall call the meeting to order promptly at the appointed hour and conduct the meeting as prescribed by these procedures and the laws of the State of California.

SECRETARIAL ASSISTANCE

Section 280. The functions of this office will be performed by an assigned Tehama County Flood Control and Water Conservation District employee, designated by the Executive Director of the District.

Section 290. This employee is not a voting member of the Committee. In the event District resources preclude this, the office of Secretary shall be established with the following duties:

Section 300. The Secretary to the Committee will attend all meetings of the Committee, and also any subcommittee meetings when requested.

Section 310. The Secretary shall maintain a record of all sessions and Committee attendance.

Section 320. The agenda for regular and special meetings shall be prepared by the Chairperson and Secretary in conformance with Brown Act requirements and distributed by the Secretary to each Committee member. Copies of the agenda shall be posted in accordance with the Brown Act and made available at each meeting for the public.

TECHNICAL RESOURCES

Section 330. As the need arises, the Committee shall make recommendations to the District Board for the purpose of obtaining and utilizing resources drawn from a "Technical Pool".

Section 334. The Technical Pool shall consist of a list of individuals or groups employed with local, state and federal resource agencies, consultants, environmental groups, local businesses and industry, and other areas.

Section 338. Any such recommendation that would incur a financial cost to the District must be first approved by the Board of Directors.

Section 340. Technical Pool participants will work with staff and the Committee to provide additional technical support where needed.

Section 345. The Executive Director of the District shall act as the liaison between the Committee and the Technical Pool.

COMMITTEES

Section 350. The Committee may create standing committees. Staff shall serve in an advisory capacity to any such committee. The Chairperson shall appoint standing committee members with the concurrence of the individual appointed. All standing committees and subcommittees shall comply with the Ralph M. Brown Act, set forth in the California Government Code sections 54950-54963, inclusive.

MISCELLANEOUS PROVISIONS

Section 360. The Ralph M. Brown Act, set forth in the California Government Code sections 54950-54963, inclusive, shall govern all meetings of the Committee and its standing committees.

Section 370. All actions and decisions shall be by a majority vote of the members present (or their Temporary Alternates, when granted the privilege of voting under Section

200). If a voting member (or their alternate, when granted the privilege of voting under Section 200) abstains without cause on any matter, their vote shall be counted as concurrence in the action of the majority of the members who do vote on the matter. In the event of a tie vote, Robert's Rules of Order shall govern the outcome.

Section 380. These Bylaws may be altered, amended, suspended, or repealed by the Tehama County Flood Control and Water Conservation District Board of Directors. The Committee may recommend such changes to the Board of Directors for their consideration.

INFORMATION SOURCES

Section 400. The following documents were referenced in the development of these Bylaws:

1. "Interoffice memorandum", Hatch & Parent, Feb. 17, 1995.
2. "BLM Seeks Resource Advisory Council Members" BLM News Release, May 19, 1995.
3. "Mental Health, Drug and Alcohol Board Bylaws", Tehama County Health Agency.
4. "Local Mental Health Board Restructuring" State Department of Mental Health Information Notice No. 92-38, December 17, 1992.
5. "The Community Values of Water and Suggestions on Incorporating Them Into Water Policy" Water Education Foundation, May 12, 1994.
6. Meetings Notes/Correspondence re: Planning Committee for Tehama County Water Resources Advisory Board, University of California Farm Advisory April-May 1994.
7. Robert's Rules of Order, Scott, Foresman and Co., 1981.
8. Chapter 2.20, "Planning Commission", Tehama County Code.
9. Public Health Advisory Board Bylaws (2009 rev.), County of Tehama
10. Community Action Agency Tripartite Board Bylaws (2009 rev.),County of Tehama

APPENDIX B – PLAN ADMINISTRATION

Appendix B-3

Dispute Resolution Process for the Tehama County Coordinated AB 3030 Groundwater Management Plan

RESOLUTION NO. 02-2004

RESOLUTION TO ESTABLISH A DISPUTE RESOLUTION PROCESS ASSOCIATED WITH THE COUNTYWIDE ADOPTED AB3030 GROUNDWATER MANAGEMENT PLAN

WHEREAS, The Tehama County Flood Control and Water Conservation District did adopt a coordinated AB3030 Groundwater Management Plan on September 22, 1998; **and**

WHEREAS, grant funding made available by the California Department of Water Resources through the local Groundwater Management Assistance Act of 2000, **and**

WHEREAS, said grant funding criteria requires a mechanism for Dispute Resolution associated with the Groundwater Management Plan**; and**

NOW, THEREFORE, BE IT RESOLVED, that the procedure established to address disputes relative to the Districts adopted Groundwater Management Plan is:

1. Submit concerns to the District Water Resources Manager who will prepare background information and report;
2. The issue will be scheduled on the AB3030 Groundwater Management Plan Technical Advisory Committee (TAC) Agenda for discussion;
3. The Water Resources Manager will incorporate the TAC comments into a report to the District Board of Directors;
4. The issue will be agendized for the next regularly scheduled Board of Directors meeting within 60 days;
5. The Board of Directors will hear the issue and make recommendations based on legal counsel review.

The foregoing Resolution was offered by Director Willard seconded by Director Borror and adopted at the regular meeting of January 27, 2004 Tehama County Flood Control and Water Conservation District.

AYES: Directors': Ross Turner; Charles Willard, Bill Borror, Barbara McIver; and George Russell

NOES: None

ABSENT OR NOT VOTING: None

Chairperson

STATE OF CALIFORNIA)
) ss
COUNTY OF TEHAMA)

I, Williams J. Goodwin, Director of the Tehama County Flood Control and Water Conservation Direstrict of the County of Tehama, State of California, hereby certify the above and foregoing to be full, true and correct copy of an order adopted by said Tehama County Flood Control and Water Conservation District on this 27th day of January, 2004

Dated: This 27th day of January, 2004

By_____
Deputy

F:\ADMIN\RESOLUTI\04Dispute Res.wpd

APPENDIX B – PLAN ADMINISTRATION

Appendix B-4

Tehama County Resolution for Support of the Northern Sacramento Valley Integrated Regional Water Management Plan and Memorandum of Understanding, 2006 - 2007

RESOLUTION NO. 1-2006

RESOLUTION IN SUPPORT OF
THE SACRAMENTO VALLEY INTEGRATED REGIONAL WATER MANAGEMENT PLAN

WHEREAS, Northern California water suppliers in partnership with local governments, conservation organizations, state and federal agencies, and other interested parties have developed the Sacramento Valley Integrated Regional Water Management Plan (IRWMP); and

WHEREAS, the Sacramento Valley IRWMP is designed to protect Northern California water rights and supplies and to help provide reliable and affordable water for farms, cities, refuges and managed wetlands, fish, the environment and recreation; and

WHEREAS, the Sacramento Valley IRWMP is intended to improve coordination and the sharing of information across the region to allow for improved water management at the local, regional, and state level; and

WHEREAS, the Tehama County Board of Supervisors passed Resolution 91-2001 in support of the Phase 8 Agreement; and

WHEREAS, the Tehama County Flood Control and Water Conservation District submitted a letter in support of the Northern California Water Association to apply for grant funding to develop the Sacramento Valley Integrated Regional Water Management Plan; and

WHEREAS, the Tehama County Flood Control and Water Conservation District supported Regional Coordination by adopting the "Four-County Memorandum of Understanding" to establish the mutual partnership of Butte, Colusa, Glenn and Tehama Counties with respect to their voluntary joint efforts towards regional coordination, collaboration and communication; and

WHEREAS, support of the Sacramento Valley Integrated Regional Water Management Plan will provide a planning document to help protect Northern California water rights and supplies, re-enforce the Four-County MOU, and provide for regional coordination as called for in the Districts Adopted AB3030 Groundwater Management Plan.

NOW ,THEREFORE BE IT RESOLVED, that the Directors of the Tehama County Flood Control and Water Conservation District support the Sacramento Valley Integrated Regional Water Management Plan.

The foregoing Resolution was offered by Director Russell seconded by Director Turner and adopted by the following vote:

AYES: Directors': Ron Warner; Gregg Avilla; Ross Turner; George Russell

NOES: Director Charles Willard

ABSENT OR NOT VOTING: None

STATE OF CALIFORNIA)
) ss
COUNTY OF TEHAMA)

I, Gary Antone, Director of the Tehama County Flood Control and Water Conservation District of the County of Tehama, State of California, hereby certify the above and foregoing to be full, true and correct copy of an order adopted by said Tehama County Flood Control and Water Conservation District on this 14th day of **November, 2006**

Dated: This 14th day of November 2006

By _____
Deputy

MEMORANDUM OF UNDERSTANDING (MOU)
FOR INTEGRATED REGIONAL WATER MANAGEMENT PLANNING
AND REGIONAL WATER RESOURCES COORDINATION,
COLLABORATION AND COMMUNICATION (MULTI-PARTY WATER RESOURCES MOU)

1. Background. The counties of Butte, Colusa, Glenn and Tehama (hereinafter "Counties" or "Four Counties") have entered into a Memorandum of Understanding ("MOU") addressing regional water resources coordination, collaboration and communication (hereinafter "Four County MOU"). The Parties hereto recognize that to further improve coordination, collaboration and communication with respect to these valuable resources, it is appropriate and desirable for the Counties to enter into this MOU involving various special districts, governmental entities and regulated water purveyors within the Counties that have statutory responsibilities, obligations and rights with respect to these regional water resources. These latter entities will for ease of reference hereinafter be referred to as "Water Partners." Moreover, the Parties further recognize activities contemplated within this MOU are consistent with and a means for furthering the existing Sacramento Valley Integrated Regional Water Management Plan as it may be amended and/or updated from time to time. This MOU (hereinafter referred to as the "Multi-Party Water Resources MOU") is not intended to usurp or take the place of the Four County MOU, but is rather intended to supplement what is provided therein.

2. Purpose/Goals. The purpose and goals of this Multi-Party Water Resources MOU is to build upon the purpose and goals of the Four County MOU. This Multi-Party Water Resources MOU is intended to further the purposes and goals of the Four County MOU by involving the Water Partners (some of which are multi-county special districts) that are charged with water resources planning and development. There is no intent that this MOU be utilized to circumvent the (current or future) regulatory authority of the Counties or to affect the valid exercise of the Counties' police powers.

3. Initial Parties. The Parties to this MOU shall initially include the Counties of Butte, Colusa, Glenn, and Tehama and shall include those Water Partners that have executed this MOU as provided for herein. However, it is anticipated that other parties may join this MOU as specified in Paragraph 8.

4. Areas of Cooperation. "Water Resources" is a large area of concern and the Parties intend, over time, to cooperate in all areas associated with it. Initially, however, the intended focus of this MOU is on issues associated with mutual concerns associated with the coordinated management of groundwater within the four county subregion, including, but not limited to, the "Lower Tuscan" and "Tehama" groundwater aquifer systems. Future actions and activities associated with this MOU shall be undertaken through amendments or addendums to this MOU, concurred in by all Parties, and shall remain consistent with and will not exceed the current authority for any participating party.

5. Areas of Responsibility. Work associated with this MOU includes local County/Water Partner coordinated water and groundwater resource planning, as well as broader regional planning efforts in this area. In general, the areas to be worked on will be set forth in addendums hereto. The addendums will describe and designate the respective roles of the Counties and the Water Partners, as those roles pertain to local and regional water resource planning. An initial focus of action will be the development of a scope of work consisting of groundwater monitoring and modeling, regional Basin Management Objective (BMO) development, regional water budgets and funding opportunities.

6. Party Representatives/Project Manager. Each Party shall designate a Party Representative to meet with the other Parties to this MOU to further its purposes. A Project Manager may be selected by mutual consent to facilitate, coordinate and implement each of the various activities set forth under this MOU. The Party Representatives shall meet to more specifically determine how future activities will be undertaken. The purpose of this determination is not to intrude on any Party's primary role with respect to delineated actions, but rather to insure appropriate coordination and cooperation. Implementation of any and all of the actions or activities shall be at the sole discretion of the respective representative Parties.

7. Role of Northern California Water Association ("NCWA"). Consistent with its role in the Sacramento Valley Integrated Regional Water Management Plan, NCWA shall serve as the "Administrative Coordinator" facilitating communication under this MOU. NCWA shall serve no substantive, technical, or funding role unless requested to do so by the Parties.

8. Participation in This MOU. Signatories to this MOU constitute the current participants. Participation is strictly on a voluntary basis and may be terminated at any time without notice or recourse. Counties adjacent to the Four Counties and other special districts or cities within the Four Counties, Public Utility Commission regulated water purveyors, and entities that operate and maintain water distribution facilities, and who share water resources common to the participating Counties and Water Partners and who are engaged in similar activities will be invited to be signatory to this MOU. The Parties hereto aspire to work collaboratively with other regional programs and technical outreach efforts.

9. Funding. Parties are not required to commit funding associated with activities completed under this MOU. It is understood that activities under this MOU may result in the more efficient use of existing and future funding resulting from improved collaboration and coordination. Parties will work collaboratively in the pursuit of external funding associated with common interest activities based on voluntary participation and agreement. When required, a mutually agreed upon Party Representative will serve as the Project Manager for activities completed under a contract with an external funding source. Existing governmental contracting mechanisms will be utilized where available for contractual and invoicing purposes between participating counties. Nothing in this MOU precludes individual Parties from the individual pursuit, contracting and completion of work from an externally funded source regardless of a real or perceived regional interest.

10. Decision-Making. To the extent necessary, all decisions shall be through consensus.

11. Non-Binding Nature. This document and participation under this MOU are nonbinding, and in no way suggest that a Party may not continue its own activities. Each Party is expected to continue its own policies and procedures and undertake efforts to secure project funding from any source.

12. Termination. Because the MOU will require periodic review and updating for use into the future, it is envisioned that the joint efforts of those involved will be ongoing in maintaining a living document. Thus, this document will remain as a reflection of the understandings of the participants. Individual signatories of this MOU may terminate their involvement at any time with no recourse.

Chair, Butte County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Colusa County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Glenn County Board of Supervisors	Date	County Counsel Approved As to Form	Date
Chair, Tehama County Flood Control and Water Conservation District	6-14-07 Date	Assistant County Counsel Approved As to Form ARTHUR J. W[illegible]	6/6/07 Date

President, Biggs-West Gridley Water District	Date	President, Butte Water District	Date
President, Glenn-Colusa Irrigation District	Date	President, Maxwell Irrigation District	Date
President, Orland-Artois Water District	Date	President, Orland Unit Water Users' Association	Date
President, Princeton-Cordora-Glenn Irrigation District	Date	President, Provident Irrigation District	Date
President, Reclamation District 1004	Date	President, Richvale Irrigation District	Date
President, Western Canal Water District	Date		

APPENDIX C – GROUNDWATER MONITORING

Appendix C-1

Minute Order of Board recommendation that the Tehama County Flood Control and Water Conservation District be identified by the California Department of Water Resources as a as a groundwater "Monitoring Entity" for Tehama County to comply with CASGEM program

TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
MINUTE ORDER

RECOMMENDATION THAT THE DISTRICT BE IDENTIFIED AS THE LOCAL GROUNDWATER 'MONITORING ENTITY' FOR THE CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING (CASGEM) PROGRAM: Gary Antone discussed this extension of our Groundwater Management Plan efforts on a state wide basis. It is recommended that the District submit notification to DWR of our desire to be the designated monitoring entity for Tehama County. County Counsel and the Executive Director are determining the category or type of agency the District would fall under

Following comments, a motion by Director Russell, second by Director Williams to authorize the Executive Director to submit notification to the Department of Water Resources identifying the District as the local groundwater Monitoring Entity for the CASGEM Program. Motion carried 5-0 with 0 absent.

Ayes: Directors': Bob Williams; George Russell, Charles Willard; Ron Warner; Gregg Avilla

Noes: None

Absent or Not Voting: None

STATE OF CALIFORNIA)
) ss
COUNTY OF TEHAMA)

I, Gary Antone, Executive Director, for the Tehama County Flood Control and Water Conservation District of the County of Tehama, State of California, hereby certify the above and foregoing to be full, true and correct copy of an order adopted by said Tehama County Flood Control and Water Conservation District on this 26th day of October, 2010

Dated: This 26th day of October, 2010.

Gary Antone
Executive Director
Tehama County Flood
Control and Water Conservation District,
of the County of Tehama, State of California

By _____
Linda Madea, Deputy

APPENDIX C – GROUNDWATER MONITORING

Appendix C-2

California Statewide Groundwater Elevation Monitoring (CASGEM) plan submitted by the Tehama County Flood Control and Water Conservation District to the California Department of Water Resources as a "Monitoring Entity" for Tehama County

CASGEM Monitoring Plan

To meet the requirements of SBX7 6

Submitted by the Tehama County Flood Control

And Water Conservation District

September 2011

Tehama County CASGEM Monitoring Plan

The Tehama County Flood Control and Water Conservation District (TCFC&WCD) applied to be a monitoring and reporting entity for the geographic area within the boundaries of the county and for the underlying groundwater basins identified in Bulletin 118. In 1996, TCFC&WCD adopted the Tehama County Coordinated AB3030 Groundwater Management Plan. Implementation of the plan led to the identification of 12 groundwater management sub-areas that were adopted by the TCFC&WCD board in 1998. The TCFC&WCD will monitor groundwater levels as described in the County's AB3030 Groundwater Management Plan and submit the groundwater basin monitoring data obtained by staff to Department of Water Resources (DWR). Information on the monitoring plan is available to the public at http://www.tehamacountypublicworks.ca.gov/Flood/groundwater.htm

Monitoring Plan Overview

Groundwater monitoring in Tehama County is currently performed by the DWR and TCFC&WCD. DWR collects data from approximately 160 groundwater wells in Tehama County. TCFC&WCD collects data from 26 dedicated monitoring wells at eight locations and submits the data to DWR. For the purposes of CASGEM, monitoring data will be collected from wells identified as "Key Wells" in the Tehama County Groundwater Management Plan. The Key Wells are of various use types and depths. Groundwater level measurements in the Key Wells are expected to adequately characterize and document the primary areas of groundwater use within the identified sub-basins. The Tehama Co. CASGEM Monitoring Plan does not involve any cooperating agencies.

Groundwater Sub-basins

The valley portion of Tehama County overlies all or a portion of the following groundwater sub-basins as identified in DWR Bulletin 118.

- Antelope (5-21.54)
- Bend (5-21.53)
- Bowman (5-6.01)
- Colusa (5-21.52)
- Corning (5-21.51)
- Dye Creek (5-21.55)
- Los Molinos (5-21.56)
- Red Bluff (5-21.50)
- Rosewood (5-6.02)
- South Battle Creek (5-6.06)
- Vina (5-21.57)

Bulletin 118 indicates that the Colusa Sub-basin (5-21.52) underlies a very small portion (approximately 1400 acres) of Tehama County. It also shows that the majority of the sub-basin lies within Glenn County. The small portion of the sub-basin that lies within Tehama County is predominantly foot hills and isolated valley areas with very little

groundwater use. The limited amount of irrigated acreage that lies within this sub-basin in Tehama County will be represented by the monitoring plan developed and submitted for CASGEM by Glenn County. Therefore it will not be necessary to include this small area of Tehama County in its monitoring plan to satisfy CASGEM goals.

The Bend Sub-basin (5-21.53) and South Battle Creek Sub-basin (5-6.06) are not currently monitored by DWR or TCFC&WCD. These sparsely populated sub-basins consist largely of foothills and isolated valleys. Groundwater use is relatively limited except in small areas near the Sacramento River and Battle Creek. For the Sacramento Valley portion of these sub-basins, there are fewer than 20 wells located in the South Battle Creek Sub-basin and approximately 180 wells in the Bend Sub-basin. Potential monitoring wells have been identified in the most densely populated portion of the Bend Sub-basin and the South Battle Creek Sub-basin. Cooperative land owners will be sought to obtain monitoring wells in these sub-basins.

The western portions of the Red Bluff Sub-basin (5-21.50) and Corning Sub-basin (5-21.51) are areas of sparse population and low water use in the foothills and isolated valleys. The Rancho Tehama Reserve (pop. 1485 in 2010) has the largest population in these sub-basins. Due to low population and water use in the western portions of these two sub-basins, groundwater monitoring is not necessary in those areas. Groundwater levels in the Sacramento Valley floor portion of these sub-basins are adequately represented by measuring Key Wells in the existing monitoring network.

Groundwater wells in the portions of the groundwater sub-basins lying outside of the Sacramento Valley floor generally consist of shallow wells constructed in shale and rock or lava formations and are not considered alluvial. The portions of the sub-basins lying outside of the Sacramento Valley will not be included in the Tehama County monitoring network because they represent limited water resources development with minimal yield per well (typically averaging less than 5 gallons per minute). Monitoring needs in these areas will be periodically assessed to address significant changes in development.

Land and Water Use Trends

Groundwater elevations in Tehama County vary greatly from north to south and between the foothills and the Sacramento River. Agricultural land use and water use shifted from un-irrigated range and flood irrigation on row crops with surface supplies, to tree crops with drip and micro sprinkler irrigation using groundwater. In the early 1900s most crops were irrigated with surface water. By 2003 two-thirds of the cropland was irrigated with groundwater and cropland had substantially increased. This growth and practice continues today.

Dedicated Monitoring Wells

In 2004, TCFC&WCD began to install a series of dedicated groundwater monitoring wells in areas identified as economically sensitive to groundwater use. Since that time, dedicated monitoring wells at eight locations have been placed in service. These wells

provide access to measure 26 zones. In these dedicated wells, groundwater levels are monitored with pressure transducers and data loggers to attain high frequency data. This information allows evaluation of aquifer interaction and potential conjunctive use programs.

The dedicated monitoring zones range from shallow (under 100 feet) to deep (approximately 1000 feet). Well zones selected for CASGEM take into consideration land and water use in the general area as well as agricultural, municipal, industrial, and domestic demand and well infrastructure to provide for the overall protection of the majority of water users.

Maps

Figure 1 shows the location of the Key Wells discussed above. Key Wells adequately characterize the County's groundwater resources and provide the most comprehensive coverage available.

Schedule

The major groundwater use in the County is for agricultural purposes and follows traditional seasonal trends of high groundwater levels in the spring and declining groundwater levels over an extended period in summer and fall. Therefore two measurements will be taken in the identified wells; one in March or April, and the other in October or November to coincide with the typical pre- and post-irrigation seasons.

Field Methods

Field methods for the collection and documentation of groundwater elevation data in the County will be standardized and meet the following CASGEM basic requirements:

- Reference Points for the Key Wells were previously established by DWR staff and will be used for the CASGEM monitoring.
- Manual measurements will be recorded in a field data book using DWR Form 1213. Automatic measurements of groundwater levels in dedicated monitoring wells will be recorded by a data logger. All measurements will be transferred to an electronic spread sheet and submitted to CASGEM with the following information:

    1. State Well Number
    2. Date of Measurement
    3. Reference Point Elevation
    4. Land Surface Elevation
    5. Reference Point to Water Surface
    6. Method of Measurement
    7. No measurement and/or Questionable Measurement Codes (consistent with DWR Water Data Library codes)

8. Agency ID
9. Comments

- A visual assessment of possible groundwater pumping in surrounding areas will confirm static groundwater conditions
- An electronic well sounder may be used to measure groundwater levels in selected wells. The sounder will typically be lowered two times at the water surface and compared for consistency
- A steel tape measure will be used to measure the domestic and irrigations wells in the monitoring grid.
- Dedicated monitoring wells are equipped with pressure transducers and data loggers and will periodically be calibrated with measurements made using an electronic well sounder or steel tape measure.

Well Information

Table 1 contains the information listed below for each Key Well as required by CASGEM:

- Local well identification name
- State Well Number
- Well coordinates (decimal lat/long, NAD83), as previously determined by DWR
- Groundwater basin or sub-basin name and number per DWR Bulletin 118
- Reference Point Elevation (feet, NAVD88) as previously determined by DWR
- Land surface elevation datum (feet, NAVD88) as previously determined by DWR
- Use of well
- Well Completion Type
- Top Perforation
- Bottom Perforation
- Total Depth of Well
- Additional Comments (if needed)

MAPS

Figure 1 shows the location of the monitoring wells used in the Tehama County CASGEM Monitoring Plan and the sub-basins as identified in DWR Bulletin 118 and the Tehama County Coordinated AB3030 Groundwater Management Plan.

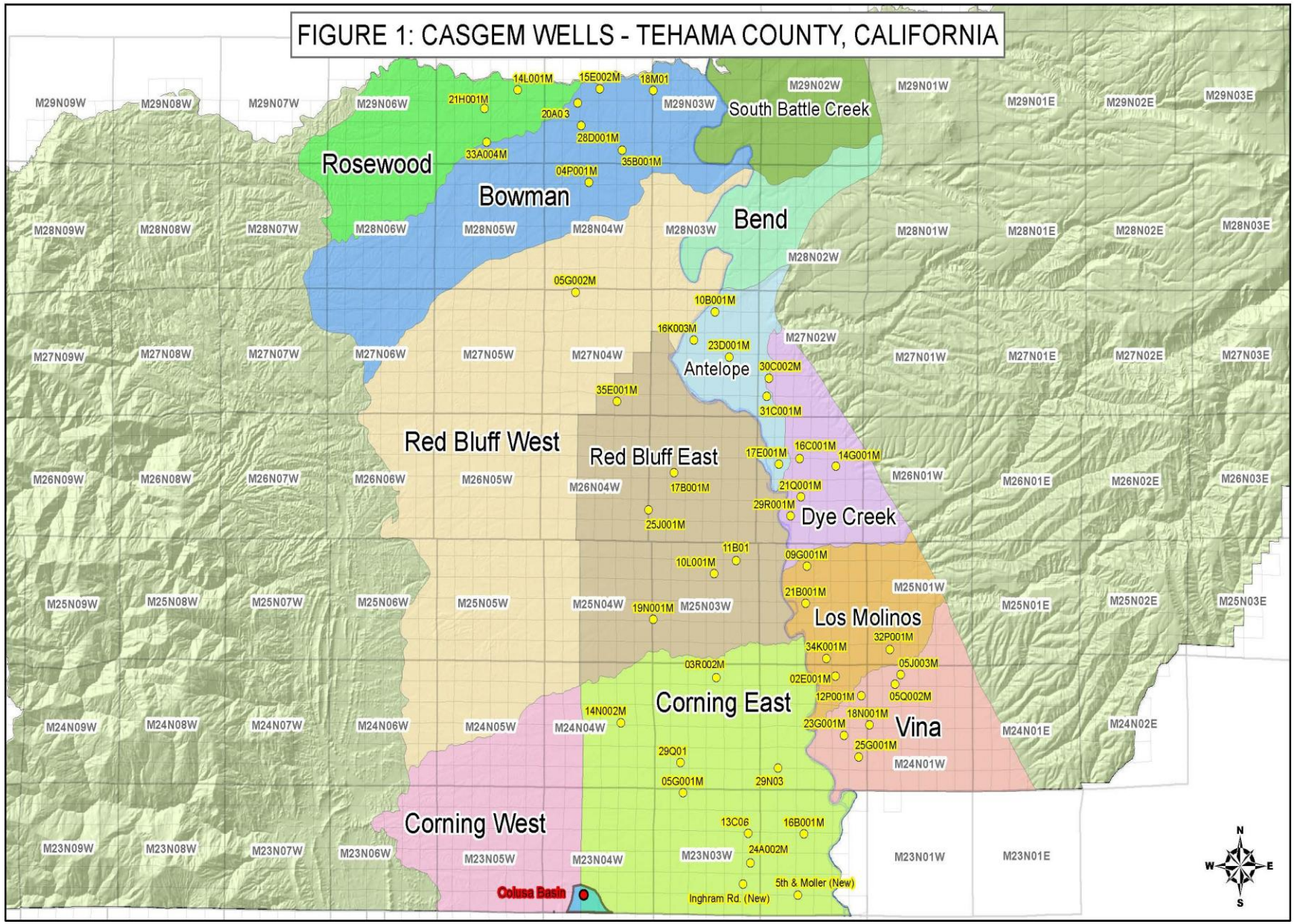


FIGURE 1: CASGEM WELLS - TEHAMA COUNTY, CALIFORNIA
Rosewood
Bowman
South Battle Creek
Bend
Antelope
Red Bluff West
Red Bluff East
Dye Creek
Los Molinos
Corning East
Vina
Corning West
Colusa Basin
Inghram Rd. (New)
5th & Moller (New)
14L001M
15E002M
18M01
21H001M
20A03
28D001M
33A004M
35B001M
04P001M
05G002M
10B001M
16K003M
23D001M
30C002M
35E001M
31C001M
16C001M
17E001M
14G001M
21Q001M
17B001M
29R001M
25J001M
11B01
10L001M
09G001M
21B001M
19N001M
34K001M
32P001M
03R002M
05J003M
02E001M
12P001M
05Q002M
14N002M
18N001M
23G001M
25G001M
29Q01
05G001M
29N03
13C06
16B001M
24A002M
M29N09W
M29N08W
M29N07W
M29N06W
M29N03W
M29N02W
M29N01W
M29N01E
M29N02E
M29N03E
M28N09W
M28N08W
M28N07W
M28N06W
M28N05W
M28N04W
M28N03W
M28N02W
M28N01W
M28N01E
M28N02E
M28N03E
M27N09W
M27N08W
M27N07W
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LIST OF MONITORING WELLS IN CASGEM PLAN FOR TEHAMA COUNTY, 2011.

Local Well ID	State Well Number	Well Coordinate Northing (Latitude)	Well Coordinate Easting (Longitude)	Groundwater Sub-basin Name and Number	Reference Point Elevation	Ground Surface Elevation	Well Use	Well Completion Type
17E001M	26N02W17E001M	40.1087	122.1229	Antelope 5-21.54	241.41	240.41	Irrigation	single well
31C001M	27N02W31C001M	40.1558	122.1361	Antelope 5-21.54	263.43	263.43	Irrigation	single well
10B001M	27N03W10B001M	40.2140	122.1901	Antelope 5-21.54	312.94	312.44	Domestic	single well
16K003M	27N03W16K003M	40.1897	122.2049	Antelope 5-21.54	274.33	273.43	Domestic & Industrial	single well
23D001M	27N03W23D001M	40.1829	122.1752	Antelope 5-21.54	272.43	271.43	Irrigation	single well
04P001M	28N04W04P001M	40.3036	122.3221	Bowman 5-6.01	538.84	537.54	Domestic	single well
18M001M	29N03W18M001M	40.3672	122.2548	Bowman 5-6.01	419.04	418.54	Irrigation	single well
15E002M	29N04W15E002M	40.3677	122.3119	Bowman 5-6.01	428.51	427.51	Irrigation	single well
20A03	29N04W20A003M	40.3585	122.3338	Bowman 5-6.01	456.17	454.01	Mon.	multi-completion
28D001M	29N04W28D001M	40.3453	122.3316	Bowman 5-6.01	503.04	502.54	Domestic	single well
35B001M	29N04W35B001M	40.3305	122.2805	Bowman 5-6.01	541.53	537.53	Test	single well
16B001M	23N02W16B001M	39.8534	122.0963	Corning 5-21.51	186.53	184.93	Irrigation	single well
Moller	23N02WxxxxxM (not assigned yet)			Corning 5-21.51			Mon.	multi-completion

Local Well ID	State Well Number	Well Coordinate Northing (Latitude)	Well Coordinate Easting (Longitude)	Groundwater Sub-basin Name and Number	Reference Point Elevation	Ground Surface Elevation	Well Use	Well Completion Type
05G001M	23N03W05G001M	39.8815	122.2225	Corning 5-21.51	280.29	279.49	unknown	single well
13C06	23N03W13C006M	39.8544	122.1524	Corning 5-21.51	218.04	215.99	Mon.	multi-completion
24A002M	23N03W24A002M	39.8389	122.1442	Corning 5-21.51	208.44	207.44	Irrigation	single well
Ingram	23N03WxxxxxM (not assigned yet)			Corning 5-21.51			Mon.	multi-completion
29N03	24N02W29N003M	39.8996	122.1227	Corning 5-21.51	216.24	214.94	Mon.	single well
03R002	24N03W03R002M	39.9586	122.1812	Corning 5-21.51	279.46	278.46	Domestic	single well
29Q01	24N03W29Q001M	39.9030	122.2246	Corning 5-21.51	318.66	316.66	Mon.	multi-completion
14N002M	24N04W14N002M	39.9305	122.2865	Corning 5-21.51	375.52	375.02	Domestic	single well
14G001M	26N02W14G001M	40.1076	122.0630	Dye Creek 5-21.55	314.43	314.13	Irrigation	single well
16C001M	26N02W16C001M	40.1126	122.1010	Dye Creek 5-21.55	242.99	242.41	Domestic	single well
21Q001M	26N02W21Q001M	40.0861	122.0998	Dye Creek 5-21.55	238.90	237.40	Domestic	single well
29R001M	26N02W29R001M	40.0725	122.1124	Dye Creek 5-21.55	234.00	230.40	Observ.	multi-completion
30C002M	27N02W30C002M	40.1684	122.1341	Dye Creek 5-21.55	282.93	282.43	Domestic	single well
02E001M	24N02W02E001M	39.9648	122.0638	Los Molinos 5-21.56	203.72	202.42	Irrigation	single well

Local Well ID	State Well Number	Well Coordinate Northing (Latitude)	Well Coordinate Easting (Longitude)	Groundwater Sub-basin Name and Number	Reference Point Elevation	Ground Surface Elevation	Well Use	Well Completion Type
32P001M	25N01W32P001M	39.9733	122.0069	Los Molinos 5-21.56	305.71	303.41	Observ.	multi-completion
09G001M	25N02W09G001M	40.0382	122.0934	Los Molinos 5-21.56	265.40	264.40	Domestic	single well
21B001M	25N02W21B001M	40.0124	122.0946	Los Molinos 5-21.56	212.91	212.41	Irr. & Dom.	single well
34K001M	25N02W34K001M	39.9746	122.0731	Los Molinos 5-21.56	206.42	206.42	Irrigation	single well
10L001M	25N03W10L001M	40.0329	122.1904	Red Bluff 5-21.50	278.43	276.43	Observ.	multi-completion
11B01	25N03W11B001M	40.0428	122.1665	Red Bluff 5-21.50	256.62	254.52	Mon.	multi-completion
19N001M	25N03W19N001M	40.0013	122.2540	Red Bluff 5-21.50	327.49	324.49	Irrigation	single well
17B001M	26N03W17B001M	40.1117	122.2267	Red Bluff 5-21.50	310.13	309.43	Domestic	single well
25J001M	26N04W25J001M	40.0770	122.2590	Red Bluff 5-21.50	334.46	333.46	Domestic	single well
35E001M	27N04W35E001M	40.1520	122.2924	Red Bluff 5-21.50	439.47	438.47	Domestic	single well
05G002M	27N04W05G002M	40.2273	122.3376	Red Bluff 5-21.50	483.83	482.53	Domestic	single well
14L001M	29N05W14L001M	40.3664	122.3984	Rosewood 5-6.02	493.55	492.55	Domestic	single well
21H001M	29N05W21H001M	40.3549	122.4311	Rosewood 5-6.02	624.05	622.55	Domestic	single well
33A004M	29N05W33A004M	40.3290	122.4261	Rosewood 5-6.02	536.56	534.56	Observ.	multi-completion
05J003M	24N01W05J003M	39.9633	121.9955	Vina 5-21.57	314.51	312.41	Observ.	multi-completion

Local Well ID	State Well Number	Well Coordinate Northing (Latitude)	Well Coordinate Easting (Longitude)	Groundwater Sub-basin Name and Number	Reference Point Elevation	Ground Surface Elevation	Well Use	Well Completion Type
05Q002M	24N01W05Q002M	39.9568	122.0016	Vina 5-21.57	290.11	289.41	Domestic	single well
18N001M	24N01W18N001M	39.9290	122.0275	Vina 5-21.57	256.91	256.41	Domestic	single well
12P001M	24N02W12P001M	39.9456	122.0399	Vina 5-21.57	230.81	228.41	Observ.	multi-completion
23G001M	24N02W23G001M	39.9218	122.0545	Vina 5-21.57	199.41	199.41	Irrigation	single well
25G001M	24N02W25G001M	39.9091	122.0396	Vina 5-21.57	196.41	194.41	Irrigation	single well

APPENDIX C – GROUNDWATER MONITORING

Appendix C-3

Summary of Key Wells and Alert Levels in Tehama County

Summary of Key Wells for Monitoring Groundwater Elevations and Management Involvement Trigger Levels in Tehama County, August 2011.[1]

Well ID No.	General Location	Ground Surface Elevation (feet above sea level)	Spring Alert Level 1 (feet below ground surface)	Spring Alert Level 2 (feet below ground surface)	Late Season Alert Level (feet below ground surface)
ANTELOPE SUB-BASIN					
26N02W17E001M	LeClaire & Decker Ave	238	16	19	20
27N02W31C001M	Bray & Craig Ave	261	28	31	38
27N03W10B001M	St. Mary & Trinity Ave	310	57	61	60
27N03W16K003M	Roundup Ave.	271	32	34	43
27N03W23D001M	Hogsback Rd & Hwy 99E	269	26	30	38
BOWMAN SUB-BASIN					
28N04W04P001M	Hooker Creek Rd & Hooker Rd	535	54	60	128
29N03W18M001M	Lake California Drive	416	32	34	43
29N04W15E002M	Draper Rd & Oak Lane	425	35	37	40
29N04W20A003M	Bowman Rd & Learning Way	452	37	38	45
29N04W28D001M	Hooker Creek & Jeffries Rd	500	105	108	104
29N04W35B001M	I-5 & Snively Rd	535	90	93	90
CORNING EAST SUB-BASIN					
23N02W16B001M	Near Cattle Drive	183	38	44	54
23N02W28N004M	5th & Moller Aves	202	n/a	n/a	n/a
23N03W05G001M	Liberal Ave & Cushman Lane	277	54	60	59
23N03W13C006M	Capay & Hall Rds	214	43	44	60
23N03W24A002M	Capay Rd & Sour Grass Creek	205	39	43	64
23N03W25M004M	Ingram Ave & TC Canal	236	n/a	n/a	n/a
24N02W29N003M	New York & Hall Rds	213	37	40	59
24N03W03R002M	Highway 99W & Finnell Ave	276	33	35	51
24N03W29Q001M	Chittenden Rd & Mt. Shasta Ave	314	75	77	89
24N04W14N002M	Corning Rd & Freeman School House Rd	373	73	79	100
DYE CREEK SUB-BASIN					
26N02W14G001M	Foothill Rd	312	78	81	85
26N02W15C001M	68th Ave & Hwy 99E	258	35	38	46
26N02W16C001M	68th & Schafer Ave	240	17	19	27
26N02W21Q001M	9th Ave & Hwy 99E	235	19	21	26
26N02W29R001M	5th Ave	228	8	9	9
27N02W30C002M	Cone Grove Rd	280	31	36	41
LOS MOLINOS SUB-BASIN					
24N02W02E001M	Tehama Vina St	200	4	5	9
25N01W32P001M	Leninger Rd & Deer Crk	301	76	78	78
25N02W09G001M	Buena Vista Ave	262	41	43	42
25N02W21B001M	Lee & Sherman St	210	13	15	18
25N02W34K001M	Hwy 99 E & Dye Creek	204	15	17	22

Well ID No.	General Location	Ground Surface Elevation (feet above sea level)	Spring Alert Level 1 (feet below ground surface)	Spring Alert Level 2 (feet below ground surface)	Late Season Alert Level (feet below ground surface)
RED BLUFF EAST SUB-BASIN					
25N03W10L001M	Rodeo & Central Ave	274	46	51	66
25NO3W11B001M	99W & Gerber Rd	252	29	32	47
25N03W19N001M	Gyle Rd	325	54	60	60
26N03W17B001M	Cody Drive	307	54	55	60
26N04W25J001M	Ottman Ave & Paskenta Rd	331	53	58	63
27N04W35E001M	Live Oak & Red Bank Rds	436	119	124	133
RED BLUFF WEST SUB-BASIN					
27N04W05G002M	Hwy 36	480	45	47	65
ROSEWOOD SUB-BASIN					
29N05W14L001M	Old Gold Rd	490	35	37	44
29N05W21H001M	Farquhar Rd	620	140	142	143
29N05W33A004M	Farquhar Rd	532	39	42	45
VINA SUB-BASIN					
24N01W05J003M	Reed Orchard Rd	310	88	93	90
24N01W05Q002M	Reed Orchard Rd	287	45	47	49
24N01W18N001M	Hwy 99E	254	64	65	69
24N02W12P001M	Vina Rd	226	30	31	31
24N02W23G001M	Vadney Ave & Rowles Rd	197	25	28	29
24N02W25G001M	South Ave & Stephens Rd	194	22	23	27

[1] Currently groundwater monitoring is not conducted in the South Battle Creek, Bend, and Corning West groundwater sub-basins.

APPENDIX C – GROUNDWATER MONITORING

Appendix C-4

Tehama County Groundwater Recharge Area Location Study

Brown AND Caldwell

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Rancho Cordova, California 95670
Tel: 916-444-0123
Fax: 916-635-8805

Summary Report

Prepared for: Tehama County Flood Control and Water Conservation District

Project Title: Tehama County Groundwater Recharge Area Location Study

Project No: 139235

Summary Report

Subject: Summary Report for Groundwater Recharge Area Location Study

Date: June 30, 2011

To: Gary Antone, Public Works Director

From: John Ayres, Brown and Caldwell Project Manager

Prepared by: John Ayres

Limitations:

This document was prepared solely for Tehama County Flood Control and Water Conservation District in accordance with professional standards at the time the services were performed and in accordance with the contract between Tehama County Flood Control and Water Conservation District and Brown and Caldwell dated April 29, 2010. This document is governed by the specific scope of work authorized by Tehama County Flood Control and Water Conservation District; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Tehama County Flood Control and Water Conservation District and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Table of Contents

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1. Introduction

The Tehama County Groundwater Area Recharge Study (study) was conducted to identify portions of Tehama County where it would be advantageous to investigate potential locations for operation of a groundwater recharge project (Figure 1-1). This summary report documents work performed during the study. It includes background information as well as information about the study area; data collected, analysis performed, and recommends areas for further investigation.

This study was conducted to identify areas of Tehama County that will benefit from artificial recharge. This study provides a screening level analysis that identifies areas of Tehama County that are suitable for additional study and siting of a pilot groundwater recharge project.

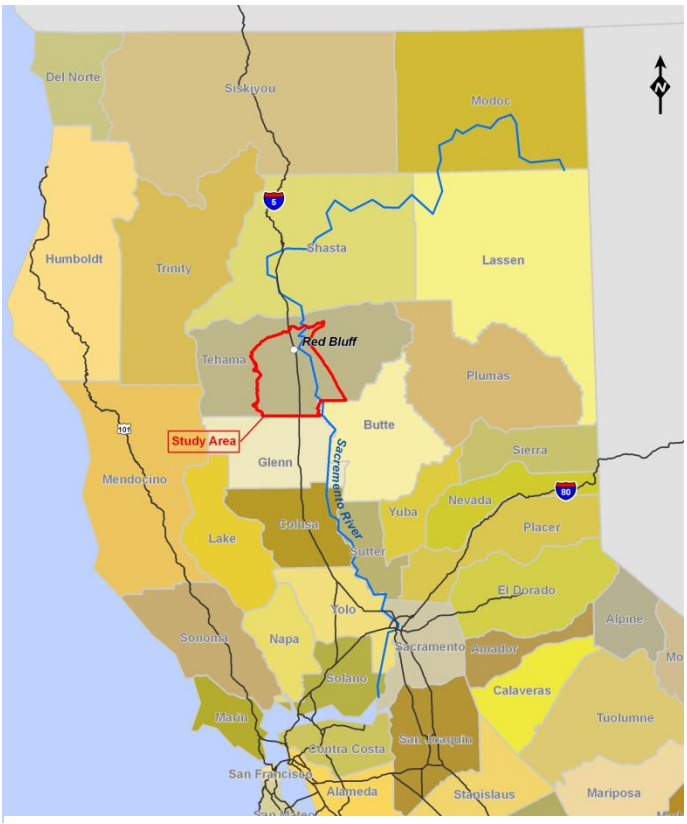


Figure 1-1. Regional Map

1.1 Background

From the 1970's to the 1990's, reliance on groundwater for agricultural, domestic, environmental, and industrial uses in Tehama County increased from about 30 to 65 percent of total water use. Today, groundwater use remains predominant. The general public recognized the need to advance with groundwater resource protection by balancing groundwater use with groundwater recharge. In 1996, after considerable public input and review, the Tehama County Groundwater Management Plan was completed and adopted by the Tehama County Flood Control and Water Conservation District.

The Plan addresses complex groundwater issues in Tehama County and as a result employs a careful approach that seeks to implement groundwater management as appropriate. The Plan encourages cooperation with cities, special districts, and landowners throughout Tehama County who share in the common objectives of the Plan. The Plan considers water resource and groundwater management interests that are common with neighboring counties and the broader Sacramento Valley area and seeks dialogue and coordination with the appropriate county and regional entities. The Plan is also consistent with state legislation (AB-3030, 1992 and SB-1938, 2002) that has been incorporated into California Water Code to guide groundwater management planning.

The Tehama County Flood Control and Water Conservation District (District) works to guide and facilitate implementation of the Plan. The Plan is implemented under the guidance of a Technical Advisory Committee (TAC). Members of the TAC represent a balanced cross-section of interests including private pumpers, surface diverters, natural resources, water districts and cities in Tehama County's groundwater resources community.

Under the Plan, the District has expanded the groundwater monitoring network, completed a Water Inventory and Analysis, and maintains a website (www.tehamacountywater.ca.gov) to share documents, TAC agendas and minutes and data to inform the public of District activities. In 2006, the District and the TAC initiated the development of groundwater "trigger levels" in accordance with

Section 325 of the Plan and trigger levels were developed in 2008 and 2009. Public workshops were held to discuss the trigger level program in 2009.

Groundwater trigger levels create an awareness of fluctuations in groundwater conditions within Tehama County over time and recommend appropriate actions to inform water users of the conditions and potential management needs in the county. Trigger levels are set in specific monitoring wells known as key wells. As groundwater levels in key wells decline, the trigger level program recommends that the District begin to take actions that are appropriate for the levels of decline. Potential actions include:

- Increase communication with water users and the public
- Investigate the possible causes of the decline
- Increase monitoring
- Consider groundwater recharge efforts
- Voluntary programs to resolve issues

The trigger level program detected a decline in spring groundwater levels in key wells in the Red Bluff East and Corning East subbasins in 2009 and 2010. The groundwater declines were investigated by the Tehama County TAC. The TAC investigated changes in land use, precipitation trends, and installation of new production wells. TAC investigation revealed that some of the trigger level exceedances were the result of increased permanent crop acreage that was reliant on groundwater, and several years of drought conditions. Because trigger levels were exceeded, the District has begun efforts to investigate the feasibility of artificial groundwater recharge in Tehama County, which has lead to this study.

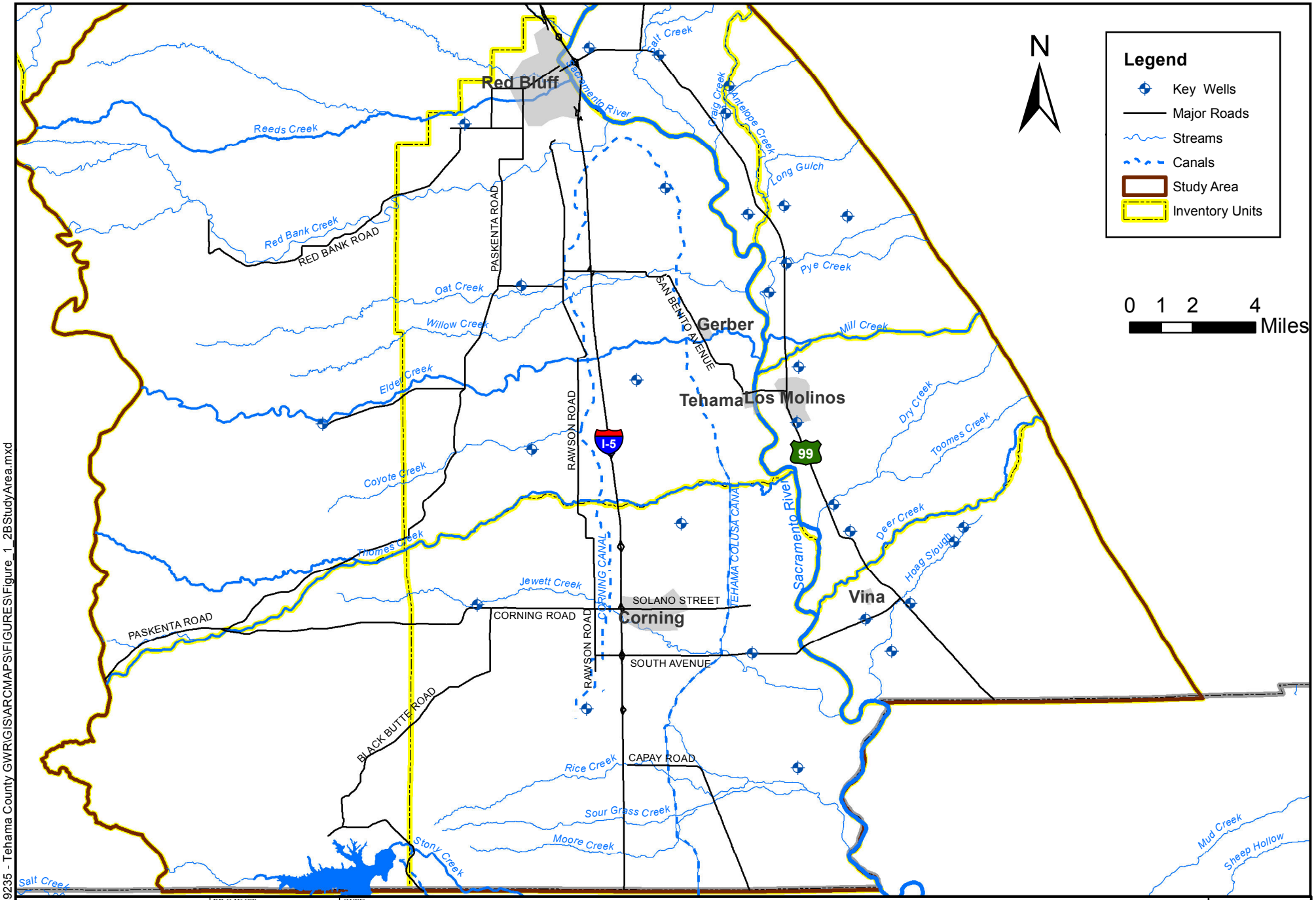
1.2 Study Area

This study was conducted in the Sacramento Valley portion of Tehama County (Figure 1-2). The study area was restricted to the Sacramento Valley portion of Tehama County where groundwater monitoring information is abundant enough for regional groundwater contours to accurately describe groundwater conditions. The study area is bounded on the east and west by the edge of the Sacramento Valley groundwater basin as identified by the Department of Water Resources (DWR) Bulletin 118. The study area is bounded in the south by the County boundary with Glenn County, and loosely bounded in the north by the region near Red Bluff, where groundwater monitoring data are unavailable. The northern boundary was determined by the location of the Red Bluff Arch.

1.3 Report Organization

This summary report contains four sections, described below:

- **Section 1, Introduction** – This section describes the report, provides background, and identifies the study area.
- **Section 2, Methodology** – This section describes analytical methods used in this study.
- **Section 3, Data Collected** – This section describes the data collected for this study.
- **Section 4, Analysis** – This section describes the analysis performed during area selection.
- **Section 5, Areas Recommended for Additional Investigation** – This section presents the areas recommended for further study.
- **Section 6, Recharge Methodologies** – This section describes available potential approaches that may be utilized by the County to perform a recharge program.
- **Section 7, Conclusions** – This section identifies priorities of recommended areas and what actions should be taken to further prepare for groundwater recharge activities.



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BROWN AND CALDWELL

PROJECT	SITE	
139235	Tehama County, CA	Figure 1-2
DATE	TITLE	
6/24/11	Study Area and Key Wells	

2. Data Collected

Data were collected and compiled from existing Geographic Information Systems (GIS) datasets, DWR provided groundwater information, and recommended data from the TAC. Data were compiled in GIS format, to facilitate analysis. This section presents and describes the data used in this study.

Geology

Geology in a GIS format was provided by DWR Northern District (Figure 2-1). Geology was used in this study to identify surficial exposures of geologic formations that were more likely to have permeabilities that would be appropriate for recharge activities.

Soil

Soil data were acquired from the National Resources Conservation Service (Figure 2-2). Soil data were sorted by textural class during analysis. Soil data were used in this study to identify more permeable soils appropriate for recharge activities.

Streams and Canals

Stream and canal data were collected from the California Spatial Information Library (CaSIL) (Figure 2-3). Stream and canal information was used to identify areas with proximity to a potential surface water source.

Irrigation Districts

Irrigation district data were collected from Tehama County (Figure 2-3). Irrigation district information was used to identify areas with infrastructure that could receive surface water.

Groundwater Contours

Contours of groundwater elevation for spring (usually measured in March) and summer (usually measured in July and August) measurements from the years 2006 to 2009 were collected from DWR Northern District (Figures 2-4 through 2-11). Contour information was analyzed to identify areas of Tehama County that would benefit from recharge activities.

Depth to Water Contour

A contour of average depth to water was provided by DWR Northern District and reported in feet below ground surface (Figure 2-12). This map was created using information from shallow (less than 200 foot deep) groundwater wells. Depth to water information was used to identify portions of Tehama County that have enough aquifer space to receive water from recharge activities.

Aggregate Mine Locations

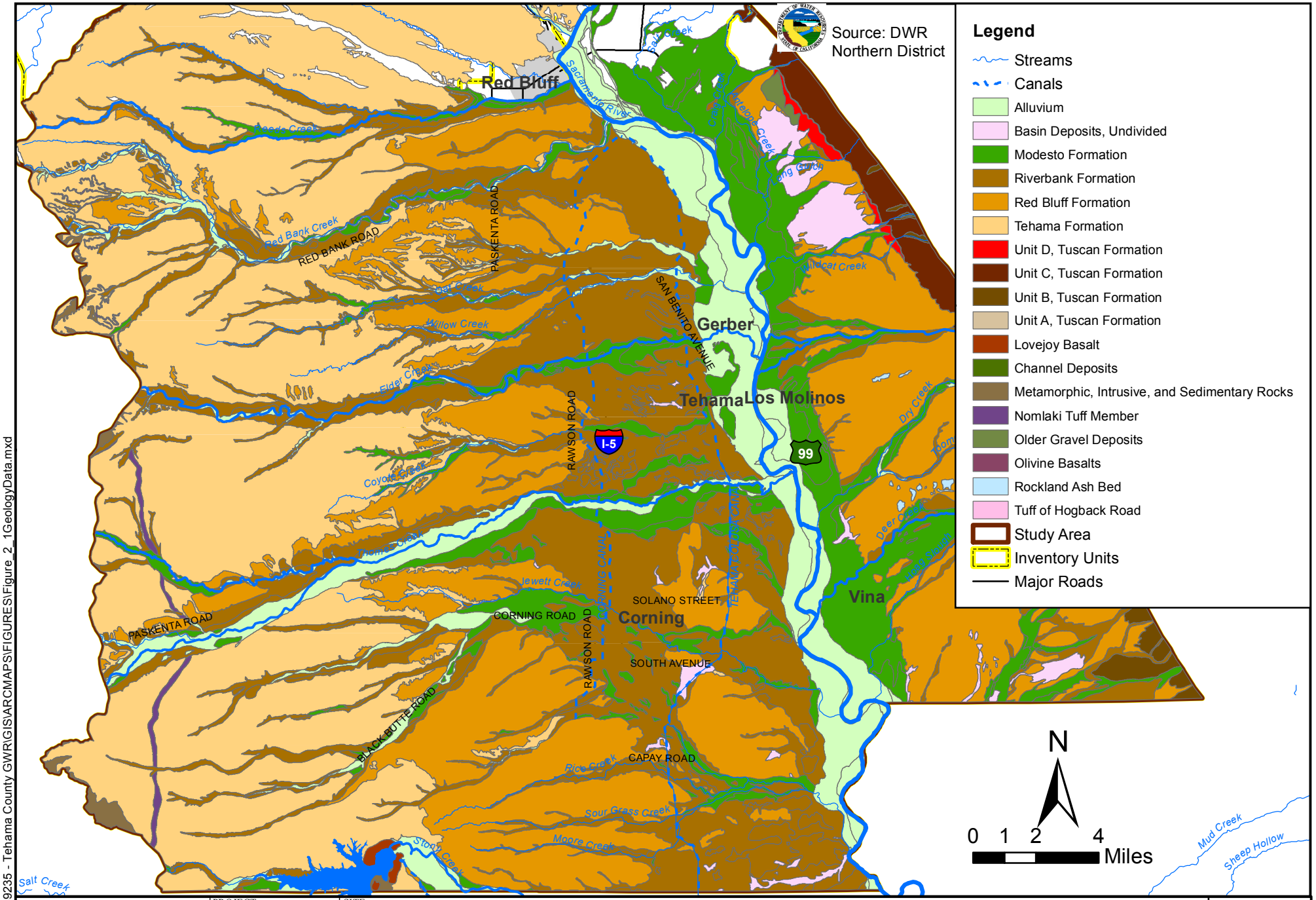
Locations of aggregate mines were received from Tehama County (Figure 2-13). Aggregate mine location information was used to help identify potential recharge areas.

Land Use by Water Source

Land use by water source information was provided by DWR Northern District (Figure 2-14). Land use was used to provide contextual information for selection of specific potential project sites.

Parcels

Parcel information was provided by Tehama County (Figure 2-15). Parcel information was used to provide contact information to the County to facilitate selection of specific potential project sites.



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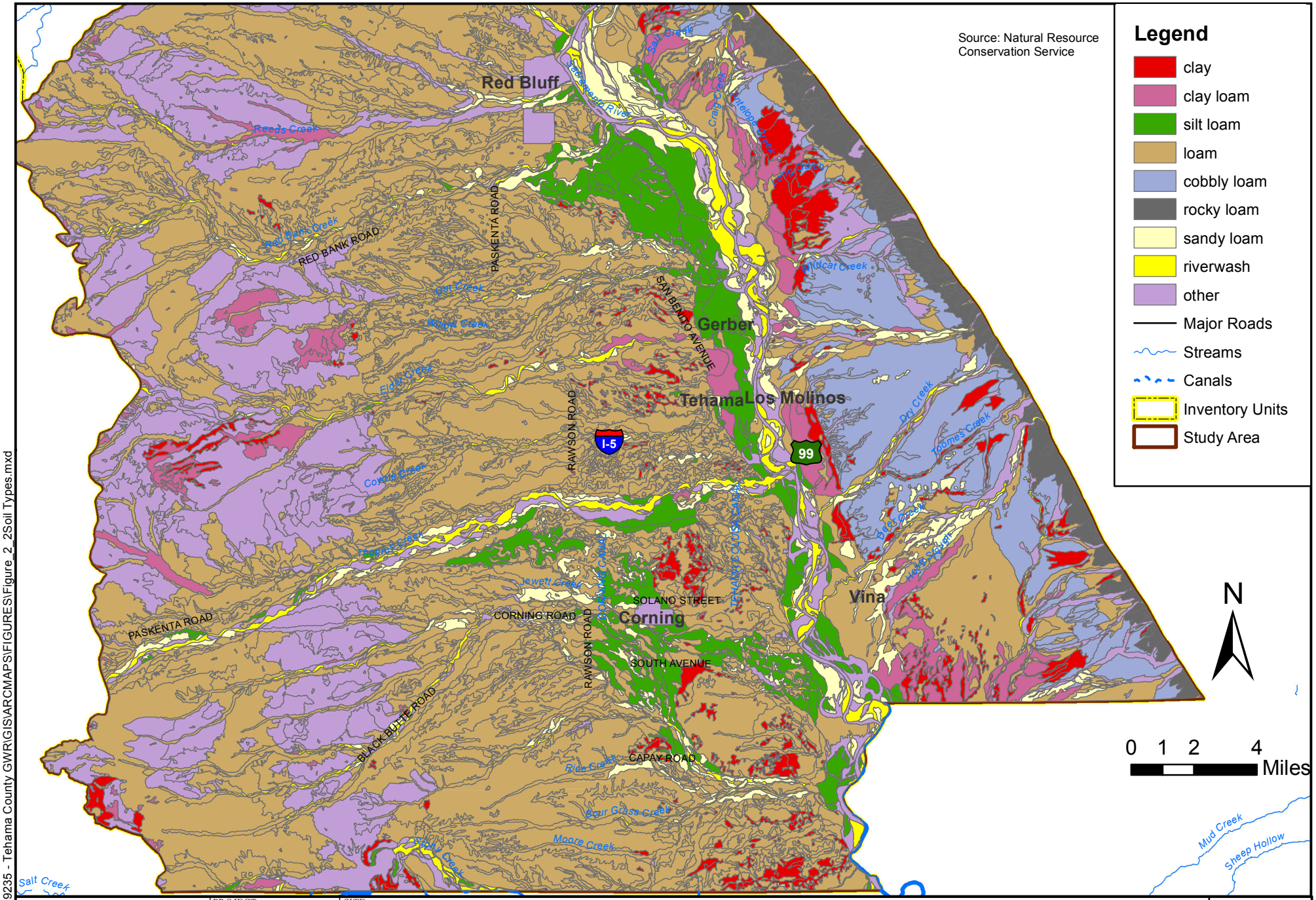
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Geology Data

Figure 2-1



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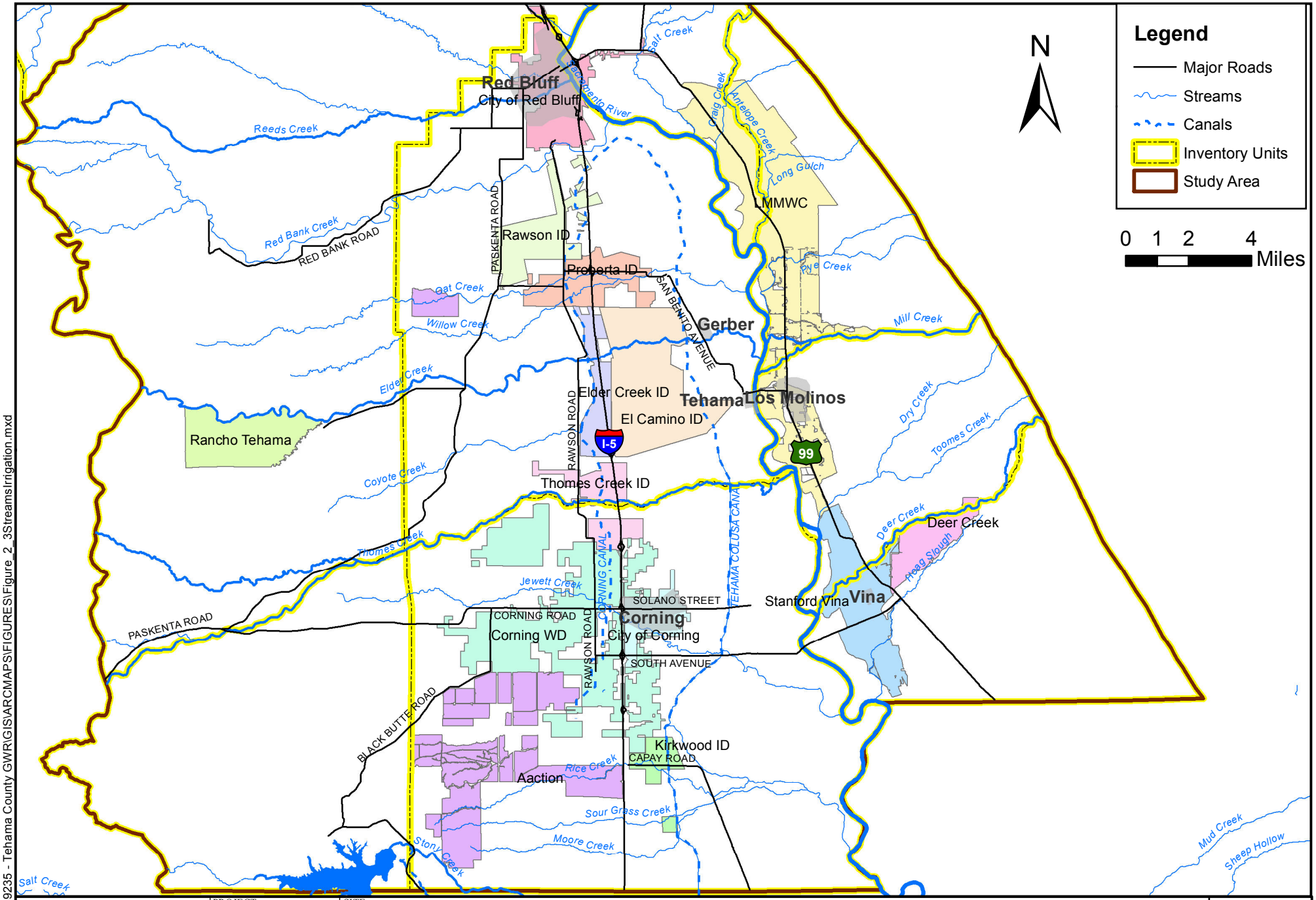
BROWN AND CALDWELL

PROJECT	SITE	
139235	Tehama County, CA	Figure
DATE	TITLE	2-2
6/24/11	Soil Types	



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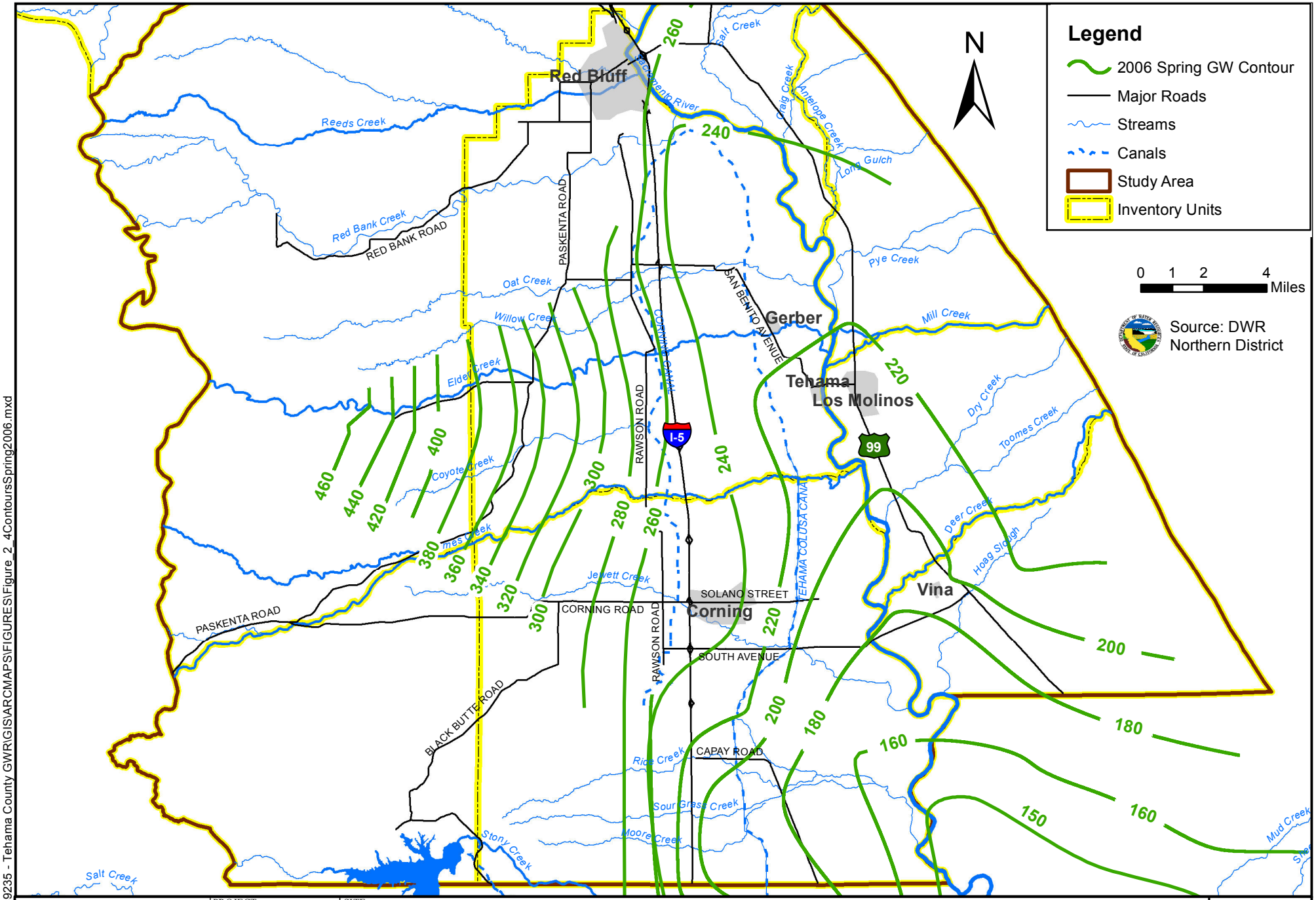
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Streams, Canals, and Irrigation Districts

Figure 2-3



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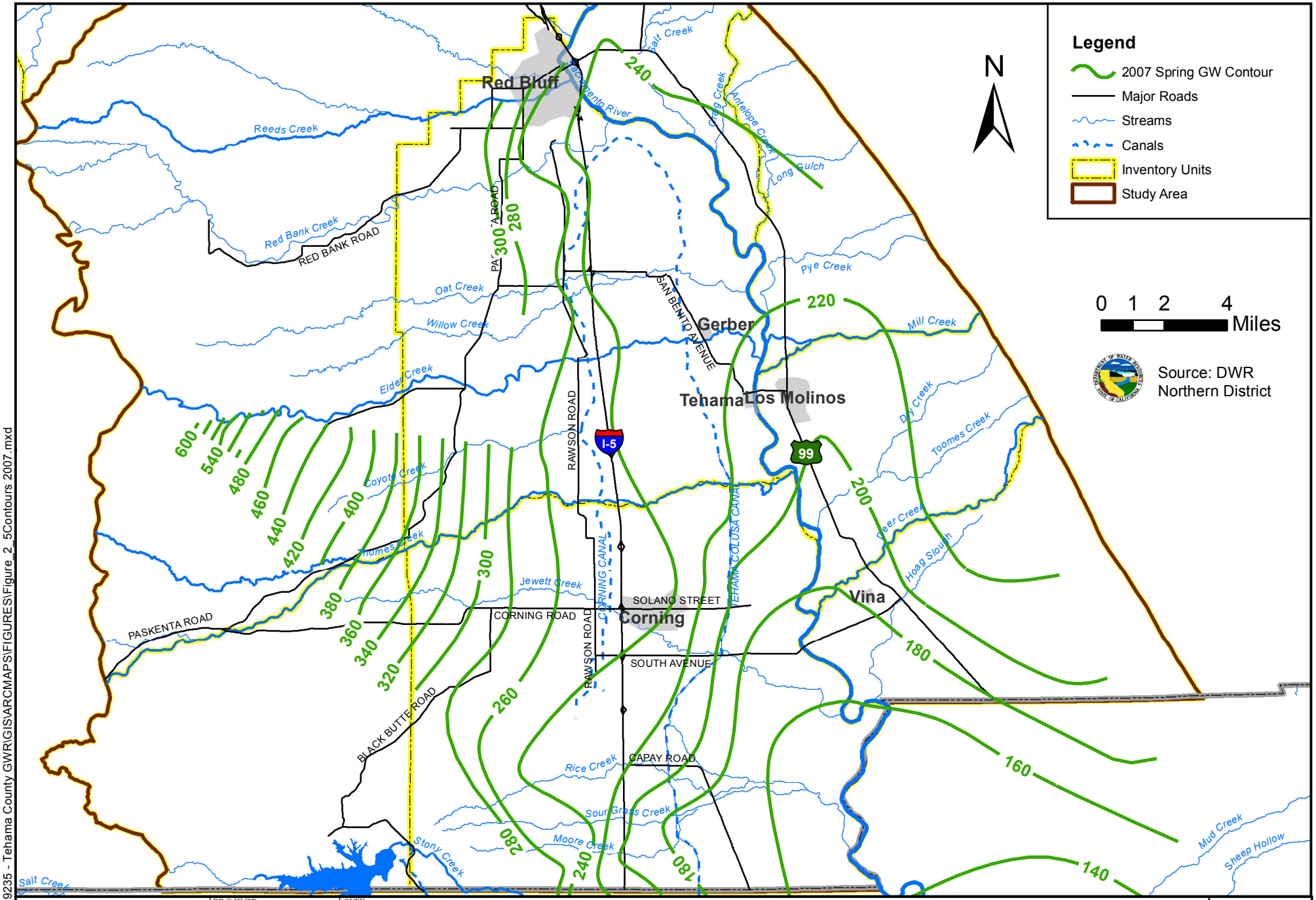
BROWN AND CALDWELL	PROJECT 139235	SITE Tehama County, CA	Figure 2-4
	DATE 6/24/11	TITLE Spring 2006 Groundwater Contour Map	



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BROWN AND CALDWELL

PROJECT	SITE
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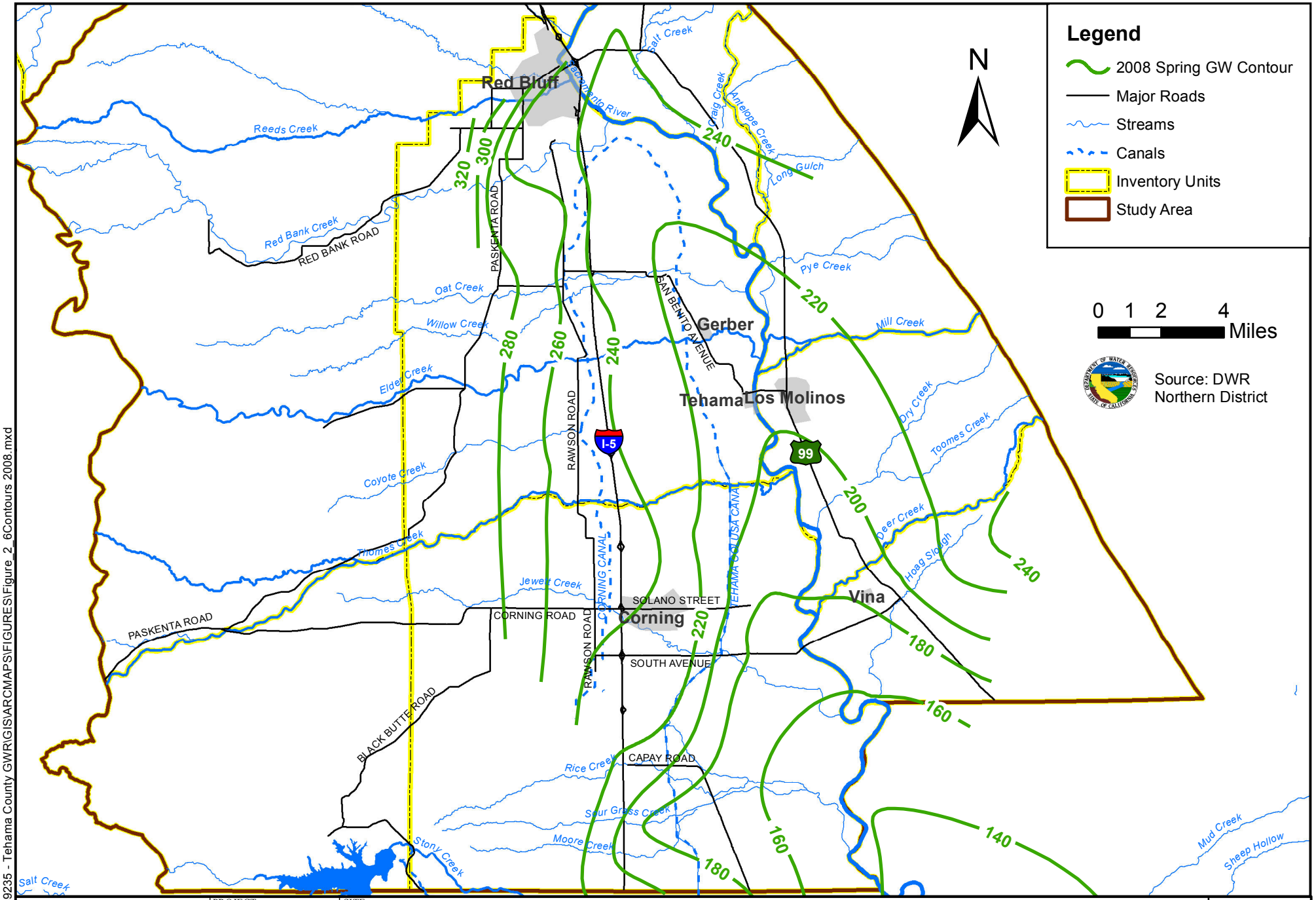
DATE	TITLE
6/24/11	Spring 2007 Groundwater Contour Map

Figure 2-5



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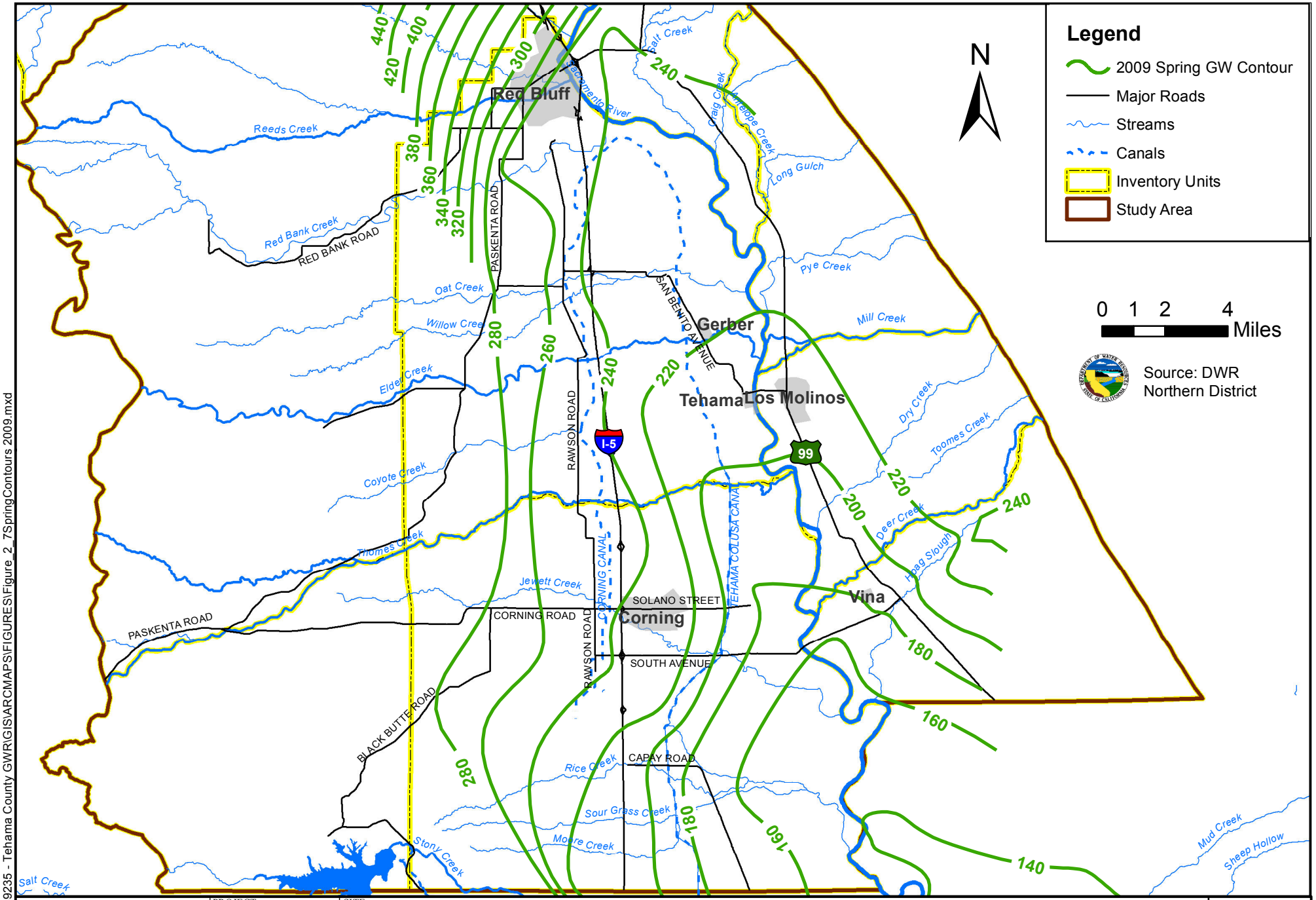
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Spring 2008 Groundwater Contour Map

Figure 2-6



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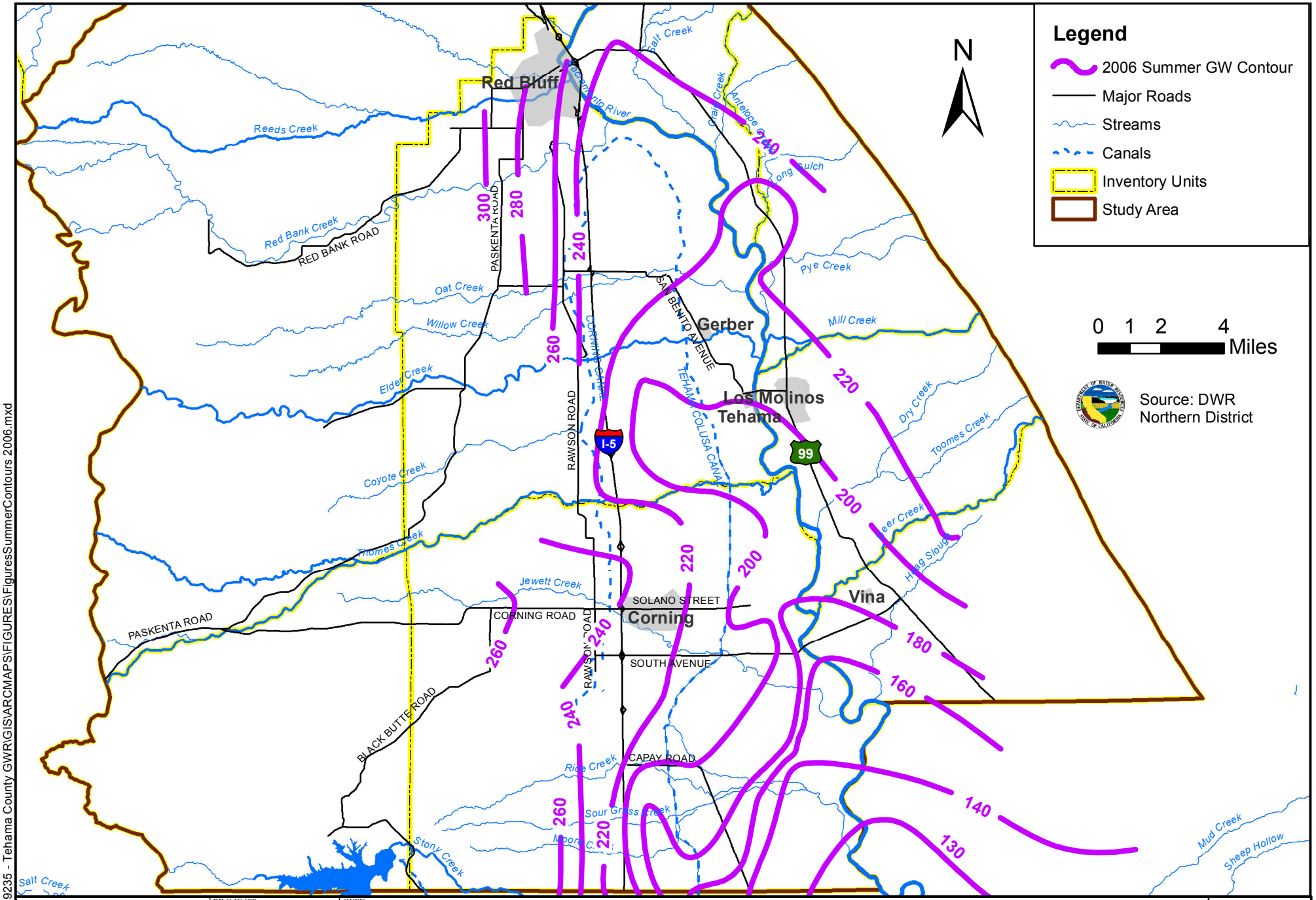
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Spring 2009 Groundwater Contour Map

Figure 2.7



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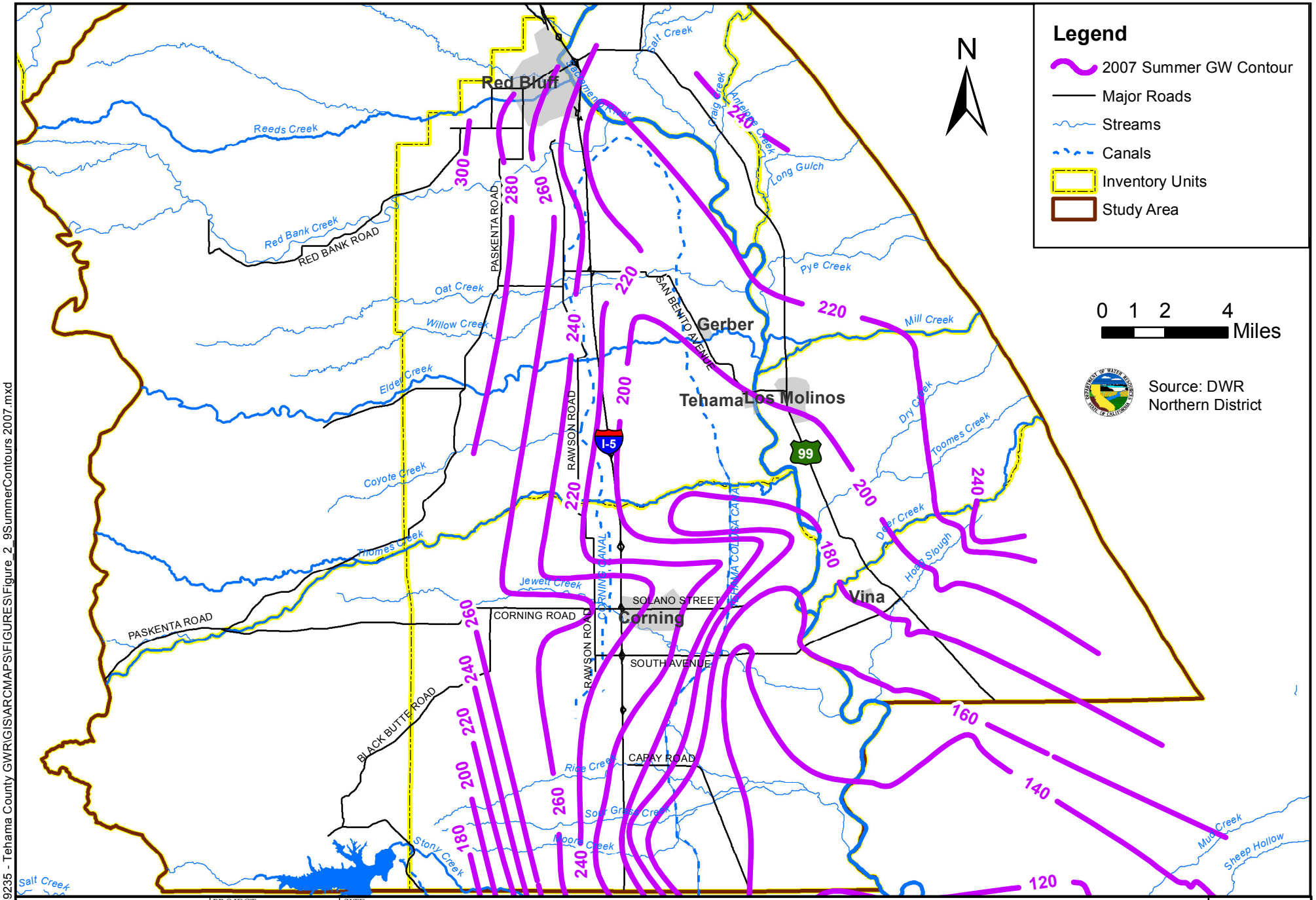
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Summer 2006 Groundwater Contour Map

Figure 2-8



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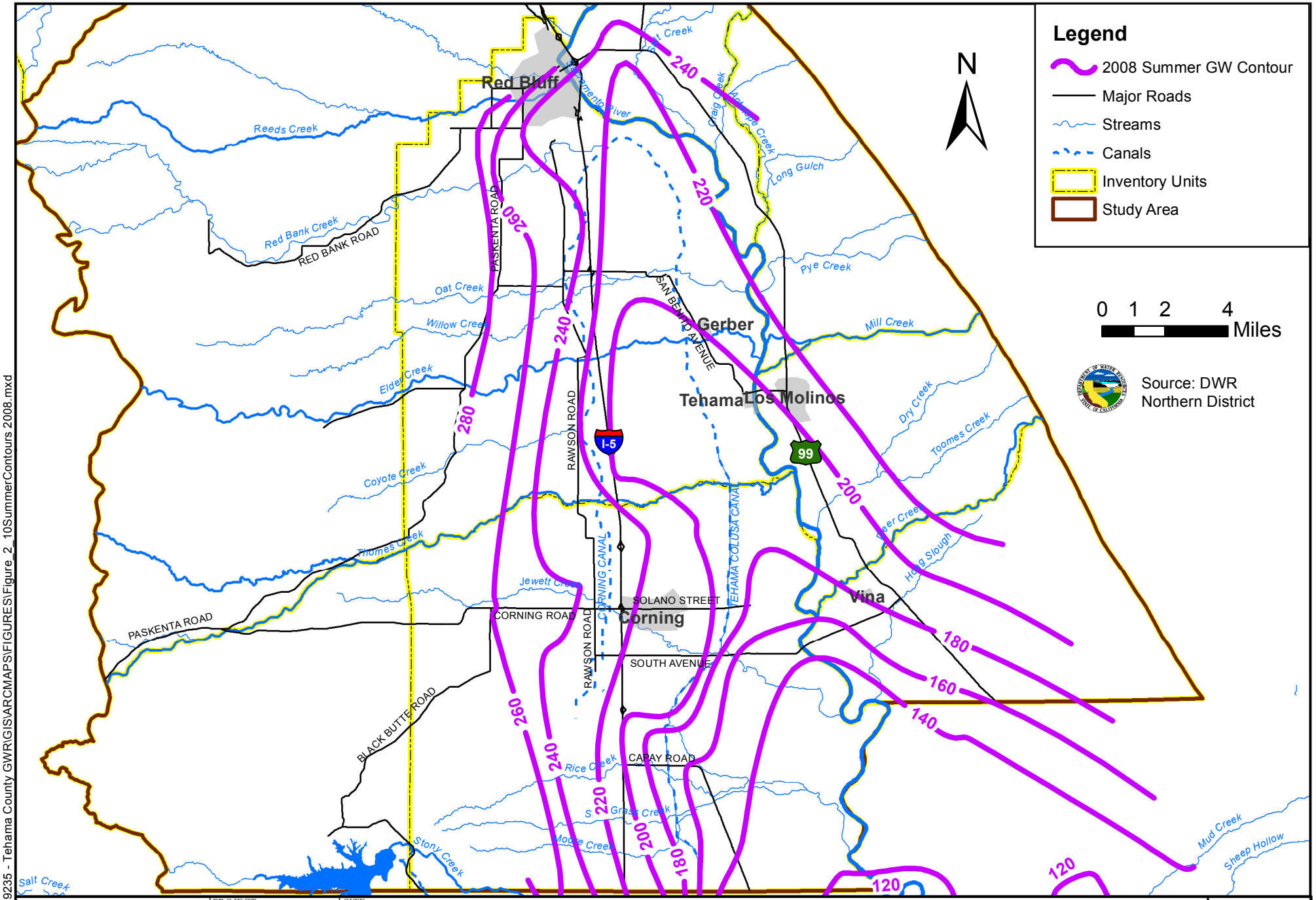
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Summer 2007 Groundwater Contour Map

Figure 2-9



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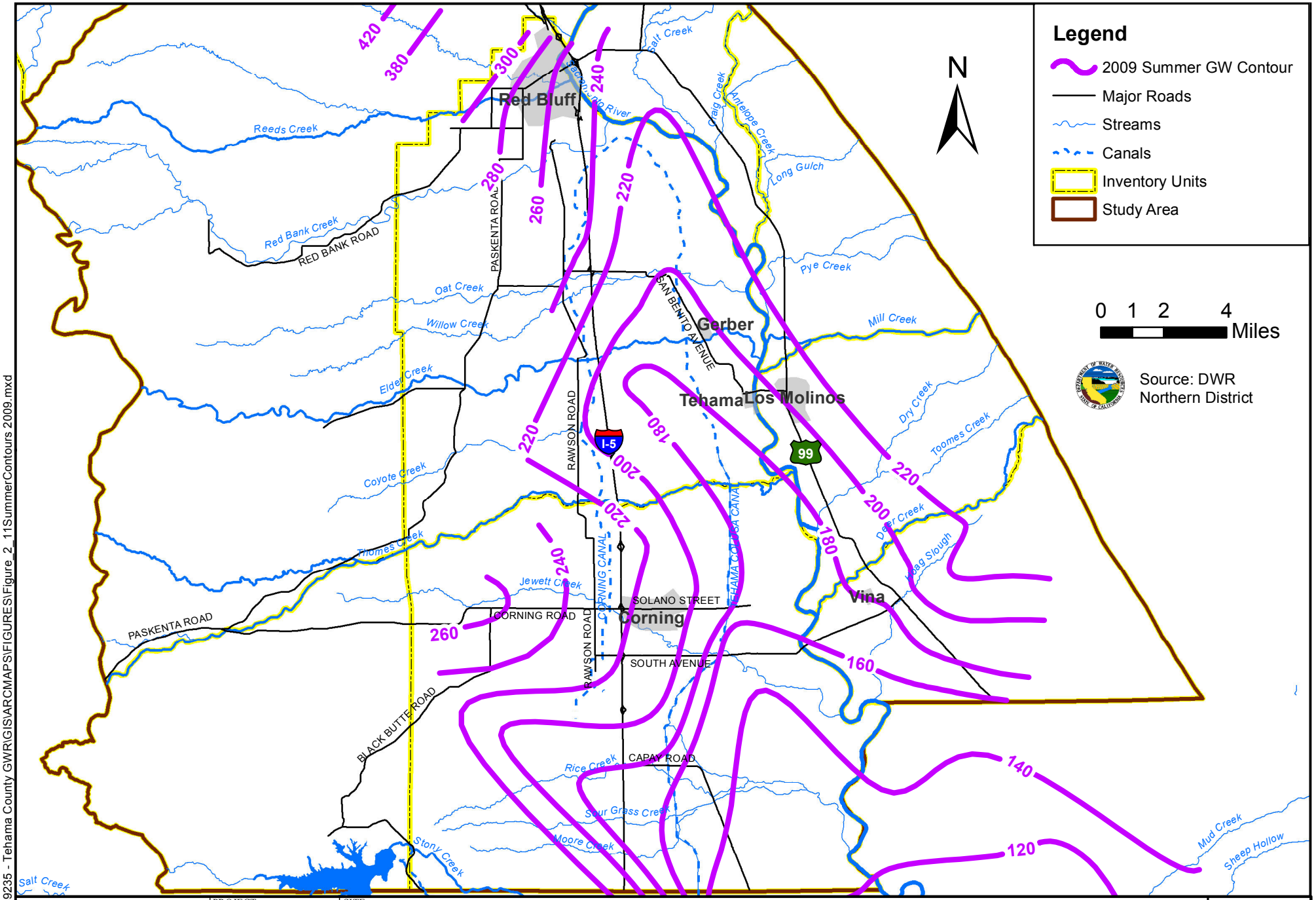
BROWN AND CALDWELL	PROJECT 139235	SITE Tehama County, CA	Figure 2-10
	DATE 6/24/11	TITLE Summer 2008 Groundwater Contour Map	



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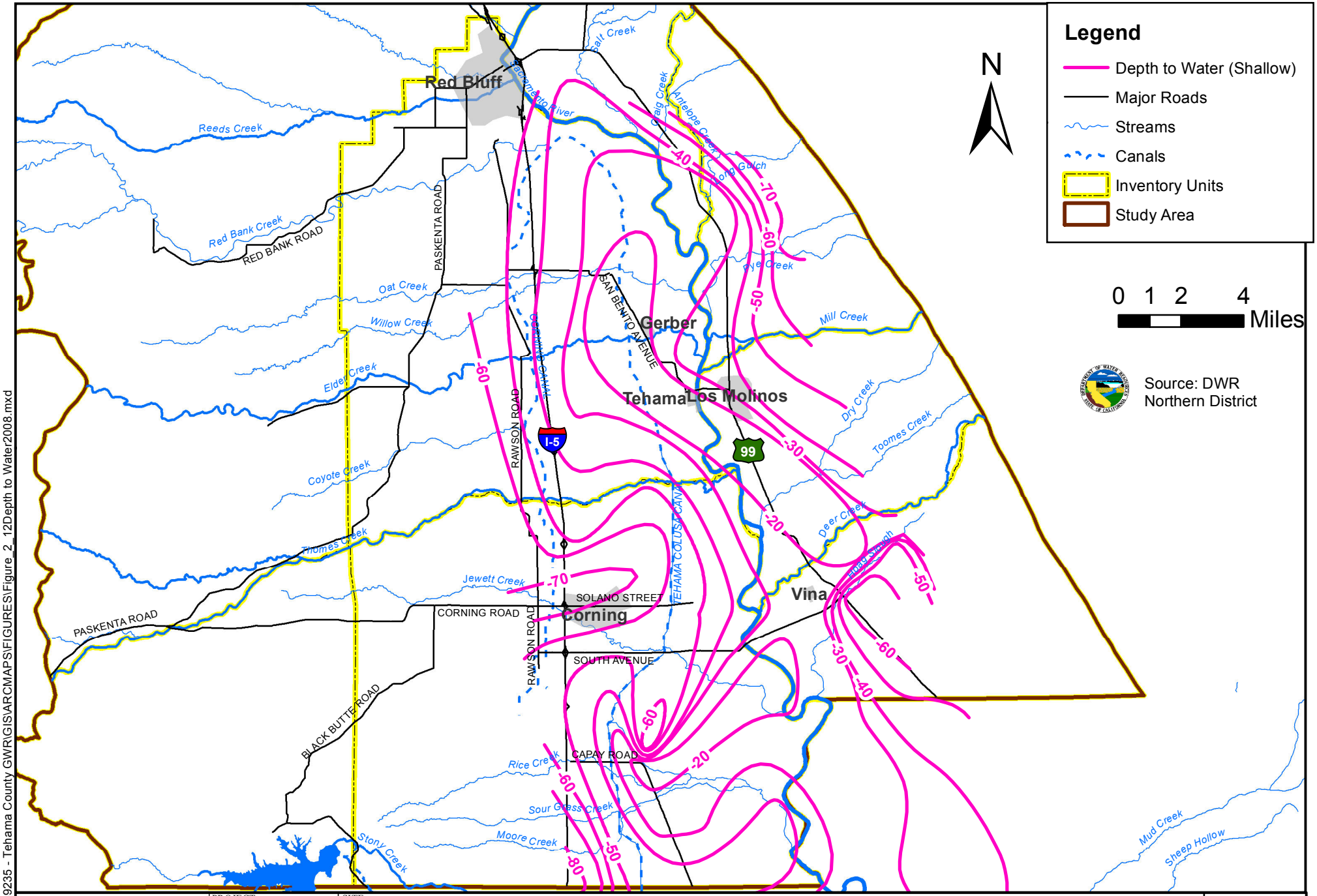
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Summer 2009 Groundwater Contour Map

Figure 2-11



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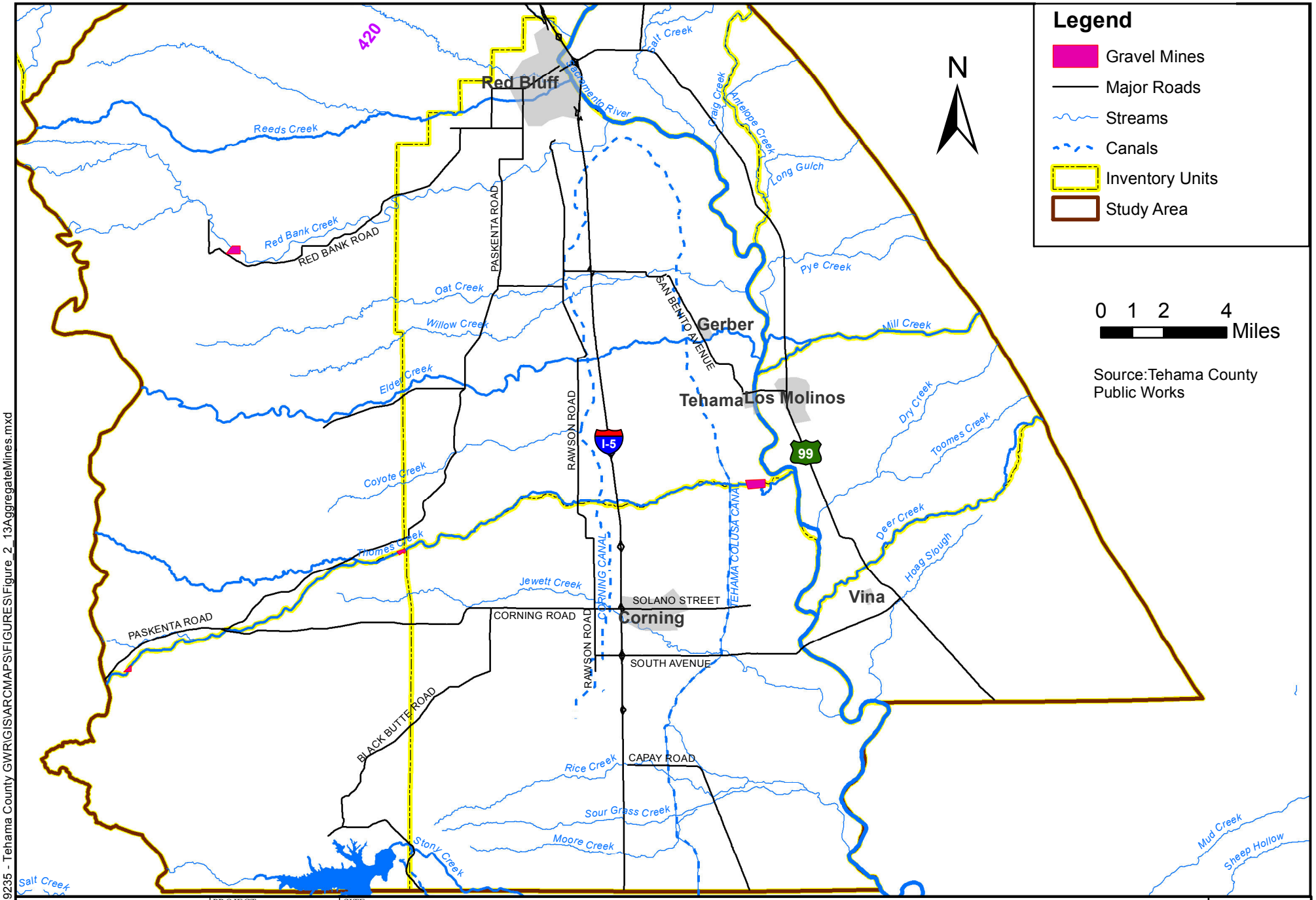
BROWN AND CALDWELL

PROJECT	SITE	
139235	Tehama County, CA	Figure 2-12
DATE	TITLE	
6/24/11	Depth to Water in Shallow Aquifer (2008)	



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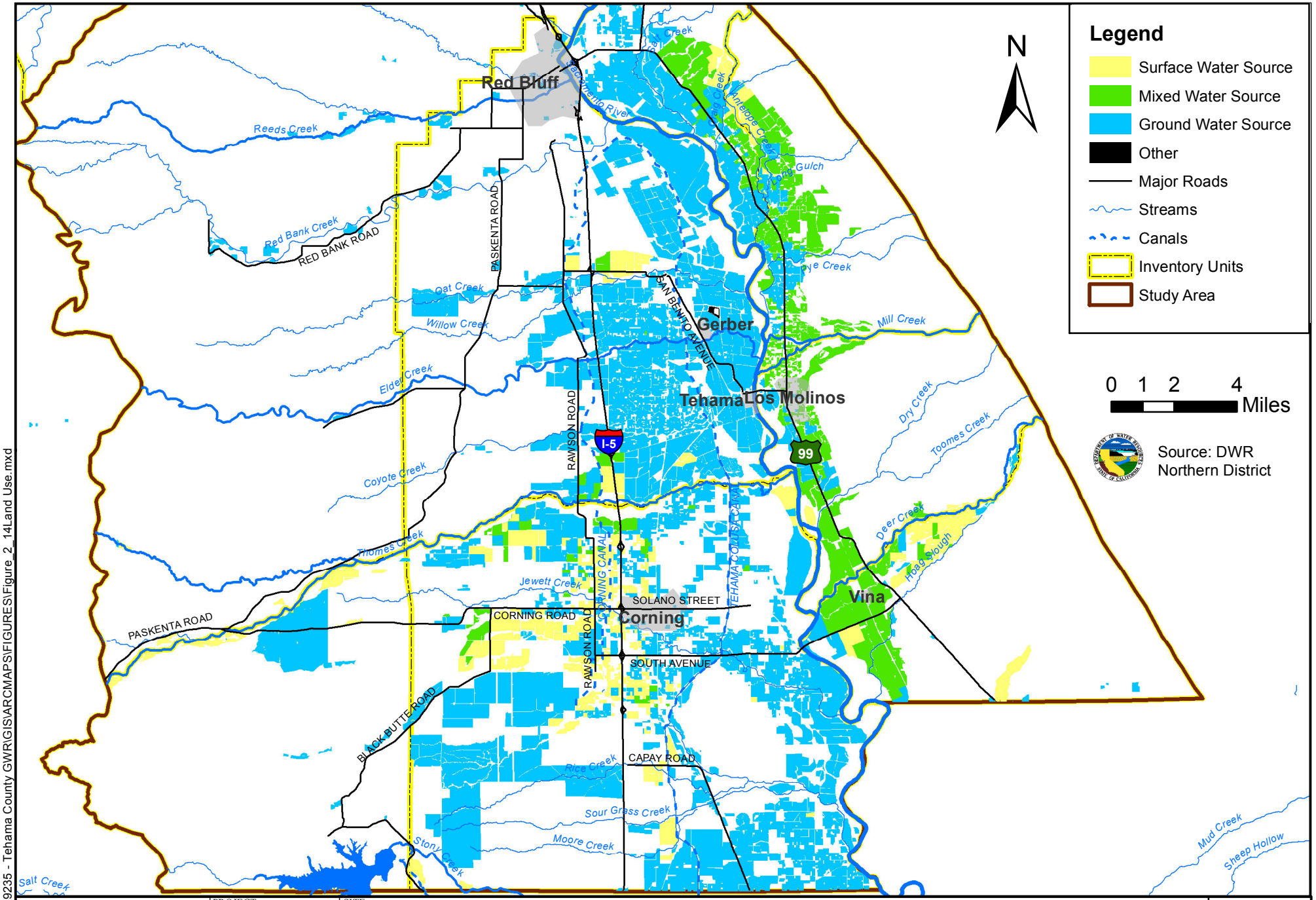
BROWN AND CALDWELL	PROJECT 139235	SITE Tehama County, CA	Figure 2-13
	DATE 6/24/11	TITLE Aggregate Mines	



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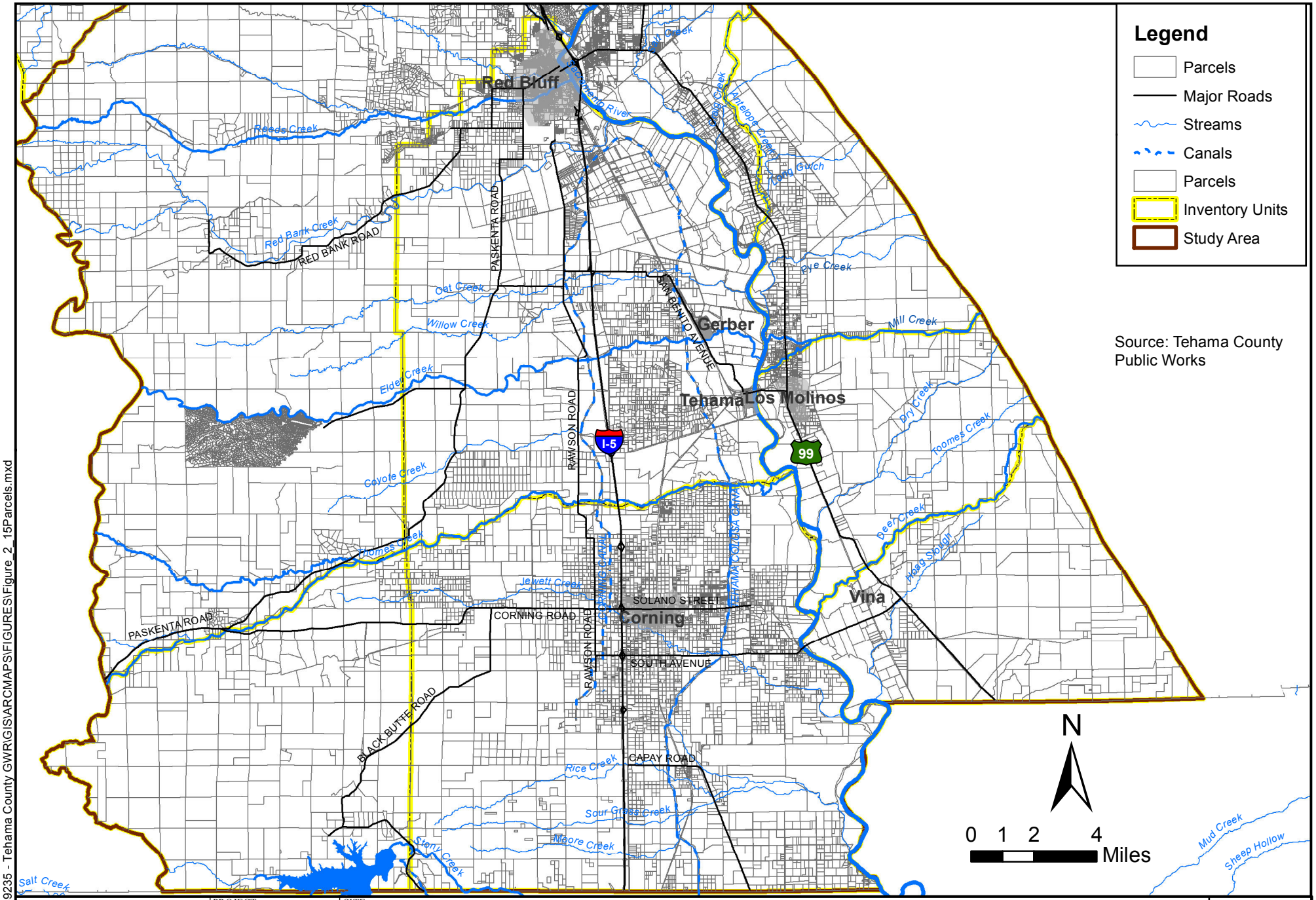
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Land Use by Water Source

Figure 2-14



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BROWN AND CALDWELL

PROJECT	SITE	
139235	Tehama County, CA	Figure 2-15
DATE	TITLE	
6/24/11	Parcel Map	

3. Analysis

This section describes the approach and methodology used to select the recommended areas for groundwater recharge and further study. Three issues of concern were identified as necessary for an area to qualify for further consideration as a potential site for artificial recharge. These issues of concern included the physical potential for recharge (i.e. can water percolate into the ground), logistical considerations (i.e. is the location able to receive surface water without building infrastructure), and areas of groundwater demand (i.e. depressed groundwater elevations).

Collected data were reviewed and analyzed to identify areas where recharge efforts are likely to be successful, areas of groundwater use, and areas near conveyance. Geologic and soil data were used to identify areas where water is likely to infiltrate. Groundwater contours were used to identify areas where groundwater demand was high. Streams, canals, and irrigation district information was used to determine if areas were likely to be able receive surface water. Criteria were developed for each data source used. Criteria are listed in Table 3-1. Preliminary criteria and analysis results were reviewed by the TAC, and were subsequently modified based on TAC recommendations. Figure 3-1 illustrates the general project approach.

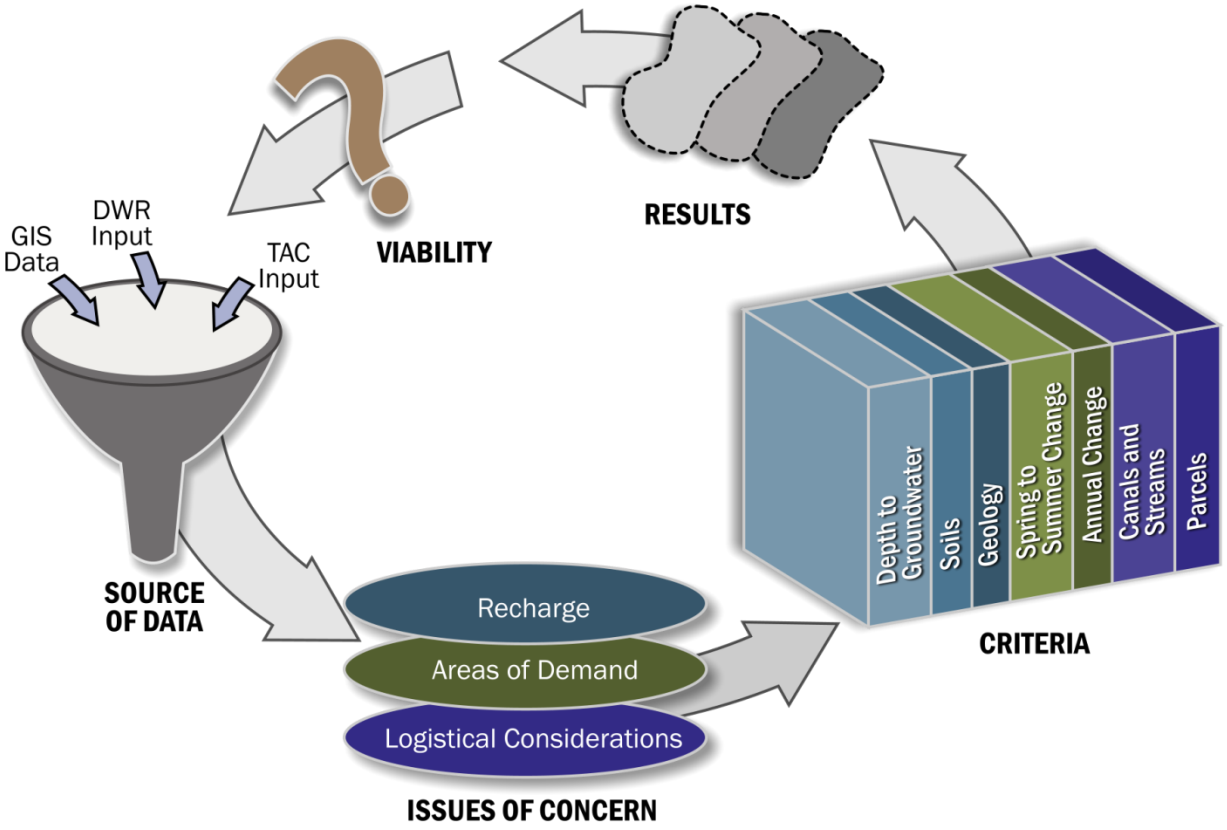


Figure 3-1. Generalized Project Approach

3.1 Groundwater Contour Analysis

Groundwater contours for spring and summer measurements from the years 2006 to 2009 (Figures 2-4 through 2-11) were used in this analysis to identify areas of Tehama County that would benefit from groundwater recharge activities. To identify those areas that would benefit, two analyses were performed on the contour data. The first analysis was of spring to summer groundwater change, and the second analysis was of spring to spring change over the period from 2006 to 2009. Analysis was performed using ArcGIS 10 to develop surfaces that represent the contours and then subtracting one surface from another surface. The difference between the surfaces was then contoured. The years 2006 through 2009 were the only years with readily available contour information.

Analysis of the change in groundwater levels between the spring and summer contours for the years 2006 to 2009 was performed to identify the portions of the County that experienced drawdowns during the irrigation season. Areas that experienced regular spring to summer drawdowns are indicative of areas with established groundwater demand, and therefore are areas that could benefit from the increased groundwater made available through groundwater recharge activities. Contours for spring to summer change in groundwater elevation are presented in Figures 3-2 through 3-5 at the end of this section. Summer was used for this comparison instead of fall because summer measurements are typically when groundwater levels are the lowest for the year, and capture the drawdown due to pumping more clearly.

Figure 3-6, at the end of this section, presents portions of Tehama County that experienced spring to summer drawdowns of over 25 feet for 2, 3 or 4 years between 2006 and 2009. Portions of Tehama County that experienced spring to summer drawdowns over 25 feet were considered areas of need that would benefit from groundwater recharge activities. Spring to summer drawdowns were largest in the Red Bluff East subbasin, with smaller areas of significant spring to summer drawdown in the Corning East Subbasin.

Analysis of spring to spring change from 2006 to 2009 was performed to identify the portions of the County that experienced a reduction in groundwater levels over the four year period of spring measurements. This decline is possibly caused by drought conditions over the period of analysis. If the decline is the result of drought periods, areas of decline are areas that will decline first in future droughts, and therefore are areas that could benefit from groundwater recharge activities. A contour map of the change in groundwater elevations from spring 2006 to spring 2009 is presented in Figure 3-7, at the end of this section. Portions of the County that experienced a reduction in groundwater levels greater than 15 feet were considered areas of need that would benefit from groundwater recharge activities; this area is presented in Figure 3-8. Areas experiencing significant declines in spring groundwater levels were in the Red Bluff East and Corning East subbasins.

3.2 Selection Criteria

This section discusses the selection criteria used to identify potential groundwater recharge areas. The criteria list is organized by the screening order and summarized in Table 3-1.

Geology: There are several geologic formations within the study area and three of the formations are preferred because of higher probable permeability that will allow for faster water percolation from the surface to the water table. The Pleistocene/Holocene Riverbank and Modesto Formations and Alluvium units identified and described in DWR Bulletin 118 are the three geologic units used to identify suitable artificial groundwater recharge areas.

Soils: Porous surface soils are needed for groundwater percolation. NCRS soil maps were used to identify non-silty loams and stream gravels as a selection criteria. Soils containing silt or clay were screened out as fine grained materials will slow or prevent water percolation.

Stream, Canal and Irrigation District Locations: A location that is suitable for groundwater recharge activities must have access to a surface water supply. Areas that are near a potential supply or within the service area of an irrigation district that delivers surface water are preferred locations. This study identifies areas within 1,000 feet of streams, 2,000 feet of canals, and areas within surface water irrigation districts as potentially appropriate for groundwater recharge activities.

Change in Groundwater Elevation from Spring to Summer: Areas that experienced a decrease in water levels of 25 feet or greater from spring to summer of a single year are areas that demonstrate a need for recharge activites, as described in Section 4.1.

Change in Spring Groundwater Levels 2006-2009: Areas that experienced a decrease in groundwater levels of greater than a 15 feet decrease in water levels from 2006 through 2009 were used as a selection criteria.

Aggregate Mines: Aggregate mines with surficial exposures of alluvial gravels were automatically identified for selection due to the material and proximity to surface water.

Depth to water: There must be appropriate storage space in the water bearing unit so as not to cause water logging or nuisance seepage to overlying crops. A water level of greater than 40 feet below the surface during the summer of 2008 was selected to identify areas with enough storage for a groundwater recharge activity to be beneficial. Areas with less than 40 feet of space before the water table are more likely to experience undesirably high groundwater levels in the region of recharge. Depth to water contours for 2008 were the only depth to water contours available at the time of analysis.

Table 3-1. Data type and Selection Criteria

Data Type	Issue of Concern	Selection Criteria
Geology	Potential for recharge	Riverbank, Modesto, Alluvium
Soils	Potential for recharge	Loam, Cobbly Loam, Sandy Loam, and Riverwash
Stream, Canal, and Irrigation District Locations	Logistical considerations	1000 feet from streams, 2000 from canals, areas within an irrigation district that serves surface water
Change in groundwater levels spring to summer	Areas of demand	Areas that experienced a larger than 25 foot decline from spring to summer 2 or more times out of 4 years
Change in groundwater levels spring 2006 to spring 2009	Areas of demand	areas that experienced a larger than 15 foot decline from 2006 to 2009
Depth to water	Potential for recharge	Depth to water in Summer 2008 estimated to be larger than 40 feet in shallow wells
Aggregate mines	Potential for recharge	Aggregate mine present

3.3 Application of Selection Criteria

Selection criteria were applied to the data sets within the study area to identify the areas recommended for additional investigation and eventual recharge activities. This section describes the application of selection criteria in a sequential manner.

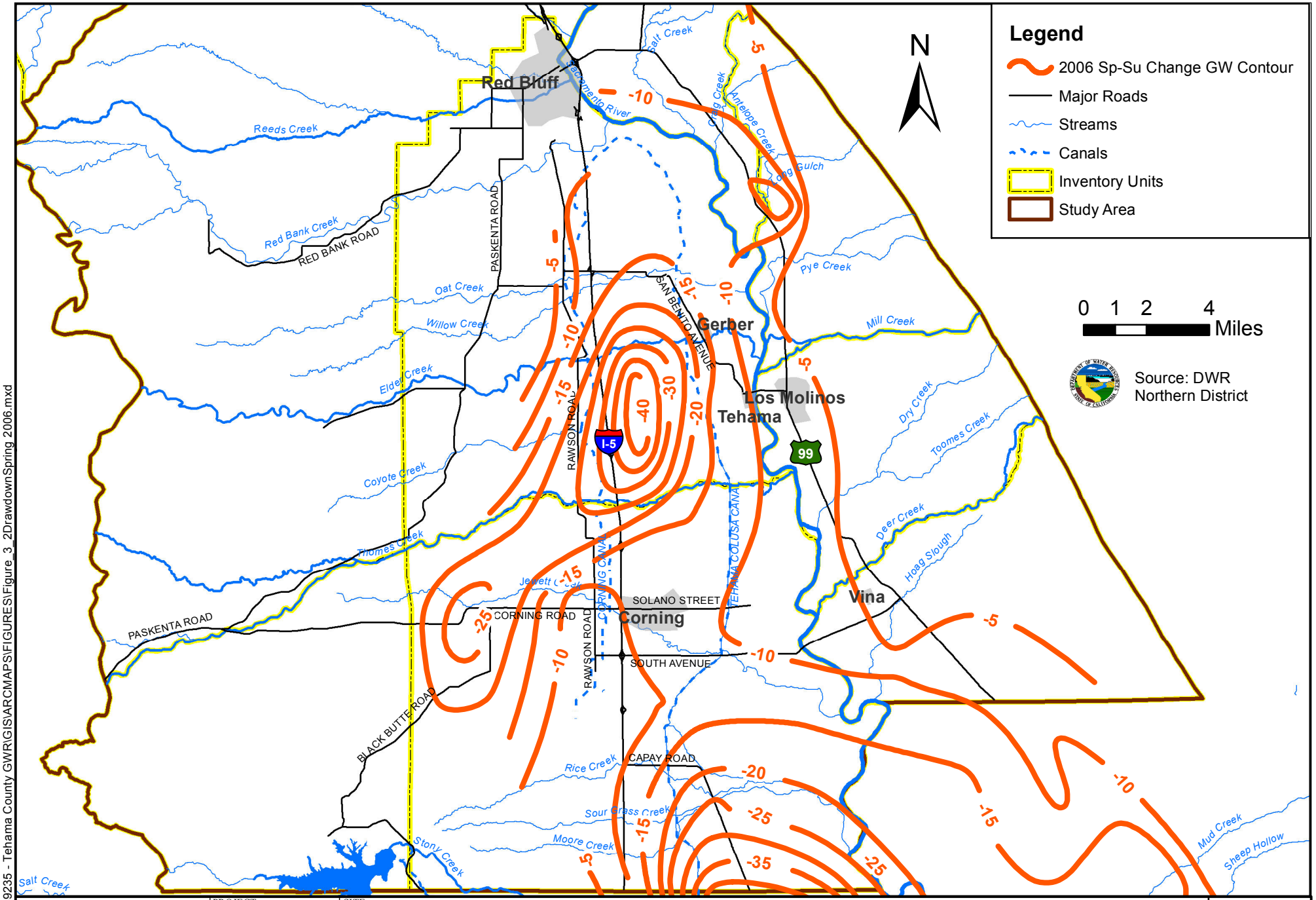
Step 1 – Geology and Soil: The first application of criteria consisted of comparing geology and soil-type data. Figure 3-9 presents portions of the County that are both overlying Riverbank, Modesto, or Alluvium geologic formations and have overlying soils comprised of loam, cobbly loam, sandy loam, or riverwash soils.

Step 2 – Streams, Canals and Irrigation Districts: The second application of criteria was the comparison of the area identified in step 1 to areas within 1,000 feet of a stream, 2,000 feet of a canal, or within the service area of an irrigation district that serves surface water to its service area. Figure 3-10 presents portions of the County that meet these criteria.

Step 3 – Areas of Need: The third application of criteria was the comparison of the area identified in step 2 to areas of need. Areas of need are defined in this study as areas that experienced 2 or more years of a greater than 25 foot spring to summer groundwater elevation decline, or areas that experienced a 15 foot or greater decline in groundwater elevations from spring of 2006 to spring of 2009. Determination of areas of need is described fully in section 4.1. Figure 3-11 presents the portion of the County selected by comparison of step 2 with areas of need.

Step 4 – Aggregate Mines: The fourth step was the comparison of aggregate mine locations to the areas identified in Step 3. Figure 3-12 presents the portion of the County selected by step 4.

Step 5 – Depth to Groundwater: The fifth application of criteria was the comparison of the area identified in step 4 with areas that have an average depth to groundwater that is greater than 40 feet. Figure 3-13 presents portions of the County that meet this criteria and the criteria of steps 1 through 4 are the recommended areas for further investigation.



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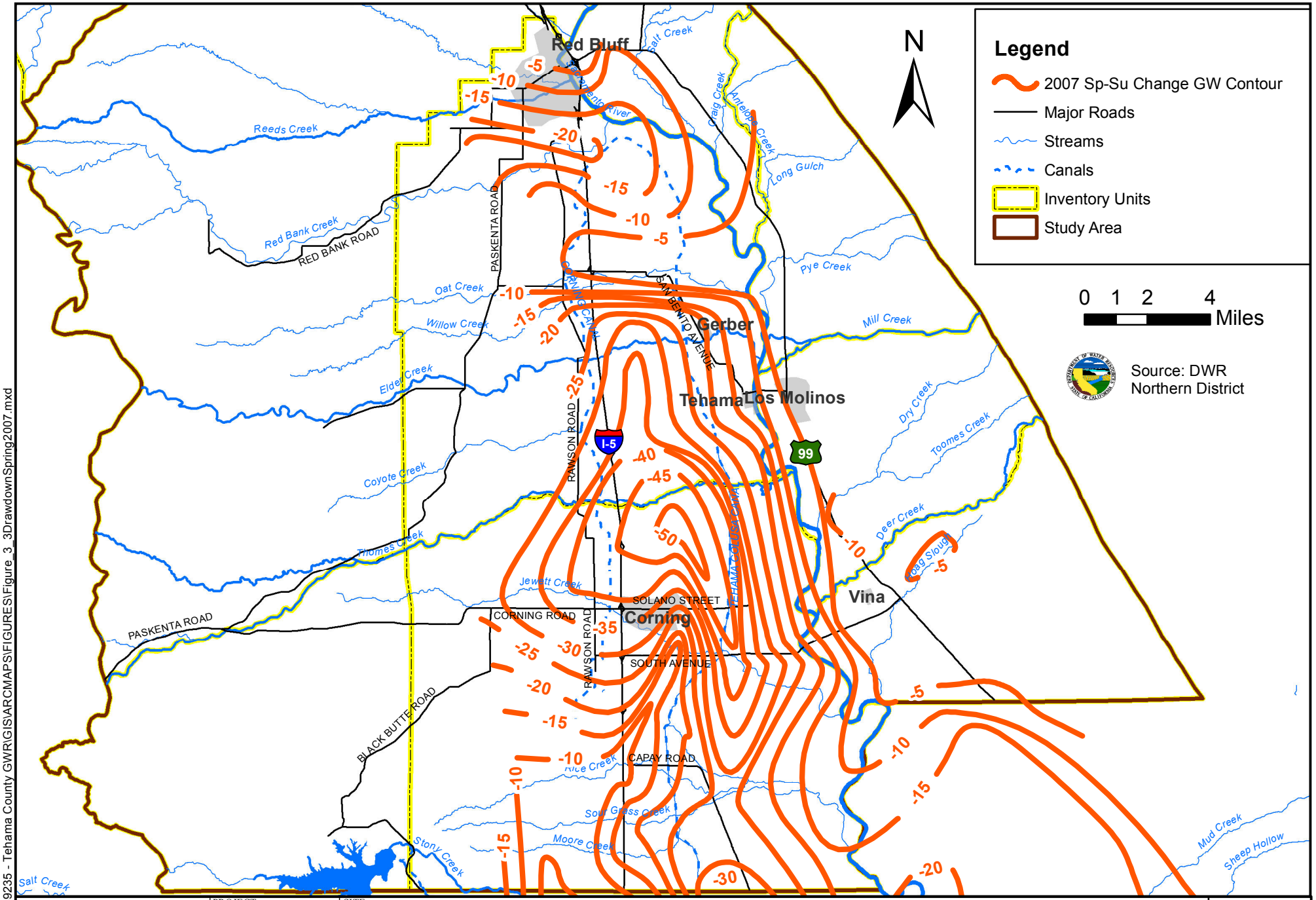
BROWN AND CALDWELL	PROJECT 139235	SITE Tehama County, CA	Figure 3-2
	DATE 6/24/11	TITLE Spring-Summer 2006 Drawdown Groundwater Contour Map	



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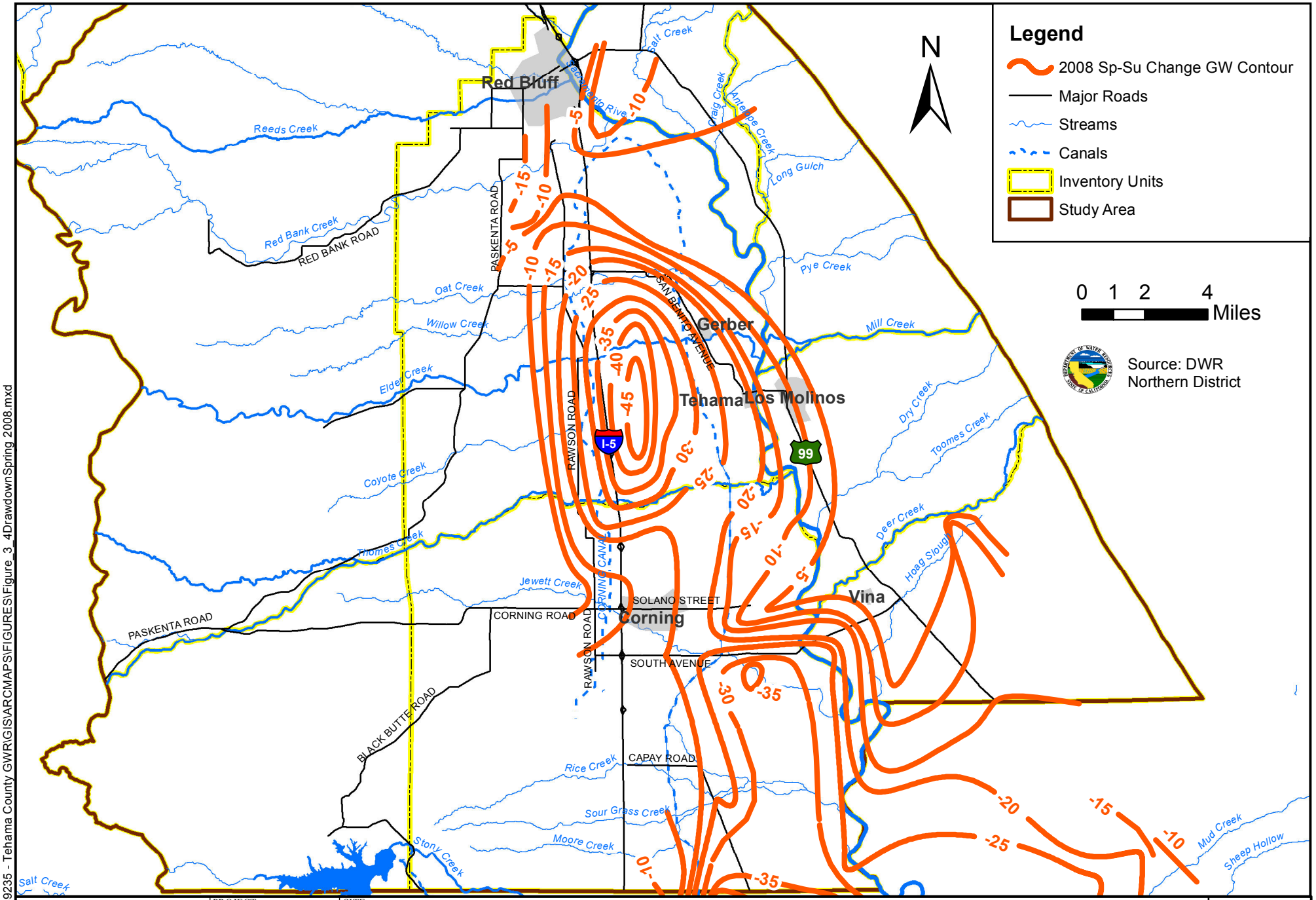
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Spring Summer 2007 Drawdown Groundwater Contour Map

Figure 3-3



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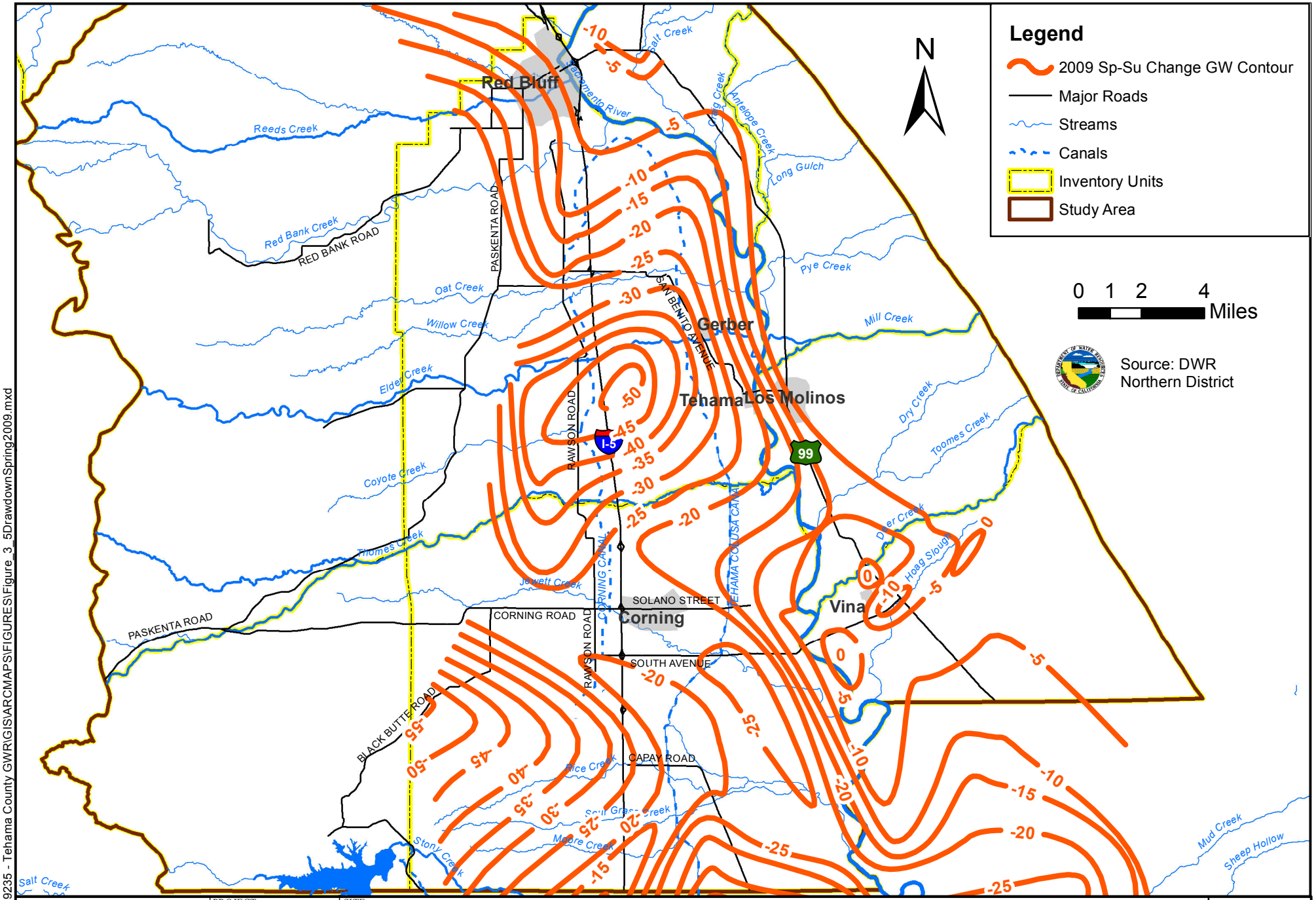
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Spring Summer 2008 Drawdown Groundwater Contour Map

Figure 3-4



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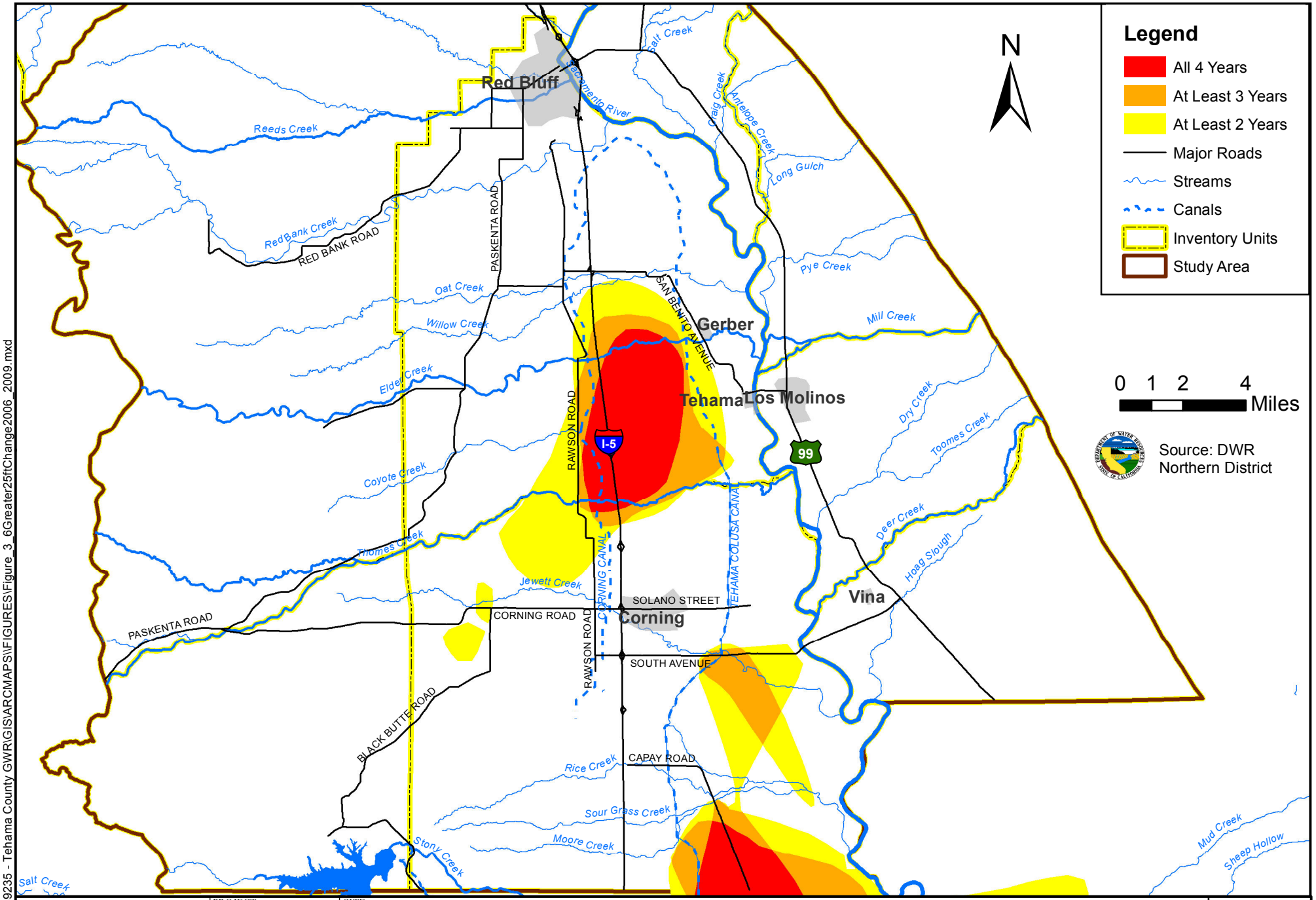
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Spring Summer 2009 Drawdown Groundwater Contour Map

Figure 3-5



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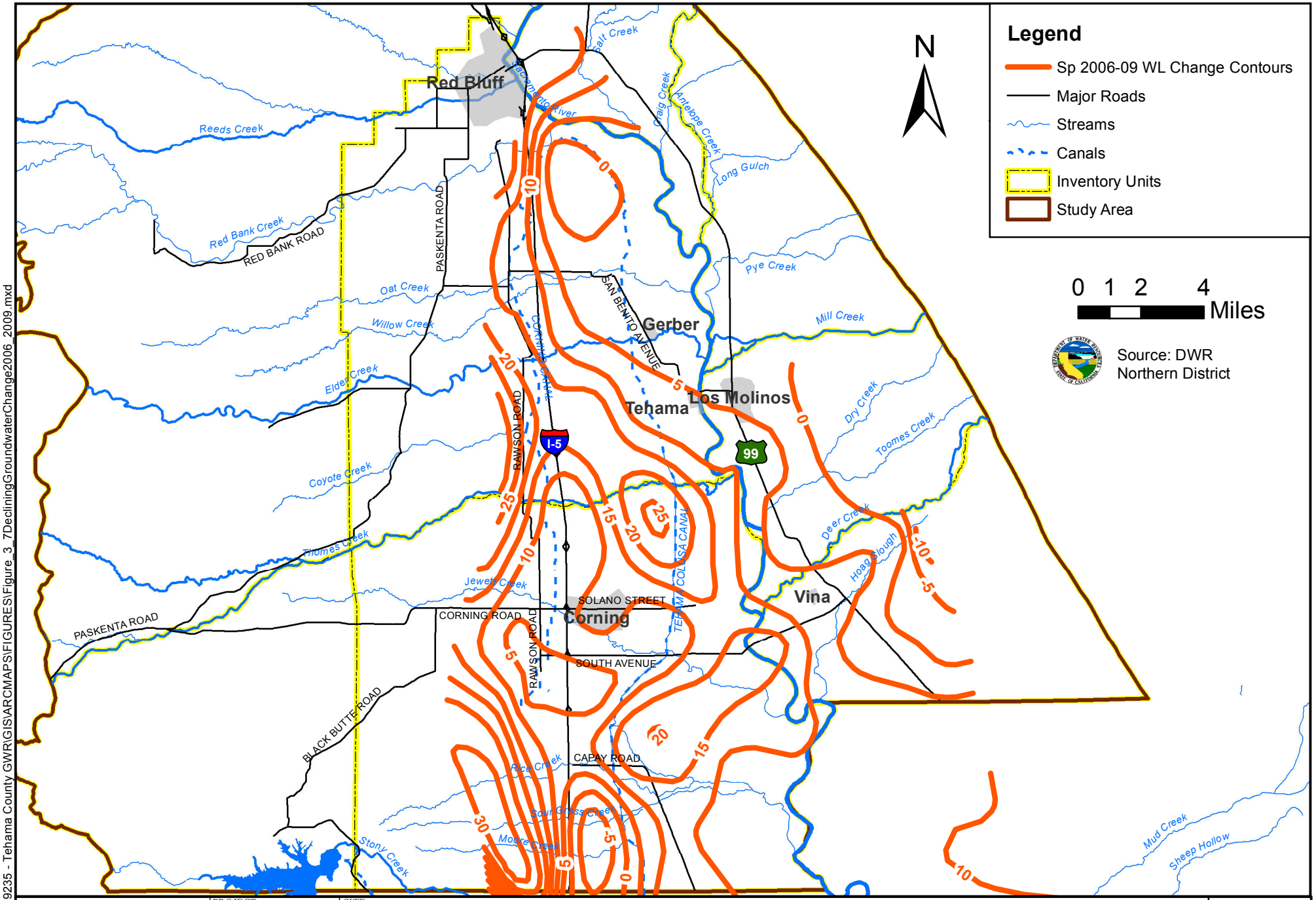
BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Areas With Greater than 25 feet Spring-Summer Change During 2006-2009

Figure 3-6

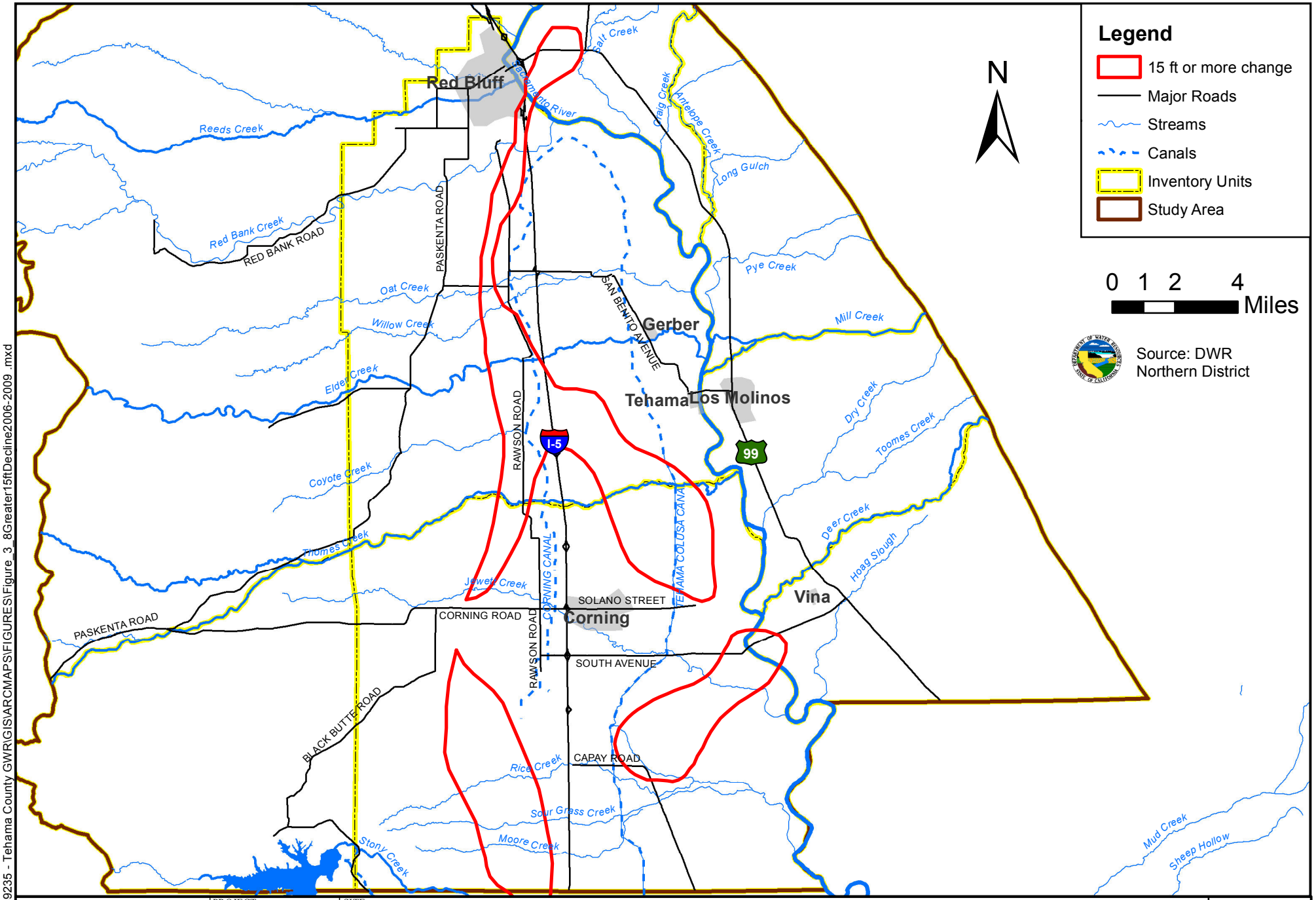


FILE: P:\39000\139235 - Tehama County GWR\GIS\ARCMAPS\FIGURES\Figure_3_7DecliningGroundwaterChange2006_2009.mxd

BROWN AND CALDWELL

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Groundwater Contour Map, Spring 2006-2009 Change, Showing Magnitude of Declining Groundwater Levels

Figure 3-7



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BROWN AND CALDWELL

PROJECT	SITE
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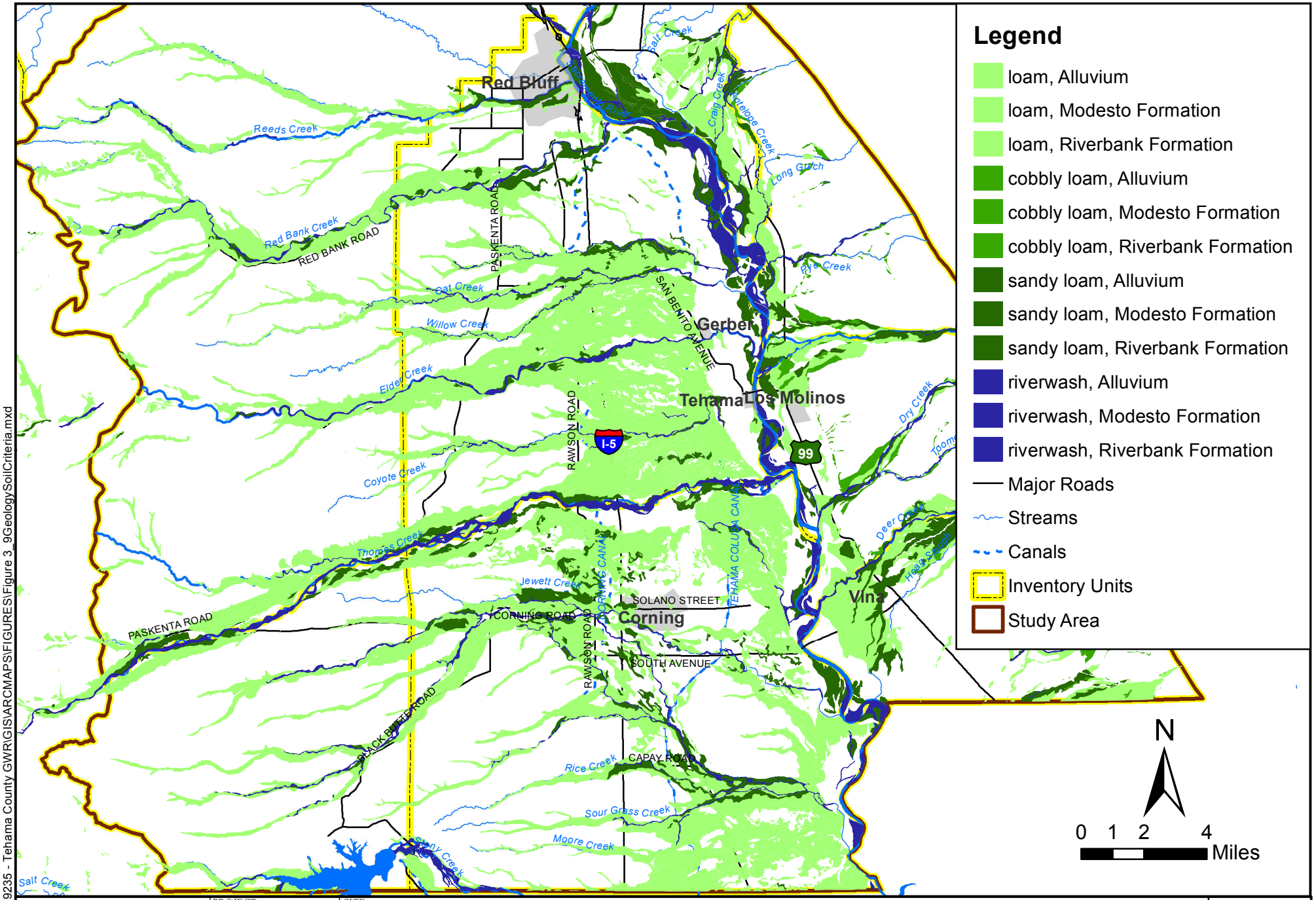
DATE	TITLE
6/24/11	Areas that Experienced Greater Than 15 Feet of Decline, Spring 2006-2009

Figure 3-8



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BROWN AND CALDWELL

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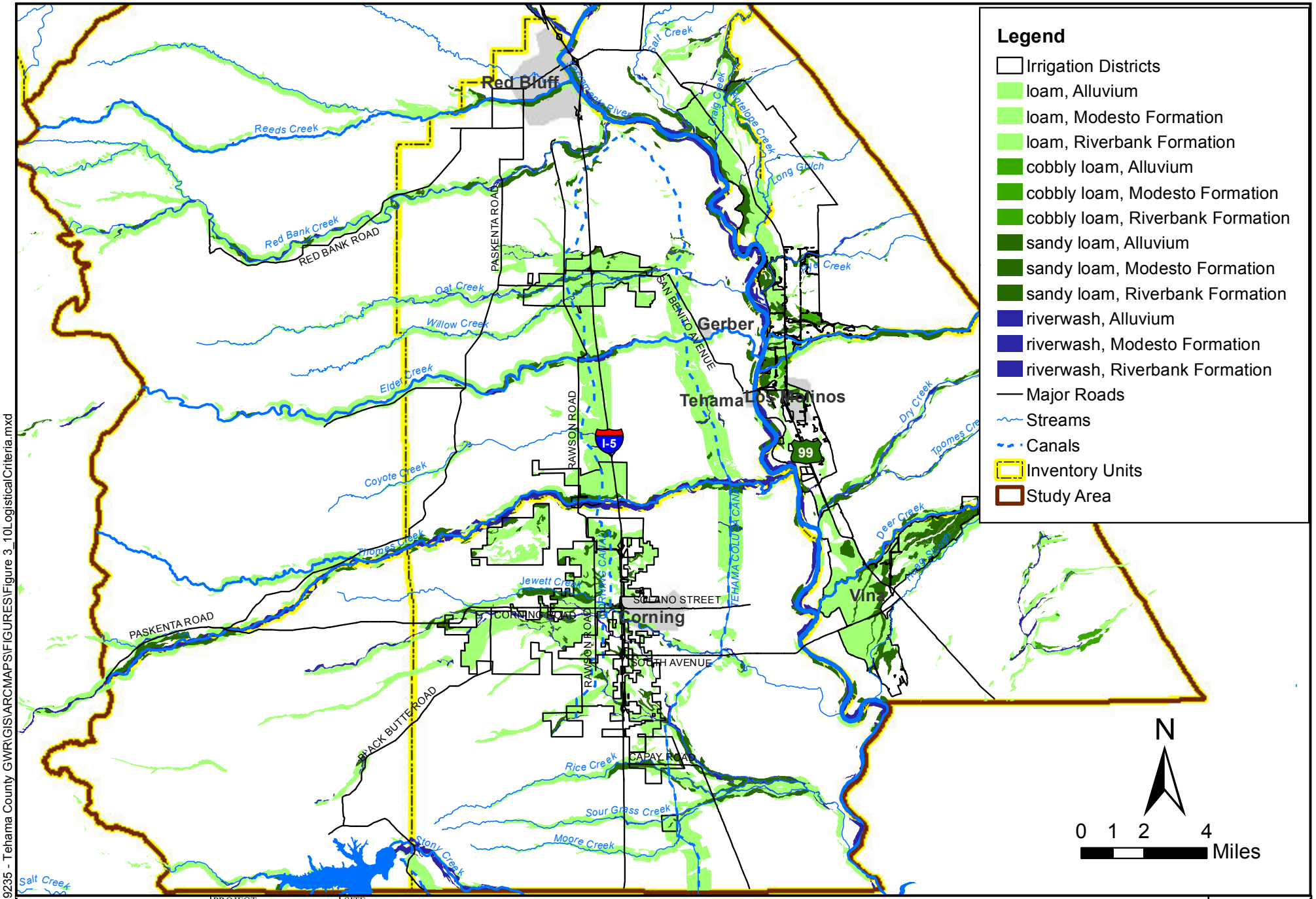
DATE	TITLE
6/24/11	Results from Applying Step 1, Geology and Soil Criteria

Figure 3-9



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PROJECT	SITE
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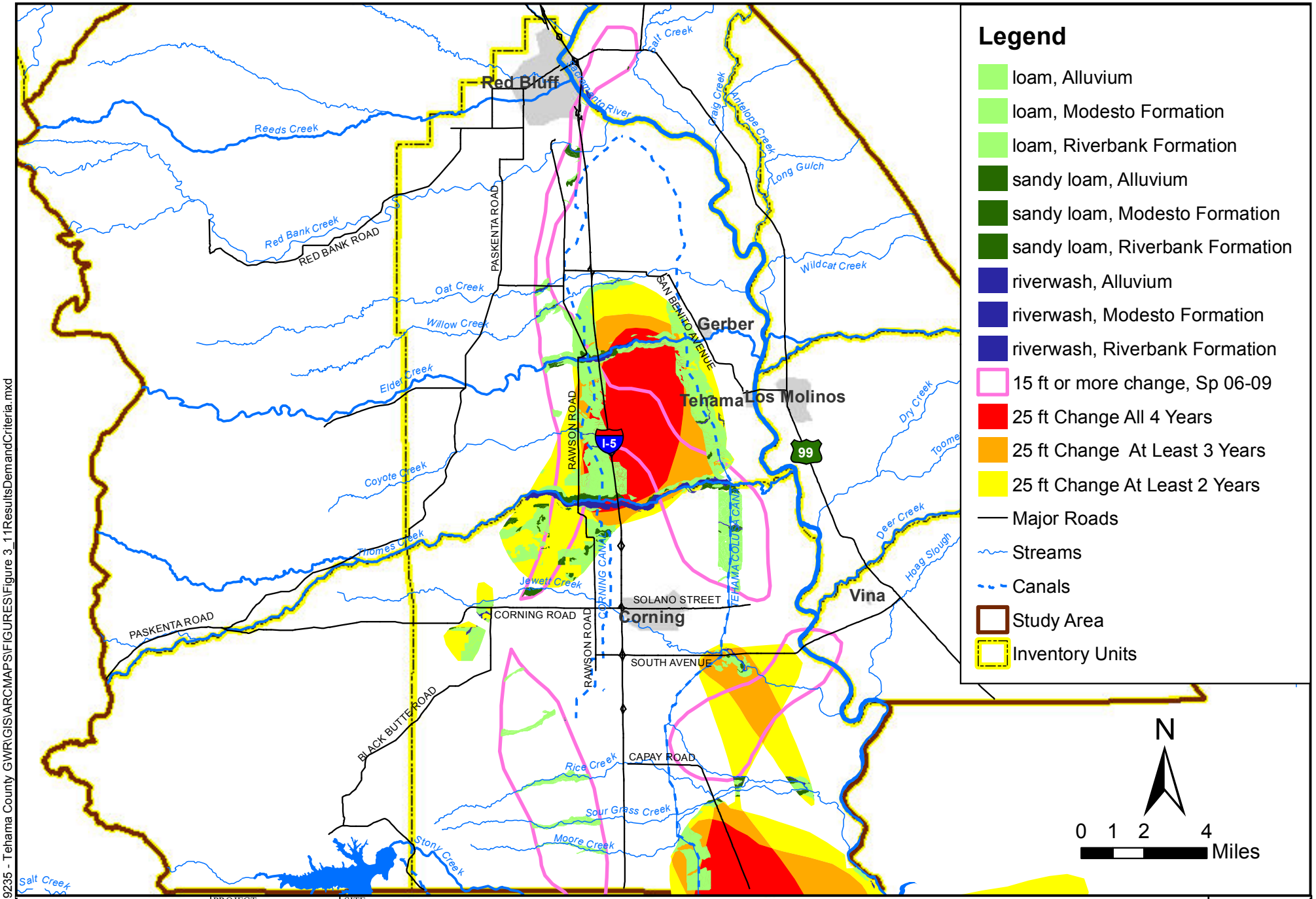
DATE	TITLE
6/24/11	Results from Applying Step 1, and 2, Logistical Consideration Criteria

Figure 3-10



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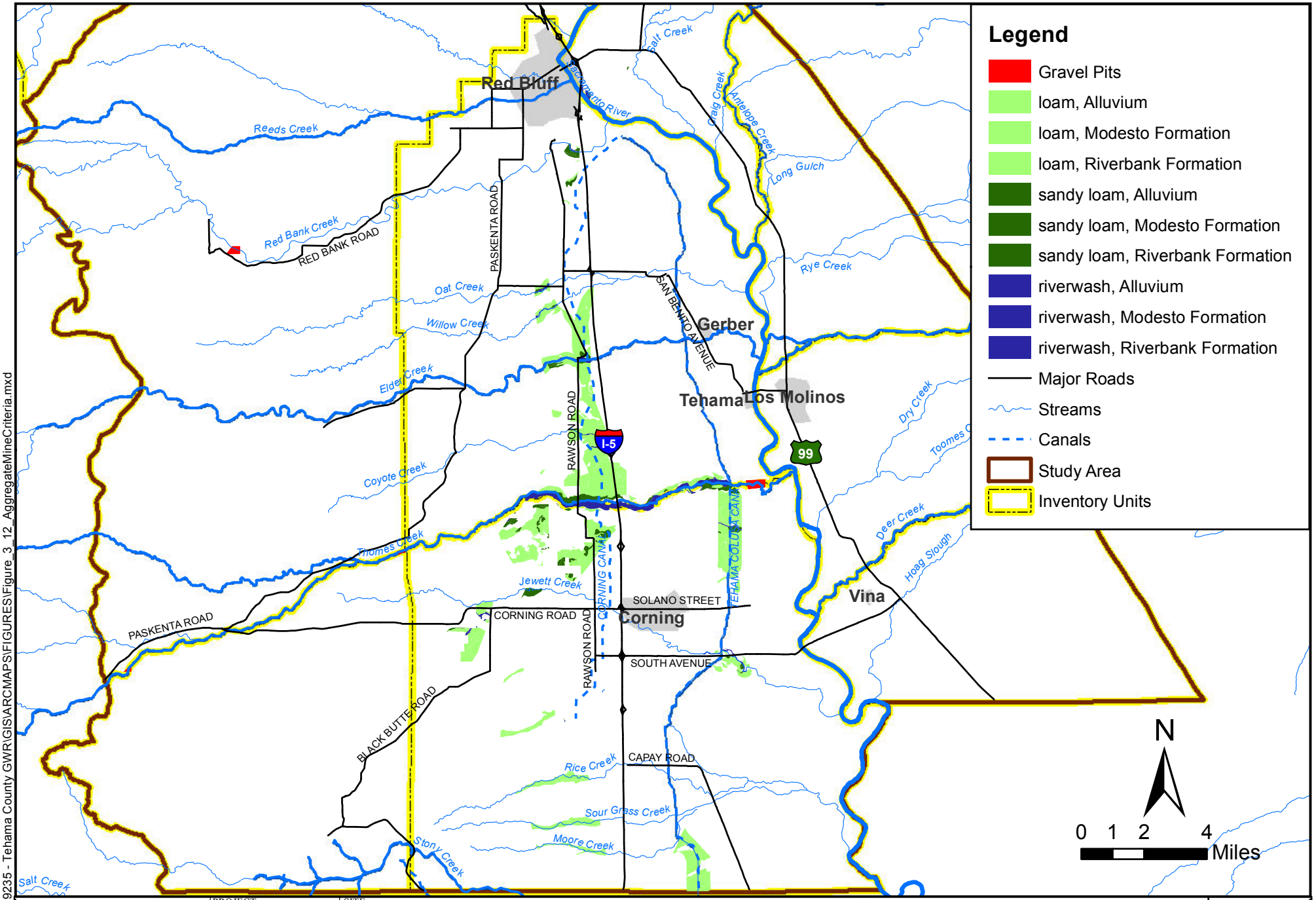
PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Results from Applying Steps 1, 2, and 3, Areas of Demand Criteria

Figure 3-11



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PROJECT	SITE
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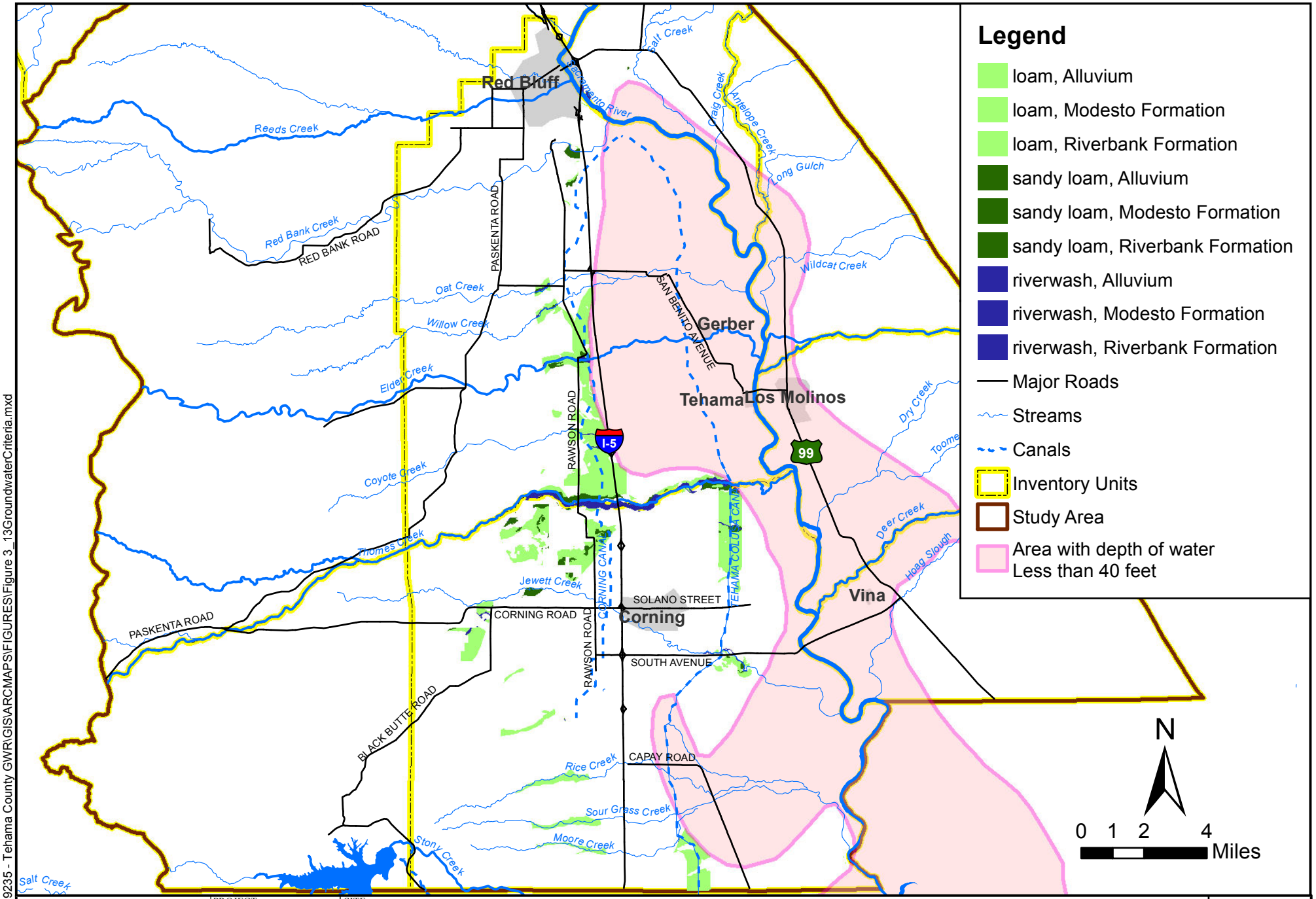
DATE	TITLE
6/24/11	Results From Applying Steps 1,2,3, and 4, Aggregate Mine Criteria

Figure 3-12



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PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Results from Applying Steps 1, 2, 3, 4, and 5, Depth to Groundwater Criteria

Figure 3-13

4. Areas Recommended for Additional Investigation

This section presents the recommended areas for further groundwater recharge investigation. Recommended areas are not presented in an order of priority. Determining priority is a task recommended in Section 5. Recommended areas are areas overlying Alluvium, Riverbank Formation or Modesto Formation surficial exposures. These three geologic units were selected due to their higher permeability than older formations in the area. Recommended areas are presented in large scale in Figure 4-1, with specific areas of interest emphasized. Specific areas of interest, labeled as recommended areas A through G, are presented and discussed below.

Recommended Area A: Recommended Area A includes areas near the Corning Canal, Elder Creek, and Willow Creek, and is generally just east of Route 5. This area is predominantly lands irrigated with groundwater that overlie loam soils. A number of parcels in this area are of a reasonable size to conduct recharge activities. Area A is presented in Figure 4-2.

Recommended Area B: Recommended Area B primarily includes areas near the Corning Canal and near Coyote Creek and includes parcels between Rawson Road and I-5. This area contains agricultural lands irrigated by groundwater and surface water, as well as lands that are not irrigated. Soils in this area are predominantly Loam, with some riverwash soils located in the parcel identified as 167. Parcels in this area are of various sizes, with some parcels of a reasonable size to conduct recharge activities. Area B is presented in Figure 4-3.

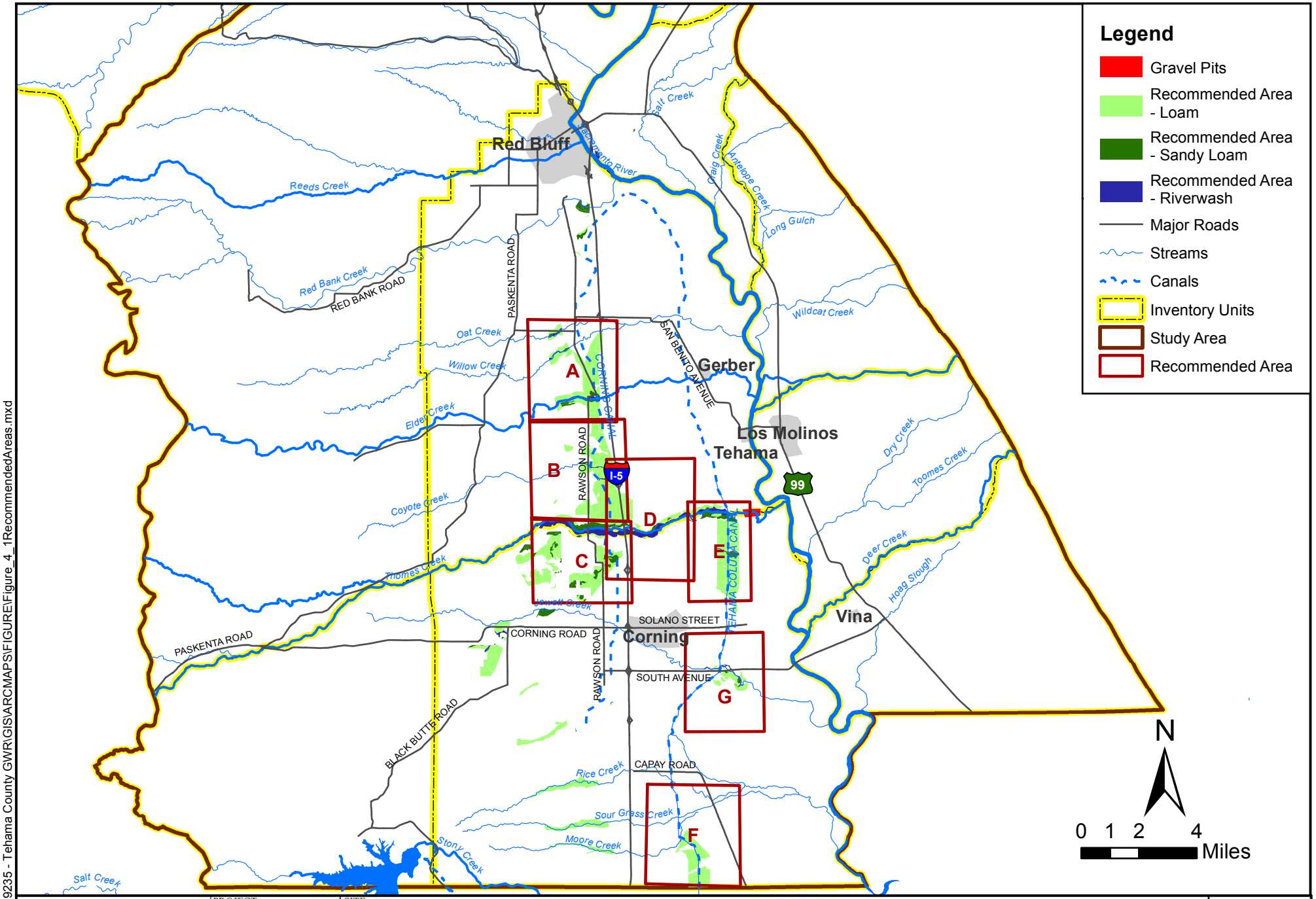
Recommended Area C: Recommended Area C primarily includes areas near the Corning Canal and Thomes Creek, near the intersection of Rawson Road and Moran Road. This area contains a variety of parcel sizes and water sources for irrigation. The northern portion of Area C includes riverwash soils along Thomes creek, and parcels in the southern portion of Area C are mostly irrigated with surface water and likely too small to conduct recharge activities. Area C is presented in Figure 4-4.

Recommended Area D: Recommended Area D includes areas along Thomes Creek, near the intersection of Route 99W and Thomes Creek Road. The recommended area in Area D is mostly lands that are not irrigated for agriculture and overlie sandy loam or riverwash soils. Area D is presented in Figure 4-5.

Recommended Area E: Recommended Area E includes areas along the Tehama Colusa Canal, Thomes Creek, and an aggregate mine also on Thomes Creek. This area contains some areas irrigated with groundwater and some areas that are not irrigated. Parcel sizes on the west side of the Tehama Colusa Canal are likely too small to conduct recharge activities. Parcels on the eastern side of the Tehama Colusa Canal are larger, and areas along Thomes Creek overlie riverwash. Area E is presented in Figure 4-6.

Recommended Area F: Recommended Area F includes areas near the Tehama Colusa Canal near Ingrahm Road. This area contains lands irrigated with groundwater, parcel sizes of a reasonable size to conduct recharge activities and loam soils. Area F is presented in Figure 4-7.

Recommended Area G: Recommended Area G includes areas near Jewett Creek just east of the Tehama Colusa Canal, near South Avenue. This area includes land irrigated with groundwater, as well as loam and riverwash soils. Area G is presented in Figure 4-8.



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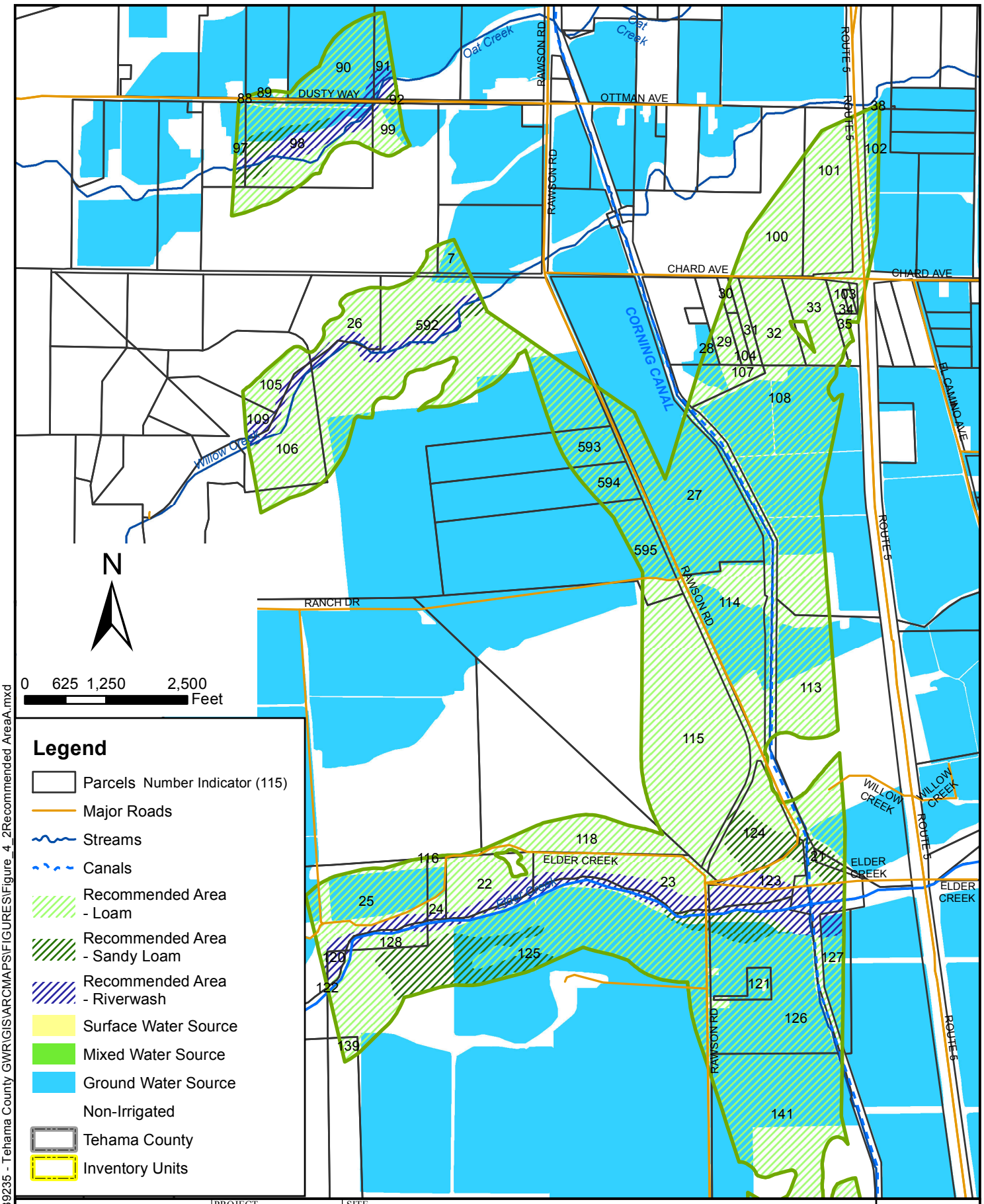
PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Recommended Areas for Further Investigation

Figure 4-1



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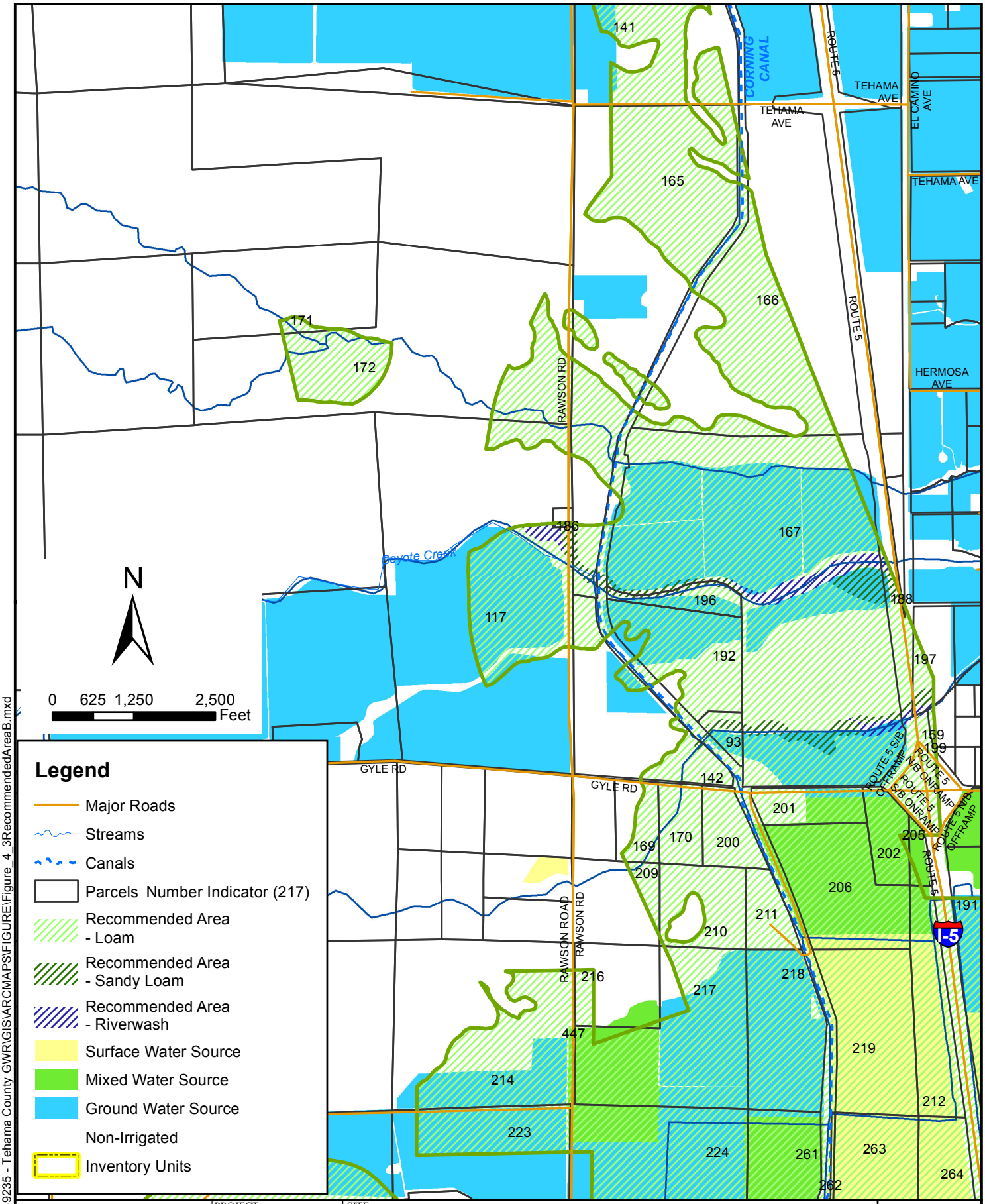
PROJECT	SITE	
139235	Tehama County, CA	Figure 4-2
DATE	TITLE	
6/24/11	Recommended Area A	

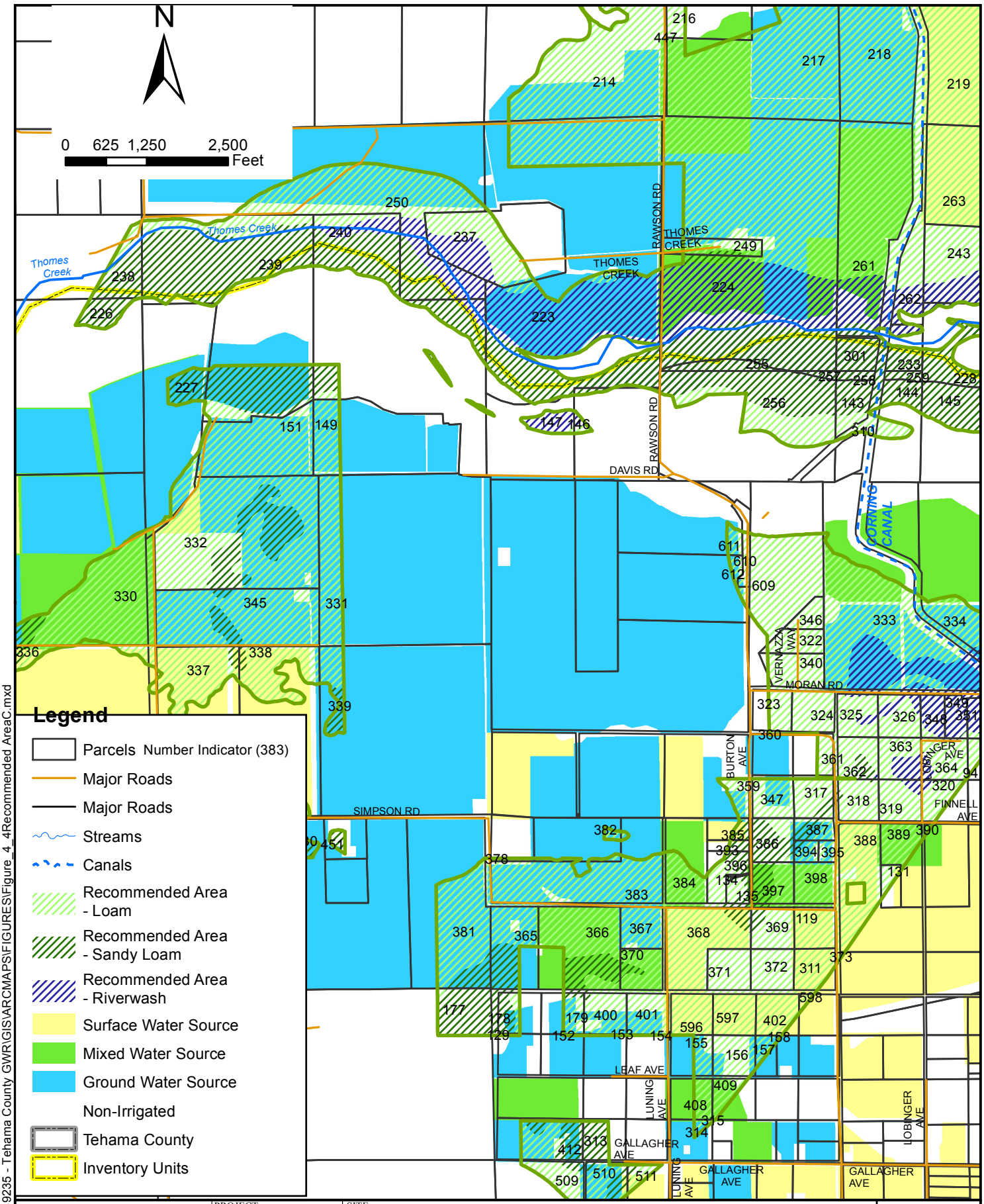


FILE: P:\39000\139235 - Tehama County GWR\GIS\ARCMAPS\FIGURE\Figure_4_3RecommendedAreaB.mxd

Brown AND Caldwell

PROJECT	SITE
139235	Tehama County, CA
DATE	TITLE
6/24/11	Recommended Area B

Figure 4-3



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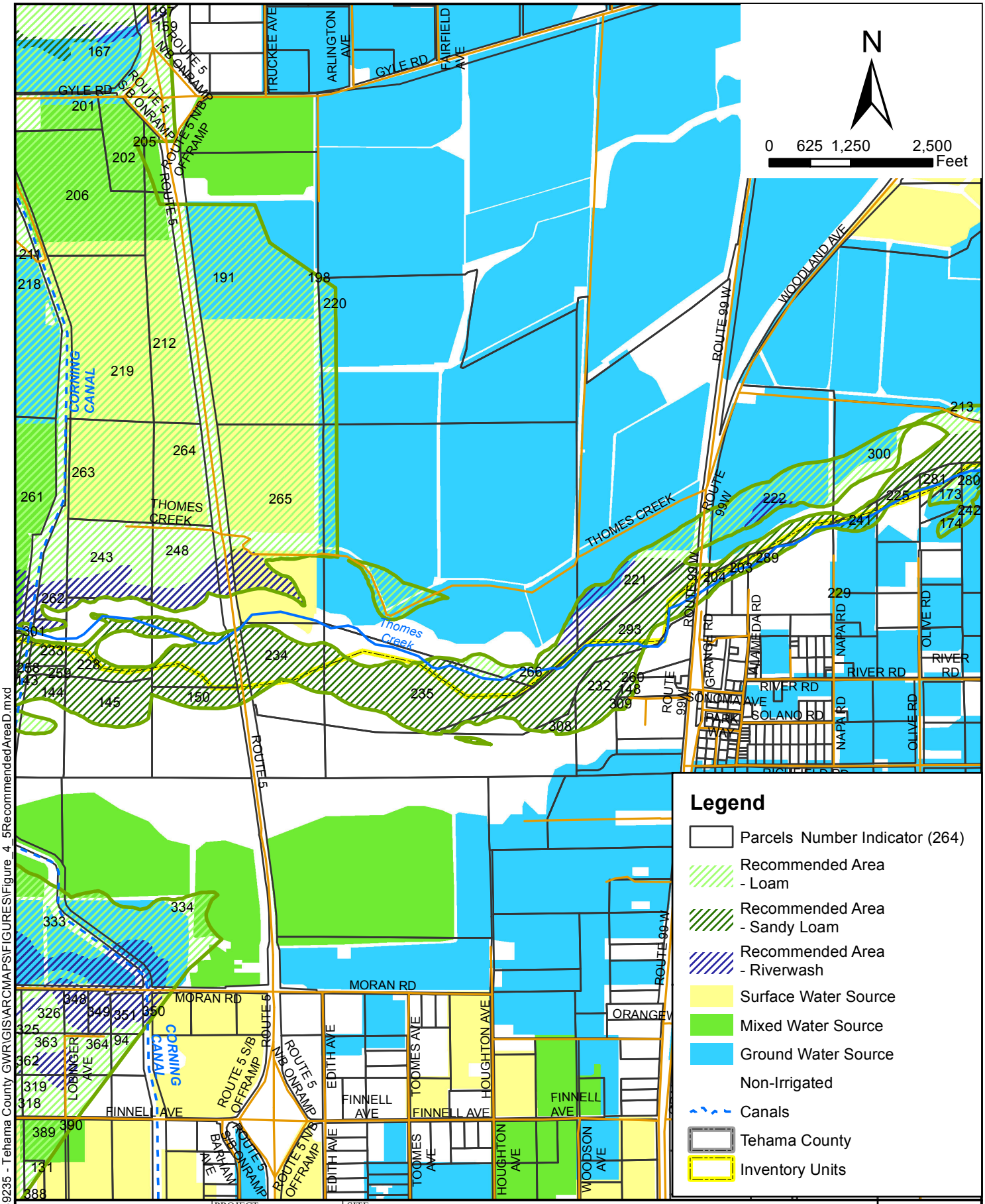
Brown AND Caldwell

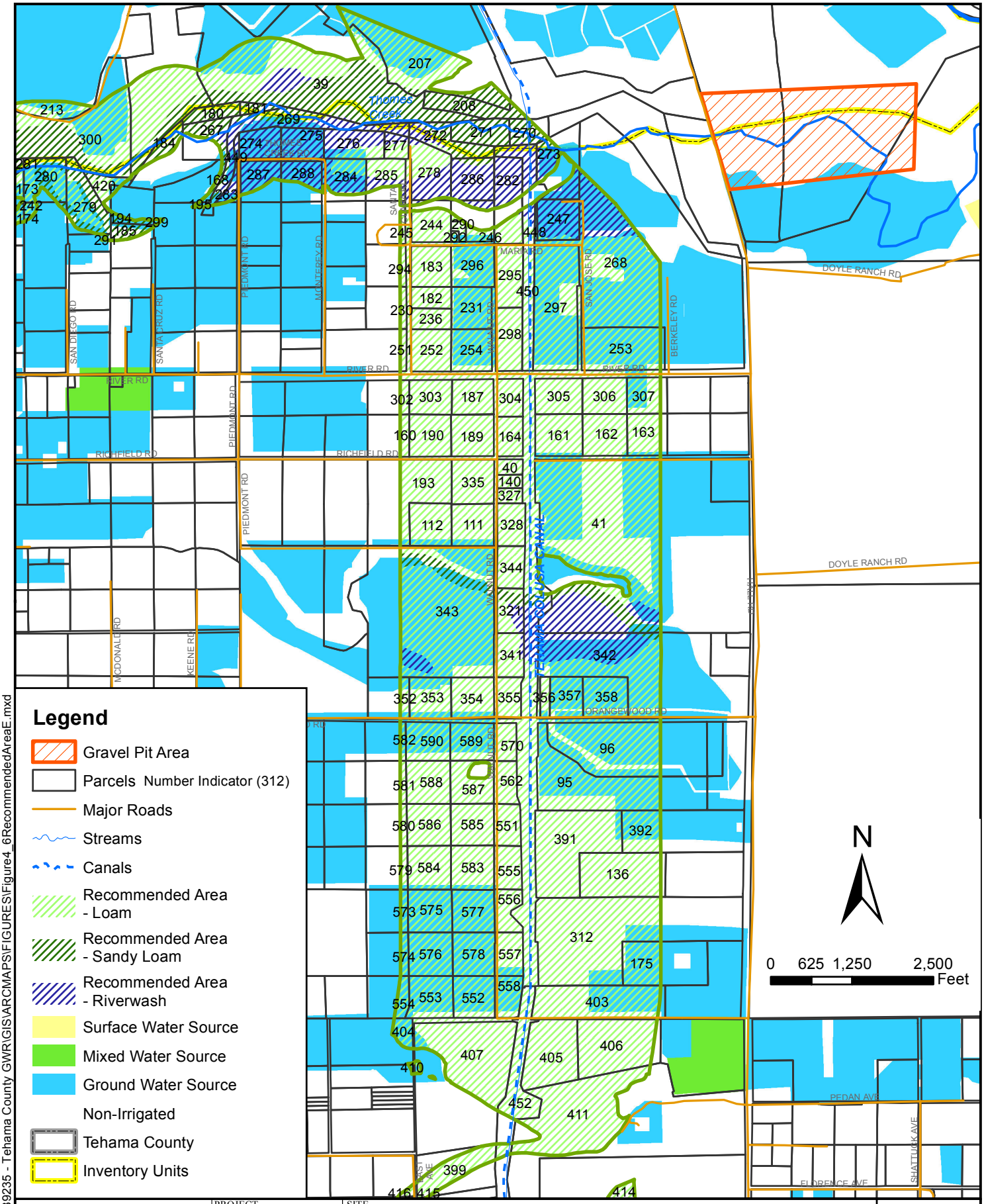
PROJECT	SITE	Figure
139235	Tehama County, CA	4-4
DATE	TITLE	
6/24/11	Recommended Area C	



FILE: P:\139000\139235 - Tehama County GWR\GIS\ARCMAPS\FIGURES\Figure_4_5RecommendedAreaD.mxd

Brown AND Caldwell

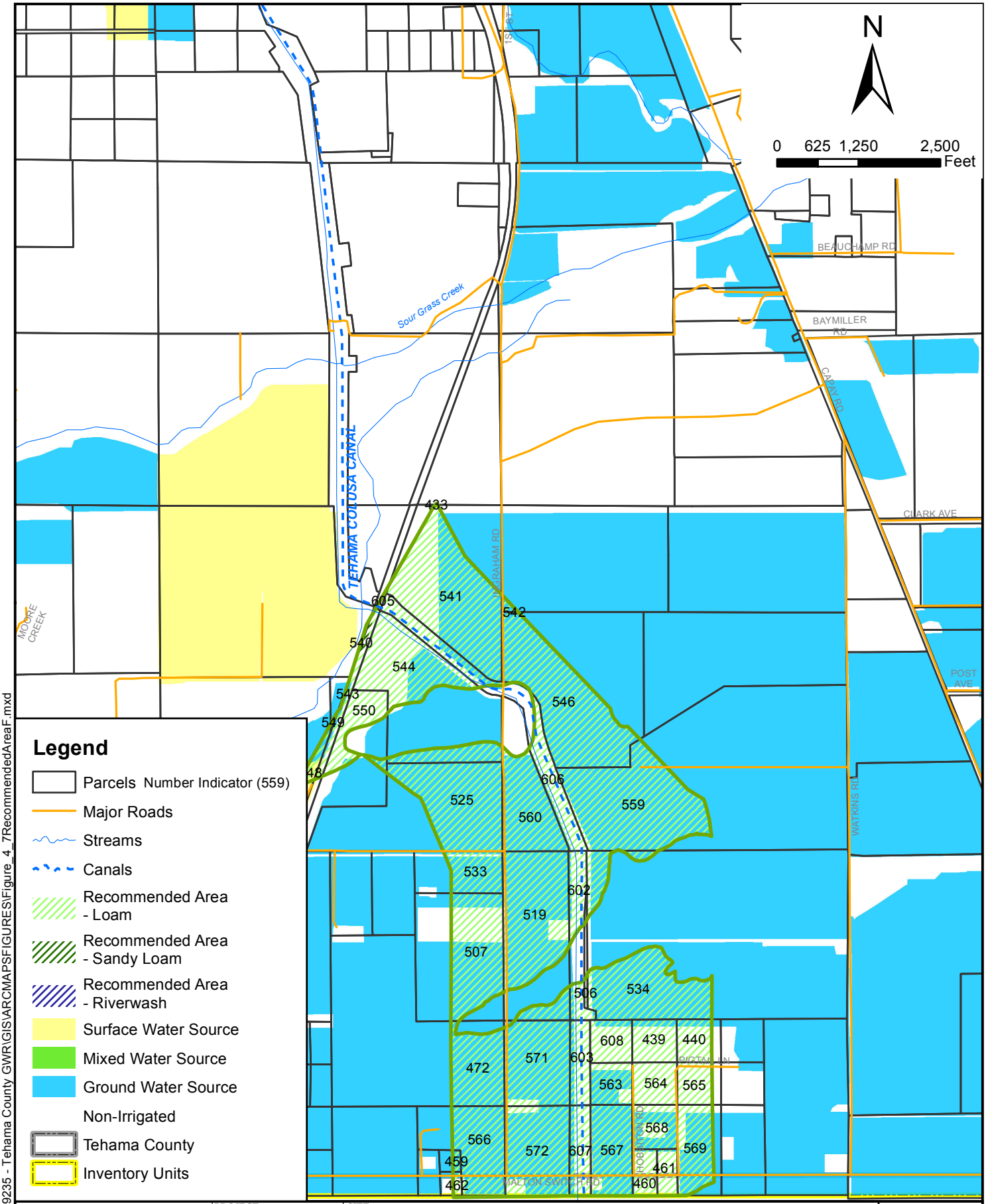
PROJECT	SITE	Figure
139235	Tehama County, CA	4-5
DATE	TITLE	
6/24/11	Recommended Area D	



FILE: P:\39000\139235 - Tehama County GWR\GIS\ARCMAPS\FIGURES\Figure4_6RecommendedAreaE.mxd

Brown AND Caldwell

PROJECT	SITE	Figure
139235	Tehama County, CA	4-6
DATE	TITLE	
6/24/11	Recommended Area E	



FILE: P:\39000\139235 - Tehama County GWR\GIS\ARCMAPS\FIGURES\Figure_4_7RecommendedAreaF.mxd

Brown AND Caldwell

PROJECT	SITE	Figure
139235	Tehama County, CA	4-7
DATE	TITLE	
6/24/11	Recommended Area F	

5. Methods of Recharge

This section presents conclusions and describes the various methods available to perform groundwater recharge activities. The various methods of artificial recharge have different benefits and constraints that make certain methods more beneficial for certain areas and less beneficial for others. Next steps include finding a surface water supply, identifying specific parcels, review of water quality, pilot testing, and long term project implementation.

Artificial recharge (AR) of groundwater is the process of adding water to an aquifer through human effort. Many different techniques and purposes exist for implementing AR, but this discussion focuses on augmentation of a water supply for later use. Projects are varied but usually involve storing surplus surface water in an aquifer for later use. Recovery (withdrawal) of the stored underground water commonly is by wells.

Artificial recharge requires some form of man-made structures and several techniques include:

- Flooded Fields
- Spreading Basins
- Excavated Recharge Pits
- Unlined Flat Leaky Canal
- Dry Wells
- Injection Wells
- Enhanced Recharge through Streams
- Flood Detention Basins
- Delivery In-Lieu of Pumping

Each groundwater recharge technique is briefly described in the following sections.

Flooded Fields

This technique includes applying water to an undisturbed field and allowing it to infiltrate.

Depending on water availability, the field could be flooded quickly to a standing depth of about 10 inches, or water could be delivered continuously at a rate that nearly matches the infiltration rate. The field would be surrounded by a small (6 to 12-inch tall) berm and may also include several interior berms to regulate the water levels and flow across the field. Interior berms would be needed on gradually sloped sites. In addition to groundwater recharge, flooded fields would provide seasonal habitat opportunities and winter habitat for waterfowl. In the non-flood season months (April-October).

Flooded fields are most appropriate in locations where cultivation has been practiced and vertical impediments to infiltration such as hardpan are not present or are shallow. If shallow hardpan exists at depth less than five feet below ground surface, the field would be ripped to increase infiltration characteristics. Before ripping could occur, the existing and potential habitat value of the site would need to be assessed. Field flooding may not be applicable at sites where hardpan is present at depths greater than five feet below ground surface. Deep ripping can result in the loss of potential vernal pool habitat (in the vernal pool zone) and potential losses of cultural resources.

Spreading Basins

Spreading basins are shallow ponds, excavated to relatively shallow depths (generally less than five feet), that are kept partially full with standing water for sustained periods. Spreading basins are commonly used in large-scale applications, such as those in the southern San Joaquin Valley, and in

southern California and Arizona. In large applications, spreading basins provide surcharge capacity to accept peak flows and provide an efficient means to convey water throughout a site. Spreading basins are applicable in a variety of geologic and topographic conditions. At sites where shallow, vertical impediments, such as organic clay soils or a thin veneer of hardpan are present, the excavation of shallow basins can remove or reduce the effect of these materials thereby increasing infiltration effectiveness. Spreading basins may provide seasonal habitat opportunities and winter habitat for waterfowl.

Excavated Recharge Pits

This technique includes construction of pits to depths of 10 to 15 feet below ground surface.

This technique is most appropriate in areas where vertical impediments such as hardpan are thick and present at depths greater than five feet.

Unlined Flat Canal

This technique includes the modification of existing unlined canals or construction of new unlined canals to convey imported water and provide groundwater recharge through its bottom.

Dry Wells

Dry wells, also known as vadose zone infiltration wells, are wells installed above the water table but below low permeability soils such as clay. The dry well typically contains a perforated pipe that extends from approximately 1-2 feet below ground surface to the bottom of the well. The entire well is filled with a permeable material, usually a gravel pack consisting of cobbles, which allows water to percolate through the well to lower more permeable underlying soils, such as sand and gravel. Dry wells would be installed with a direct water supply to each well.

Dry wells are prone to plugging from the accumulation of fine sediment in the coarse material and are only appropriate where the source water has low turbidity. As a dry well becomes plugged with sediment from turbid water, the recharge effectiveness of the well substantially decreases. Once a dry well is plugged, it must be redeveloped so that clogging materials may be removed. This cleaning process is not entirely effective because some fine material will have been carried into the formation and cannot be removed. This technique will therefore not be effective for recharging flood-season water unless a settling basin is constructed or filtration and chlorination is conducted before recharge, which would add significant costs. Pilot testing of this technique would be necessary to determine if such treatment was necessary.

Injection Wells

Injection wells are constructed to recharge water directly to the aquifer. The well contains an injection tube that terminates below the static water table in a well with a screen and filter pack so that positive pressure exists along its entire length. When water is discharged from an injection well, a cone of recharge will form similar in shape but the mirror image of a cone of depression surrounding a pumping well (Driscoll, 1986). In theory, an injection well can recharge as much as the pumping capacity allows. However, problems associated with water quality, high water temperature, biologic activity, and turbidity often reduce the recharge rate over relatively short periods of time (Driscoll, 1986). Injection wells are not well suited for use with floodwater or other sources with high dissolved or suspended solids because fine particles in the water can quickly plug the aquifer in the near vicinity of the well. Generally, water supplies for injection wells are either treated or obtained from high quality sources to assure that water quality requirements can be reliably and consistently met. Injection wells are often designed to operate as both injection and extraction wells. The dual use in this fashion can help keep the wells from clogging as quickly.

Enhanced Recharge in Streams

In many portions of the study area, water is conveyed through stream channels that in some areas lose water to the aquifer. This technique would involve modifying existing surface water conveyance facilities to promote additional groundwater recharge where possible. This may be accomplished by deepening or widening an existing channel, or by the installation of temporary dams or check structures to increase in-stream water levels and maximize the wetted surface area to slow the movement of water, and therefore, increase the natural recharge through the streambed.

Costs and performance of this technique can vary significantly, depending on the modification considered. Installation of temporary dams or check structures could be expensive relative to the amount of water that would be recharged. However, this technique should be considered when changes or updates to water diversion facilities are contemplated, particularly those that involve relocation or enlargement. Modifications to the stream bed, such as excavation or widening to expose permeable soils may be cost prohibitive, create undesirable environmental impacts to aquatic species, and cause hydraulic impacts to downstream locations if excavated areas increase the potential for erosion.

Flood Detention Basins

Flood detention basins are designed to either reduce peak flows on neighboring streams during flood events, or to detain local runoff from newly developed areas. This technique would include modifications to any existing and future detention basins to increase their groundwater recharge effectiveness. Many detention basins are adjacent to streams that are or could be used to convey water from sources considered in this study. Modifications to flood detention basins would include changes to or the addition of diversion facilities for low-flow water deliveries; the addition of pumps from conveyance to detention basin; and changes in the operation of the basins. For each flood detention basin, the groundwater recharge operations would be possible only where the required amount of flood storage could be maintained. Potential modifications to detention basins may be possible to accommodate long-term groundwater recharge without reducing flood protection.

In-Lieu Delivery

This technique includes delivery of surface water to groundwater users in-lieu of groundwater pumping. This may be accomplished through the utilization of existing conveyance facilities, expansion of existing conveyance facilities, or the construction new conveyance facilities.

In-lieu programs can be developed at several levels of intensity. A minimum program would involve increased delivery of surface water to existing surface water users, or the delivery of surface water to groundwater users that are near existing conveyance facilities (usually within ½ mile). The minimum program would require relatively low capital investment because only those water users in close proximity to existing conveyance facilities would be involved. A more intensive, or maximum, in-lieu program would require the construction of new conveyance facilities.

An in-lieu program for application in the study area would be limited to increased deliveries of water to agricultural water users that pump groundwater during the irrigation season. Opportunities for increased deliveries to urban areas in-lieu of groundwater pumping would require an increase in water treatment capacity. Although increased delivery of surface water to urban areas that pump groundwater would help reduce groundwater overdraft in the area of saline water migration, this program would not provide seasonal habitat or other ecosystem restoration benefits. Therefore, an in-lieu program for urban areas is not considered in this study.

In agricultural areas, surface water deliveries during the irrigation season to areas that rely on groundwater may be possible. Conveyance and distribution facilities that are used to delivery water

to flooded fields and spreading basins during winter months could also be used during the irrigation season to convey water to nearby agricultural lands.

6. Next Steps and Recommendations

This section, prioritizes recommended areas, outlines next steps towards implementation of recharge, and presents a summary of the study,

6.1 Prioritization of Recommended Areas

This section prioritizes and provides observations on the viability of the recommended areas identified in Section 4. Priority was developed based on practical considerations, viability, regional groundwater flow direction, and other unique factors. Areas are listed with high priority areas listed first, and lowest priority areas listed last or not listed in this section. Appropriate recharge methods (identified in Section 5) are discussed for each prioritized recommended area.

Priority Area 1 – Recommended Area F and Surrounding Areas

Recommended Area F is located north of Glenn County, along the Tehama Colusa Canal. The area is restricted to the area immediately near the canal to ensure that water can reach possible recharge sites. If a water distribution system was built in this area, the area recommended for recharge by the methodology in this study would increase. This area is a suitable area for in-lieu recharge activities because the land use in the area is primarily irrigated land that is irrigated with groundwater. If irrigators in this area utilized surface water in-lieu of groundwater, this would help to increase groundwater levels in the area. By utilizing surface water supplies during wetter years for irrigation, groundwater levels will be higher at the start of drier years when surface water may not be available, and irrigators can use surface water to irrigate during these periods.

The Glenn County Department of Agriculture is currently performing a feasibility study to determine if delivering surface water in-lieu of groundwater to irrigators in the East Corning basin (loosely known as the Capay area) is possible. Glenn County has indicated that it is willing to expand this study into the Tehama County portion of the region between the Tehama Colusa Canal on the west, the Sacramento River on the east, and Moore Creek to the north. Because portions of Recommended Area F and Recommended Area G fall within this study area, this report recommends that Tehama County collaborate with Glenn County where possible to assist this feasibility study.

Priority Area 2 – The Aggregate Mine within Recommended Area E

Within Recommended Area E is an aggregate mine along Thomes Creek. Aggregate mines are strong candidate locations for recharge activities for a number of reasons: The mine exists because there is a concentration of coarse materials, coarse materials like gravel are more likely to allow percolation of water into the subsurface, facilitating recharge. Aggregate mines have been previously environmentally permitted for disturbing of the streambed, which should help with permitting of the recharge facility,

Recharge methodologies that are appropriate for use near an aggregate mine site include spreading basins and excavated recharge pits. Often, the mining activity has created depressions that could be more easily developed into spreading basins or recharge pits with some modification. Further, converting these existing depressions to recharge pits and spreading basins would create waterfowl habitat that may improve the environmental footprint of the site. Additional recharge methodologies that may be appropriate based on this site's proximity to Thomes creek include: enhanced recharge in streams, and flood detention basins. Enhanced recharge from streams could be applied at this

location by installing temporary structures to slow the flow of the creek to encourage percolation. Flood detention basins may be used by diverting winter flows from the creek into depressions created by aggregate mining. Both stream alteration methods will require extensive environmental review.

Special considerations for this site should include consideration of the movement of recharged water and the site's location downgradient from the area of high groundwater fluctuation. Research needs to be conducted to ensure that recharge activities at this location benefit regional groundwater levels instead of contributing water to Sacramento River recharge.

Priority Area 3 – Parcels Near the Corning Canal in Recommended Areas A, B and C

A number of large single owner parcels are located along the Corning Canal in Recommended Areas A, B, and C. These areas are strong candidates for recharge activities because the recharge would be occurring in and upgradient of areas where the highest amount of groundwater use is occurring. Groundwater gradients in the area move from west to east, as indicated in spring and summer contours of groundwater elevation (Figures 2-4 through 2-12). Recharge in these areas is likely to reduce drawdowns in areas of high groundwater use to the east of the recharge zone.

Recharge methods in these areas would depend on whether the parcel is used for agriculture or is fallow. Some of these parcels are irrigated with groundwater, while some are not currently irrigated. Parcels used for agriculture could be used for the flooded fields method, which floods fields during high winter flows to encourage percolation. Parcels used for agriculture also could utilize surface water in-lieu of groundwater if surface water supplies are available and conveyance of surface water to the parcels was available. Parcels without irrigated agriculture could be used for spreading basins, flooded fields, or even excavated recharge pits if appropriate.

Priority Area 4 – Parcels near Thomes Creek in Recommended Areas C, D, and E

This priority area includes parcels that are located near Thomes Creek. Parcels near Thomes creek are mostly unirrigated lands that are near or in the floodplain of the creek. These parcels may be advantageous to perform creek based recharge efforts due to their proximity to the creek, and by their location on the southern border of areas that see large groundwater level fluctuations.

Methods that are likely to be feasible on these parcels include enhanced recharge in streams and flood detention basins. Enhanced recharge can be performed by constructing facilities that impede and slow the movement of water, increasing recharge. Flood detention basins are less likely to be feasible in this area, however, upon detailed analysis of sites, may prove feasible and is worth considering.

Priority Area 5 – Recommended Areas E and G near the Tehama Colusa Canal

The last priority area includes parcels that are near the Tehama Colusa Canal in Recommended Areas E and G. These areas generally have smaller parcel sizes and are located in areas that don't experience the largest groundwater level fluctuations. These challenges make these areas least desirable of the recommended areas for recharge efforts.

Parcels in Recommended Areas E and G are either used for agriculture and irrigated with groundwater or not irrigated. Parcels used for agriculture also could utilize surface water in-lieu of groundwater if surface water supplies are available and conveyance of surface water to the parcels was available. Parcels without irrigated agriculture could be used for spreading basins, flooded fields, or even excavated recharge pits if appropriate.

6.2 Next Steps

This study marks the first step of Tehama County's efforts to develop an artificial groundwater recharge program. A number of activities are required before a groundwater recharge facility can be in operation in Tehama County. This section identifies the necessary activities prior to operation, which include:

Identification of surface water: A surface water supply that can be dedicated to groundwater recharge is necessary to provide the water that will recharge the aquifer. Potentially available supplies include un-utilized surface water available during the flood season and the irrigation season. During flood season, water may be available from storm flows, and potentially available irrigation supplies include surface water purchased from irrigation districts, or surplus irrigation water during above average wet years.

Review of groundwater monitoring for trends: Review of hydrographs in recommended areas can reveal if trends identified during the 2006 to 2009 period are indicative of longer time scale declines. If declines have been occurring for longer periods, this makes these areas more desirable for recharge efforts.

Selection of specific parcels: Specific parcels to solicit participation in artificial groundwater recharge activities need to be selected. Considerations during selection of parcels should include: public or private ownership of the parcel, accessibility, space for recharge operations, local changes in land use patterns, existence of habitat zones, and owner willingness to participate.

Environmental Review: An appropriate level of environmental review and analysis will be required when the specific project location is selected. The purpose of an environmental review is to disclose the potential impacts of a project, suggested methods to minimize those impacts, and to discuss project alternatives so that decision-makers will have full information upon which to base their decision.

Secure landowner participation: Landowner participation will need to be secured and documented with a written agreement. Agreements should include discussion of necessary geologic investigations, short term pilot testing, and eventual long term project implementation.

Review of water quality: Water quality is an important consideration during artificial recharge activities. Site-specific soil and groundwater testing as well as assessments of the quality of source water need to be conducted prior to project implementation.

Perform a pilot study: A pilot study needs to be conducted to determine specific sites for investigation and to perform investigation at selected sites to determine the feasibility of long term project implementation. A pilot study should include:

- Field investigation of soil characteristics. Investigation of shallow soils and geology will likely need to be performed through trenching and review of visible strata in the trench by geologists.
- Drilling at selected sites to provide information that will aid in recharge methodology selection, as well as to confirm porosity of subsurface materials,
- Installation of piezometers to monitor the effects of pilot testing on the water table, and
- Short term operation of recharge methodologies. Affects of recharge activities on the aquifer will be measured in the installed piezometers.
- Investigation of groundwater flow during recharge. This portion of the field study will identify retention time of water in the recharge area, and ascertain its flow direction.

Long term project implementation: A specific artificial recharge methodology and project site will be selected based on the results of the pilot study, resulting in long term project implementation of the selected methodology at the recommended location.

6.3 Summary

This study represents the first step by the Tehama County Flood Control and Water Conservation District to identify potential areas that would benefit from, and are suitable for artificial recharge activities. This first step has been taken based on direction by the AB3030 TAC as a response to decreases in groundwater levels in established Trigger Levels, as discussed in Section 1.1.

This study compiled the best available datasets for analysis. Data was collected for geology, soils, streams, irrigation districts, aggregate mine locations, land use, and groundwater levels. Data was collected from DWR Northern District, Tehama County, or the California Spatial Information Library. Data is discussed and presented in Section 2.

Data was analyzed to determine which portions of Tehama County had the largest areas of demand, had soils and geology suitable for groundwater recharge efforts, and was in a location that was able to receive surface water. Areas of demand were determined by analyzing groundwater level contours from 2006 to 2009. Areas that had soils and geology that were preferable for groundwater percolation included areas with sandy, gravelly, or loam soils, and overlay the Riverbank and Modesto Formations. Areas near were either near a creek or canal, or within the service area of a surface water irrigation district. Analysis is presented in Section 3.

Application of the analysis resulted in seven recommended areas for further investigation, discussed in Section 4. Recommended areas included areas along the Corning Canal, Tehama Colusa Canal, Thomes Creek, and areas within the Corning Water District's service area.

This report describes various methods of performing artificial recharge in Section 5. Methods that may be used by the District include: flooded fields, spreading basins, excavated recharge pits, unlined canals, dry wells, injection wells, enhanced stream recharge, flood detention basins, and in-lieu recharge.

Recommendations about the priority and appropriate recharge methods for the recommended areas are presented in Section 6.1. The first priority area includes Recommended Area F, which is near the Capay region and is north of the Glenn County border. Recommended Area F is a prime site for the use of surface water in-lieu of groundwater, and is within the study area of an in-lieu project being performed by Glenn County. The second priority area is the aggregate mine within Recommended Area E. The aggregate mine has a number of existing features that make it feasible and cost-effective for recharge activities. Concerns about the direction of recharged water will need to be addressed at this location. The third recommended area includes parcels located near the Corning Canal in Recommended Areas A, B, and C. These parcels are located upgradient from the area of strongest groundwater fluctuation, and are likely to directly influence groundwater levels in that region.

Lastly, this report identifies the next steps necessary to implement a pilot study and full implementation of a recharge program. These steps include: identification of surface water supplies, review of groundwater monitoring for trends beyond 2006 to 2009, selection of specific parcels, secure landowner participation, environmental review, water quality review, field investigation, piezometer installation, pilot study operation, and long term project implementation.

APPENDIX D – REFERENCES

Appendix D-1

Selected Internet Websites and Referenced Information Sources

APPENDIX D-1. SELECTED INTERNET WEBSITES AND REFERENCED INFORMATION SOURCES

1. Butte County Department of Water and Resource Conservation. http://gis.buttecounty.net/bmoic3/GIS/Default.asp?loadfile=map.asp&county=.
    a. Basin Management Objectives Information Center (BMOIC)

2. California Department of Finance. http://www.dof.ca.gov/research/demographic/data/.
    a. Historic and projected birth rates for Tehama County
    b. Historic and projected population for Tehama County

3. California Department of Pesticide Regulation – Groundwater Protection Program
    a. http://www.cdpr.ca.gov/docs/emon/grndwtr/index.htm

4. California Department of Water Resources – California Irrigation Management Information System (CIMIS). http://wwwcimis.water.ca.gov/cimis/data.jsp
    a. Regional measurement of real-time grass reference evapotranspiration (ETo)

5. California Department of Water Resources Groundwater Information Center. http://www.water.ca.gov/groundwater/.
    a. Basic groundwater information
    b. Bulletin 118 -2003 and Regional- specific Bulletin reports
    c. Region-specific groundwater elevation change maps
    d. Land subsidence and groundwater quality data
    e. Links to other related websites.

6. California Department of Water Resources, California Statewide Groundwater Elevation Monitoring (CASGEM) program. http://www.water.ca.gov/groundwater/casgem/
    a. Tabular database of annual spring, summer, and fall groundwater level measurements from monitoring wells in Tehama County and statewide
    b. Hydrographs showing historic records of groundwater elevations

7. California Department of Water Resources – Water Use Efficiency. http://www.water.ca.gov/wateruseefficiency/sb7/docs/DRAFT_Quantifying_Efficiency_of_Ag_Water_Use_Report_11152011.pdf
    a. Quantifying the Efficiency of Agricultural Water Use.

8. California Department of Water Resources Data Exchange Center. http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST
    a. Water Year Hydrological Index

9. California State Water Resources Control Board Groundwater Protection Section, GAMA Program Domestic Well Project. http://www.swrcb.ca.gov/gama/docs/tehama_focus_area_draft_datareport2.pdf
    a. GAMA Domestic Well Project, Groundwater Quality Data Report Tehama County Focus Area

10. California Urban Water Conservation Council. http://cuwcc.org/about/default.aspx
    a. Best Management Practices Memorandum
    b. SB x7-7 Process

11. Glenn County Water Advisory Committee. http://www.glenncountywater.org/.
    a. 2008 DWR/USBR Sacramento Valley Subsidence Project Report

12. Official California Legislative Information-California Law. http://www.leginfo.ca.gov/calaw.html.
    a. California Water Code (focus on groundwater for Plan update)

13. Tehama County Code. Title 9: Health and Safety. http://library.municode.com/index.aspx?clientID=16652&stateID=5&statename=California
    a. Chapter 9.40 Aquifer protection
    b. Chapter 9.42 Well construction, rehabilitation, repair, and destruction.

14. Tehama County Department of Agriculture. http://www.co.tehama.ca.us/index.php?option=com_content&task=view&id=27&Itemid=107
    a. Annual Crop Reports. Summary of county-wide farm production and revenues
    b. Pesticide Use Enforcement

15. Tehama County Planning Department. http://www.co.tehama.ca.us/images/stories/planning/Tehama%20BRE%20Progr%20Anal%20rpt%2012%20final.pdf
    a. Tehama County Business Attraction and Retention Program Analysis. 2009

16. Tehama County Flood Control and Water Conservation District. http://www.tehamacountypublicworks.ca.gov/Flood/
    a. Ordinance No. 1617
    b. 1996 Coordinated AB 3030 Groundwater Management Plan
    c. AB 3030 Technical Advisory Committee (TAC) meeting agendas and minutes
    d. Technical Memorandums for defining groundwater elevation trigger levels and awareness actions, 2009
    e. Tehama County Water Inventory and Analysis, 2003
    f. Database of continuous groundwater elevation monitoring data from dedicated groundwater monitoring wells
    g. 2011 Tehama County Groundwater Recharge Area Location Study
    h. Evaluation of groundwater well infrastructure in Tehama County

17. Tehama County General Plan. http://www.tehamagp.com/
    a. General Plan Update, March 31, 2009.
    b. Designations and descriptions of "Planning Areas" in Tehama County

18. United States Census Bureau. http://2010.census.gov/2010census/popmap/
    a. Population statistics
    b. Population trends

19. United States Geological Survey, California Water Science Center. Groundwater Ambient Monitoring and Assessment (GAMA) program. http://ca.water.usgs.gov/gama/
    a. Groundwater Quality Data for the Northern Sacramento Valley 2007. Results from the California GAMA Program, Data Series 452
    b. Groundwater Quality Data in the Middle Sacramento Valley Study Unit 2006. Results from the California GAMA Program, Data Series 385

20. Western Regional Climate Center. http://www.wrcc.dri.edu/CLIMATEDATA.html
    a. Source of climate and rainfall information for Tehama County

APPENDIX D – REFERENCES

Appendix D-2

APPENDIX D-2. SELECTED INFORMATION SOURCES NOT AVAILABLE FROM THE INTERNET

1. California Department of Water Resources Bulletin 118-6, Evaluation of Ground Water Resources: Sacramento Valley, 1978.
2. California Department of Water Resources Bulleting 118-7. Draft Report, Geology and Hydrogeology of the Freshwater Bearing Aquifer Systems of the Northern Sacramento Valley, California, 2001.
3. California Department of Water Resources Bulletin 118-80, Groundwater Basins in California, 1980.
4. California Department of Water Resources, Memorandum Report, Geology of the Northern Sacramento Valley, 2011, (in approval process as June 10, 2011).
5. Field Guide to the Mesozoic-Cenozoic Convergent Margin of Northern California: Camarillo, CA. Editor S.A. Graham. 1981. "Stratigraphic and depositional patterns and hydrocarbon occurrence, Sacramento Valley, California". American Association of Petroleum Geologists. Pp 43-58.
6. Tehama County Flood Control and Water Conservation District. Small Water Systems Drought Vulnerability Assessment. 2004.
7. United States Geological Survey Water Supply Paper 495. Kirk Bryan, 1923.
8. United States Geological Survey Water Supply Paper 1497, 1961.